# A New Approach to the Valuation of Real Estate Investment Trusts

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# Executive summary

The valuation of corporations has received considerable attention in the scientific literature. In contrast, little academic research has been devoted to the valuation of Real Estate Investment Trusts (REITs) as a major vehicle for the securitisation of property investments.

Taking academic research into consideration, a tool that is appropriate for the valuation of REITs is proposed in this work. Particular attention is paid to major legal requirements that need to be fulfilled by REITs to benefit from a tax exemption on earnings distributed to shareholders. The assessment of these requirements, in terms of their implementation through REITs, revealed a strong impact on total firm revenues emanating from the holding, management and operation of real estate assets. Likewise, the portfolios held by REITs are mostly concentrated on a specific property sector and financed by substantial debt. Further analyses regarding the explanatory power and predictive ability of both observable and latent variables on REITs show a notable impact of the change in the leading indicator variable and general stock market returns on changes in REIT share prices. Capitalising on these findings and on a review of both conventional corporate and REIT-specific valuation approaches, a new valuation tool is proposed. The operating, investing and financing activities pursued by REITs are addressed separately in detail. Operating activities refer to the holding, management and operation of real estate assets. Investing activities concern the acquisition and disposal of properties and are found to have a considerable impact on the valuation. Financing activities are primarily motivated through the possibility that a REIT will finance assets below market conditions, while bankruptcy costs can account for a considerable share.

Overall, the proposed model complements scientific research on the valuation of REITs while offering the possibility of performing a structural assessment of these real estate-related entities.

# Zusammenfassung

Die Bewertung von Unternehmen wurde zahlreichen wissenschaftlichen Abhandlungen unterzogen. Im Gegensatz dazu existieren nur vereinzelt akademische Untersuchungen zur Bewertung von so genannten Real Estate Investment Trusts (REITs), welche eine bedeutende Form der Verbriefung von Immobilienanlagen darstellen.

Ausgehend von diesen Beobachtungen soll in der vorliegenden Arbeit ein Instrument zur Bewertung von REITs entwickelt werden. Sorgfältige Beachtung finden dabei die gesetzlichen Auflagen, welche REITs zu erfüllen haben, um hinsichtlich ihrer ausgeschütteten Erträge eine Steuerbefreiung zu erhalten. Die Untersuchung der Auflagen zeigt, dass die Immobilienbestandshaltung, welche das Management und das Betreiben von Objekten beinhalten kann, einen wesentlichen Einfluss auf die insgesamt erwirtschafteten Umsatzerlöse eines REIT ausübt. Darüber hinaus sind die von REITs, zumeist mit nennenswertem Fremdkapitaleinsatz, gehaltenen Objektbestände häufig einer einzelnen Nutzungsart zuzuordnen. Weitere statistische Untersuchungen belegen einen relativ hohen Erklärungs- und Prognosegehalt von Frühindikatoren sowie Aktienmarktrenditen auf die Börsenkurse von REITs. Unter Berücksichtigung dieser Erkenntnisse sowie der Untersuchung bestehender Unternehmensbewertungsmethoden, wird ein Instrument zur Bewertung von REITs entwickelt. Neben der zuvor beschriebenen Bestandshaltung und den damit verbunden Aktivitäten, werden im Rahmen des Instruments Investitions- und Finanzierungsaktivitäten eines REIT berücksichtigt. Investitionsaktivitäten beziehen sich auf den Objektan- und verkauf während Finanzierungsaktivitäten vorwiegend etwaige Einsparungen von Fremdfinanzierungskosten sowie erwartete Insolvenzkosten betreffen.

Im Ergebnis erweitert das vorgeschlagene Modell, welches sich insbesondere zur strukturierten Beurteilung eines REIT eignet, bereits bestehende Untersuchungen.

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# 1 Introduction

## 1.1 Subject and aims

Within the financial literature, an extensive body of research has examined corporate valuation approaches based on dividends, earnings and cash flows. A main objective of applying corporate valuation models is in the determination of the intrinsic value[1] of a company.[2] In this regard, both discounted cash flow (DCF) and multiplier models have emerged as important corporate valuation methodologies. The application of these methodologies with Real Estate Investment Trusts (REITs) should be scrutinised. REITs mainly pursue real estate-related business activities, with the peculiarity of earnings being tax-exempt if they are distributed to shareholders. Currently, REITs represent a major form of securitising property investments. In particular, a considerable number of countries have introduced legal frameworks to regulate these property companies. Until the year 2000, scientific publications on REITs were largely confined to studying the market in the United States. Subsequently, little academic research has been carried out in other countries. This observation squares with the finding that the bulk of existing country-specific Real Estate Investment Trust (REIT) legislations were introduced after the year 1999. Additionally, past scientific work primarily considers the risk and return characteristics attached to Real Estate Investment Trusts in the context of multi-asset portfolios. Having classified REITs regarding their risk and return characteristics, the decision-making concerning the selection of particular REIT investments has not been addressed adequately, given the limited scope of the academic work. In contrast, the application of corporate valuation models may not be preferable in the case of REITs.

Presumably, corporate valuation models that reflect the distinctive features attached to REITs show superiority in capturing the intrinsic values of these entities. However, sufficient academic evidence to confirm or to reject this assumption is apparently unavailable. Most extensive research has been devoted to the specific REIT

[1] Following PINTO et al. (2010, p. 2), the "[…] intrinsic value of any asset is the value of the asset given a hypothetically complete understanding of the asset's investment characteristics. For any particular investor, an estimate of intrinsic value reflects his or her view of the "true" or "real" value of an asset."

[2] See, for example, STEINER/BRUNS (2002, p. 229).

valuation approach called the net asset value (NAV) model. However, despite its distinct practical relevance, this model has been subject to widespread criticism.
As a consequence, there exists no consensus in scientific research on models that should be used in the valuation of Real Estate Investment Trusts. Likewise, a deficit in empirical testing in the context of REIT valuation is evident. Although a REIT-specific earnings measure has been developed and recommended for use within multiplier models, statistical examinations could not justify the application of the measure in terms of a significant explanatory power regarding stock prices. Furthermore, the definite shortage of academic research raises further questions when trying to assess the fundamental condition of a REIT. For example, no extensive inter-country comparison of REIT-specific features is available. In this context, the propensity of REITs to carry out certain business activities, regions, sectors or leverage ratios has not been subjected to intense scrutiny. Similarly, the question of why REITs employ leverage despite being largely tax-exempt on a corporate level has not been addressed sufficiently, especially in the context of corporate valuation. Nevertheless, these features could become important when the appraisal of a particular firm is intended to ultimately estimate an intrinsic value.

Considering the preceding issues, the following work aims to address the main research question, i.e., which approach seems to be particularly suitable for the determination of the intrinsic value of a Real Estate Investment Trust.
In this context, seven sub-questions have been developed and ought to be discussed in this study.[3]
First, the question of what are the distinctive features of Real Estate Investment Trusts, which can become important in the valuation, should be answered. In addition, to become acquainted with the valuation of a firm by means of corporate valuation approaches, fundamental principles of corporate valuation are explained and evaluated.
Taking the findings from the previous examinations into account, the study will elaborate on the second sub-question through delivering the results of an assessment of major existing approaches to REIT valuation.

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[3] See Appendix 1.

The subsequent development of a REIT valuation tool capitalises on recent findings. In this context, the third and the fourth sub-question of which objectives are associated with, and which requirements ought to be fulfilled through, a new approach to REIT valuation will be addressed.

Fifth, the question of which factors probably possess a significant influence on the intrinsic value of a REIT is examined in more detail. Extensive quantitative analyses, with total REIT stock returns and dividends per share returns used as value benchmarks, should reveal essential variables that have a likely effect on the intrinsic value of a REIT.

Sixth, the question of the structure of a new approach particularly suitable to the valuation of REITs should be addressed through an examination of the potential components of a REIT valuation tool, such as the discount rate and cash flow calculation schemes differentiated by operating, investing and financing activities.

Seventh, the meaningfulness of the introduction of a new approach to REIT valuation is discussed while considering the relevance of existing REIT valuation tools. For this purpose, the proposed tool will be assessed from both a quantitative and a qualitative perspective.

## 1.2 Structure of the study

The assessment of the unique features of Real Estate Investment Trusts in connection with the development of a new REIT valuation tool is carried out in several steps.

Chapter Two provides a taxonomy of Real Estate Investment Trusts. In the first subsection (2.1), the compiled sample of REITs (this is included in the analyses in subsequent chapters) is described and compared against the total REIT population. Thereafter, the analysis of REIT-specific features (2.2) is closely connected with the legal requirements that need to be fulfilled by a property company to achieve or maintain REIT status. Particular attention will be devoted to the taxation (2.2.1), the organisational structure (2.2.2), the stock exchange listing and the shareholder base (2.2.3), the asset base (2.2.4), the business activities (2.2.5), the capital structure (2.2.6) and the distribution requirements (2.2.7). This analysis should help to highlight the unique features of REITs, which could also depend on their country of origin. Concurrently, several features of REITs are identified that are also assumed to affect the valuation result. Chapter Two concludes with a comparison of the distinct features of REITs to those of alternative forms of real estate entities (2.3).

An introduction to the fundamental principles pertaining to corporate valuation methods is provided in Chapter Three. First, the rationale for a corporate valuation is explained (3.1). Subsequently, principles of corporate valuation models, which become relevant when developing a new approach to REIT valuation, are collected (3.2). Section 3.3 reveals the possibility of classifying a corporate valuation model. Particular attention will be paid to corporate valuation to address the objectives of the principal of the valuation exercise. This includes an examination of the motives and the purpose of corporate valuation, both of which confine the availability of appropriate corporate valuation methodologies. Finally, a critical review of corporate valuation methodologies (3.3.3) should provide information regarding major elements that might be included in the valuation tool proposed thereafter with REITs.

Having gained an overview concerning conventional corporate valuation models, Chapter Four comprises an inspection of major methods used for the valuation of Real Estate Investment Trusts. These methods aim at accommodating the specific features of REITs mentioned previously. The overview helps to identify the factors employed in existing methodologies that probably carry a high impact on the valuation result. An examination of both the strengths and weaknesses of the models allows a conclusion to be drawn on elements that should be adopted in the new REIT valuation tool. In detail, the investigation covers approaches relying on the net asset value (4.1), the funds from operations (4.2) and the discounted cash flow (4.3).

In Chapter Five, the features of the tool for the valuation of Real Estate Investment Trusts are explained. Initially, requirements are formulated against the new REIT valuation tool based on a review of conventional corporate valuation methodologies (5.1.1) on the one hand and founded on REIT-specific features (5.1.2) that have been identified in Chapters Two and Four on the other. A classification of the proposed tool in accordance with the identification of the valuation object (5.2.1) and the stakeholders (5.2.2), the motive and the purpose (5.2.3) as well as the methodology (5.2.4) is performed in Section 5.2.

Chapter Six concerns the identification of fundamental features of REITs using a variety of statistical analyses. In Section 6.1, the dataset applied in the subsequent analyses is described in detail. Thereafter, methods used to prepare the collected time series for the statistical analyses are reviewed and chosen in accordance with the individual characteristics of the dataset (6.2). This procedure should help to prevent biased results of the statistical examinations arising from distortions included in the time series, such as the presence of outliers (6.2.2), missing values (6.2.4) or non-stationarity (6.2.5). Having prepared the dataset, a factor analysis is employed to extract underlying variables of the sampled REITs (6.3). In this regard, the resulting factors are characterised by considering the findings obtained in Chapter Two. Subsequently, observable independent variables, expressed as returns, such as interest rates, the consumer price index (CPI) or the level of industrial production are included in a multiple regression model to assess their impact on REIT returns (6.4). This procedure probably helps to identify variables that carry a high explanatory power regarding REIT returns and thus should be considered in the valuation tool. Finally, two analyses based on vector autoregressive models aim at assessing the forecasting ability of variables towards REIT stock returns (6.5). Considering that the REIT valuation tool relies on an assessment of future cash flows paid out to the owners of the firm, variables exhibiting a forecasting ability should also ideally be captured in the valuation tool.

The development of both cash flow items and a discount rate is carried out in Chapter Seven and capitalises on the findings of the previous chapters. Initially, the explicit cash flow calculation is derived through accounting for operating activities (7.1.1) and by addressing investing activities (7.1.2). The separation between operating and investing activities facilitates the identification of the impact of each activity on the valuation result. Considering the results of the REITs systematisation, particular attention is devoted to the calculation of the cash flows from operating activities including quantitative approaches to evaluate both the explanatory power and the information content of individual cash flow items on dividends per share returns and stock returns (7.1.1.3). The discount rate used to transfer cash flows to the present represents a critical component of a valuation tool. Accordingly, specific attention will be paid to the development of a model to estimate the discount rate (7.3). In this context, the explanatory power of models regarding the required rate of return is calculated and assessed. Finally, a method of estimating the value pertaining to the period following the detailed planning period is proposed (7.4).

Given the separate examination of operating and investing activities on the one hand and financing activities on the other, Chapter Eight considers the impact of financing activities on the valuation result. In particular, the costs of financing (8.2), expected bankruptcy costs (8.3) and agency costs (8.4) are examined. Indications regarding the impact of these debt-related components on the valuation result are provided, and recommendations whether to include the elements into the valuation tool are made. Additionally, Chapter Eight provides further explanations as to why REITs employ leverage despite the tax exemption of earnings distributed to shareholders.

Chapter Nine provides a final assessment of the proposed REIT valuation tool. In this regard, the basic concept of the valuation tool (9.1) and the cash flow components concerning operating (9.2.1), investing (9.2.2) and financing (9.2.3) activities are critically reviewed. Finally, the results of a quantitative assessment regarding the predictive ability of the valuation tool concerning long-term stock returns realised by REITs are presented (9.3).

Chapter Ten concludes the work with a review of the main findings and their implications, together with recommendations for further research.

# 2 Distinctive features of REITs

The following paragraphs are devoted to addressing the research sub-question regarding the distinctive features pertaining to Real Estate Investment Trusts. Complementary to a description of the major features associated with REITs, data on an extensive sample of REITs have been collected. Section 2.1 introduces the sample of REITs utilised in the following analyses and compares them to the total REIT population. Subsequently, company-specific features are examined to compile the distinctive features of REITs (2.2). For this purpose, both the legal framework and its implementation through the REIT are explained. Finally, the distinctive features of REITs are compared against those of real estate companies without a REIT status on the one and real estate mutual funds on the other hand (2.3).

## 2.1 Description of the REITs sample

The development of a REIT valuation tool should be based on the analysis of a representative dataset. Accordingly, a sample of REITs has been collected that aims to capture a high share of the population of stock exchange-traded REITs.[1] However, the feasibility of approximating the population of REITs as accurately as possible is reduced due to several factors. First, the number of REITs offering long-term data is limited. As of the 31st of December 2009, 27 countries possessed a REIT regime. Specifically, 18 of the 27 regimes have been established in the twenty-first century (see Figure 2.1). Second, both the amount and type of information that is publicly available differ between REITs, which exacerbates the problem of comparing them.
The total sample used in this study consists of 218 REITs, chosen from a population of 454 REITs.[2] Each of the 218 sampled REITs is domiciled in one of eleven countries. According to Figure 2.1, the number of sampled REITs equals 48.02% of the REIT population, and the market capitalisation of the sample accounts for 78.47% of the overall population. In essence, each REIT included in the total population was

[1] The term Real Estate Investment Trust is not standardised in all countries having introduced a regime for these entities.
[2] The data have been retrieved from company reports. All REITs included in the total population as well as in the sample are classified as Equity-REITs and listed in Appendix 2.1. [See Section 2.2.4.2 for a categorisation of Equity-REITs.]

also part of the sample if all of the following criteria were met. The company should exhibit stock market data over a time period from January 2005 until December 2009. In addition, the REIT status must have been maintained between January 2005 and December of 2009. For example, companies that obtained a REIT status in the United Kingdom were not included in the sample, despite the possibility that they exhibited stock data from January 2005 onwards.[3]

The bulk (in terms of both the population and the sample) of REITs included in Figure 2.1 operate in accordance with the laws of the United States. Referring to the total population, the dominance of a few countries is observed: in terms of the REITs market capitalisation, the United States and Australia comprise 58.97% of the total population, and the seven countries[4] exhibiting the highest market capitalisation account for 90.86% of the total capitalisation. In addition, Figure 2.1 reveals that the average market capitalisation of a REIT shows differences across the countries of origin.

Time series data on REITs were collected from January 1985 until December 2009. This time span should contribute to offering a long-term perspective of the fundamental features of REITs.

While most of the variables used in the study are available on a monthly basis, data such as appraisal-based direct real estate investment indices are provided in quarterly time intervals, though specific data included in the REIT balance sheet and income statements can be retrieved on an annual basis only. To ensure the inclusion of variables that are supposed to share a significant connection with REIT-specific measures, monthly, quarterly and annual data were employed where applicable. Several researchers have suggested that the correlation between REITs and other stocks has altered in recent years.[5] Potential changes in this and other types of relationships might be captured by dividing the time period under consideration into nine sub-periods.

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[3] The data used in the subsequent analyses employ either the whole or a fraction of the REIT sample described in the following. Despite the introduction of the Bulgarian REIT regime in 2004, no REITs have been sampled as no REIT exhibits data since the beginning of 2005.

[4] These are Australia, Canada, France, Japan, Singapore, the United Kingdom and the United States.

[5] For example, JOHNSON (2000, p. 285) argued that the positive relationship between returns of REITs headquartered in the United States and stock returns of companies belonging to other industries has diminished during the nineties.

## *Figure 2.1: REITs sample considered in the study.*

| | Country of origin | Year of introduction of REIT status | Total Population: Number of REITs | Total Population: Market capitalisation (in million US-Dollars) | Total Population: Average market capitalisation per REIT (in million US-Dollars) | Sample used in the current study: Number of REITs | Sample used in the current study: Market capitalisation (in million US-Dollars) | Sample used in the current study: Average market capitalisation per REIT (in million US-Dollars) | Sample used in the current study: Number (in % of the total population) | Sample used in the current study: Market capitalisation (in % of the total population) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | United States | 1960 | 124 | $265,388.51 | $2,140.23 | 103 | $243,131.02 | $2,360.50 | 83.06% | 91.61% |
| 2 | Australia | 1971 | 59 | $66,546.16 | $1,127.90 | 30 | $64,064.14 | $2,135.47 | 50.85% | 96.27% |
| 3 | France | 2003 | 45 | $64,576.30 | $1,435.03 | 11 | $45,283.16 | $4,116.65 | 24.44% | 70.12% |
| 4 | Singapore | 2002 | 22 | $35,126.75 | $1,596.67 | 6 | $26,827.75 | $4,471.29 | 27.27% | 76.37% |
| 5 | United Kingdom | 2007 | 18 | $30,486.86 | $1,693.71 | 0 | --- | --- | 0.00% | 0.00% |
| 6 | Japan | 2000 | 40 | $28,220.94 | $705.52 | 13 | $19,809.88 | $1,523.84 | 32.50% | 70.20% |
| 7 | Canada | 1994 | 32 | $21,113.50 | $659.80 | 20 | $19,340.30 | $967.01 | 62.50% | 91.60% |
| 8 | South Africa | 1981 | 16 | $11,920.10 | $745.01 | 4 | $2,939.70 | $734.92 | 25.00% | 24.66% |
| 9 | Hong Kong | 2003 | 8 | $11,438.41 | $1,429.80 | 0 | --- | --- | 0.00% | 0.00% |
| 10 | Netherlands | 1969 | 6 | $11,297.89 | $1,882.98 | 6 | $11,297.89 | $1,882.98 | 100.00% | 100.00% |
| 11 | Belgium | 1995 | 14 | $6,737.51 | $481.25 | 10 | $5,717.84 | $571.78 | 71.43% | 84.87% |
| 12 | New Zealand | 1956 | 7 | $2,533.52 | $361.93 | 6 | $2,399.68 | $399.95 | 85.71% | 94.72% |
| 13 | Turkey | 1998 | 15 | $1,895.94 | $126.40 | 9 | $896.81 | $99.65 | 60.00% | 47.30% |
| 14 | Taiwan | 2003 | 8 | $1,718.81 | $214.85 | 0 | --- | --- | 0.00% | 0.00% |
| 15 | Malaysia | 2005 | 12 | $1,508.96 | $125.75 | 0 | --- | --- | 0.00% | 0.00% |
| 16 | Bulgaria | 2004 | 21 | $771.02 | $36.72 | 0 | --- | --- | 0.00% | 0.00% |
| 17 | Italy | 2008 | 1 | $690.69 | $690.69 | 0 | --- | --- | 0.00% | 0.00% |
| 18 | Germany | 2007 | 2 | $662.98 | $331.49 | 0 | --- | --- | 0.00% | 0.00% |
| 19 | South Korea | 2001 | 3 | $131.00 | $43.67 | 0 | --- | --- | 0.00% | 0.00% |
| 20 | Israel | 2006 | 1 | $120.53 | $120.53 | 0 | --- | --- | 0.00% | 0.00% |
| 21 | Puerto Rico | 1972 | --- | --- | --- | --- | --- | --- | --- | --- |
| 22 | Mexico | 2004 | --- | --- | --- | --- | --- | --- | --- | --- |
| 23 | United Arab Emirates | 2006 | --- | --- | --- | --- | --- | --- | --- | --- |
| 24 | Pakistan | 2008 | --- | --- | --- | --- | --- | --- | --- | --- |
| 25 | Finland | 2009 | --- | --- | --- | --- | --- | --- | --- | --- |
| 26 | Spain | 2009 | --- | --- | --- | --- | --- | --- | --- | --- |
| 27 | Philippines | 2009 | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total** | | | **454** | **$562,886.35** | **$1,239.84** | **218** | **$441,708.17** | **$2,026.18** | **48.02%** | **78.47%** |

*Source: Own calculations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*
*Note: The "Sample used in the current study" will be denominated as the "total sample" in the following. The market capitalisation regarding REITs domiciled in South Korea has been available without decimals only.*

As previously explained, the availability of data on REITs limits the size of the sample. With the bulk of countries having introduced the REIT concept in the twenty-first century, the number of sampled REITs has more than doubled, when comparing the series beginning in January 1995 to the series beginning in January 2005. As an exception, the number of REITs regulated by law in the United States decreased over recent years mainly due to mergers, takeovers or privatisations. Taking these effects into account, the relative share of REITs in the sample domiciled in the United States has diminished during recent years.

***Figure 2.2: Time periods considered in the study.***

| Start date | | End date | Number of observations | | | Number of sampled REITs |
|---|---|---|---|---|---|---|
| | | | Monthly | Quarterly | Annually | |
| January 1985 | - | December 2009 | 300 | 100 | 25 | **15** |
| January 1990 | - | December 2009 | 240 | 80 | 20 | **37** |
| January 1995 | - | December 2009 | 180 | 60 | 15 | **89** |
| January 2000 | - | December 2009 | 120 | 40 | 10 | **142** |
| January 1985 | - | December 1989 | 60 | 20 | 5 | **15** |
| January 1990 | - | December 1994 | 60 | 20 | 5 | **37** |
| January 1995 | - | December 1999 | 60 | 20 | 5 | **89** |
| January 2000 | - | December 2004 | 60 | 20 | 5 | **142** |
| January 2005 | - | December 2009 | 60 | 20 | 5 | **218** |

*Source: Own calculations based on the total sample (218 REITs)*

## 2.2 Analysis of company-specific features

On a global scale, the first concept of a REIT was introduced in the year 1960 in the United States. The creation of this concept offered the possibility for investors to participate in large scale, income-producing real estate at a low minimum investment amount with the same tax treatment as a direct real estate investor, implying a tax exemption at the REIT level. Subsequently, 26 countries put this conceptual idea of a Real Estate Investment Trust into national legislation. Every country exhibiting a REIT regime has imposed certain regulatory requirements on companies that elect to adopt the REIT status. Compliance with these requirements is tested at regular intervals. Despite differences between REIT concepts and a missing international standardisation of the entity, the country-specific regimes share several similarities.[6] A characterisation of REITs on the basis of these similarities will be accomplished in this section. Specifically, the taxation (2.2.1), the organisational structure (2.2.2), the stock exchange listing and the shareholder base (2.2.3), the asset base (2.2.4), the business activities (2.2.5), the capital structure (2.2.6) and the distribution requirements (2.2.7) are considered.

### 2.2.1 Taxation

The taxation of Real Estate Investment Trusts substantially differs from that of taxable companies. For REITs, no taxes are due on income as well as on potential capital gains, which are both distributed to shareholders through dividends. The tax exemption is achieved by companies that fulfil the requirements prescribed by the respective REIT regime. Possibly, the tax exemption creates an incentive for an entity to apply for the REIT status.[7]

However, if a corporation elects to obtain REIT status, a conversion tax might be due. Furthermore, registration duties might have to be paid on capital contributions. The income or capital gains that are not distributed to shareholders usually have to be taxed at the corporate level. Taxes can also be levied on the acquisition or sale of assets. The so-called stamp duty represents the tax that has to be paid by the REIT when purchasing a property. This duty is usually expressed as a percentage of the property sale price and often has a value between 1% and 7%. Under certain requirements, the gain from the sale of REIT shares will be taxed as well.[8]

On a shareholder level, the dividends from the income and capital gains distributed by a REIT can be taxed differently.[9]

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[6] For example, an attempt to introduce a REIT regime common to all countries of the European Union has not succeeded until now. [See, for example, EICHHOLTZ/KOK (2007, p. 1).]

[7] CADMUS (2003), p. 197; CAPOZZA/SEGUIN (1999a), p. 604; FUNK/SCHULZ-EICKHORST (2002), p. 794; GYOURKO/SINAI (1999), p. 355-359; SCHARPENACK/NACK/HAUB (1998), p. 664.

[8] EPRA (2010).

[9] EPRA (2010).

So-called withholding taxes on the payout of dividends are directly levied at the company level. Alternatively, the tax type might be levied at the level of domestic or foreign shareholders. Withholding taxes on income are approximately 20% of the dividends across the REIT regimes on average and are spread between 6% and 33%. Depending on the legislation, the withholding tax rate when distributing capital gains may differ from the tax rate attached to withholding taxes on income. Subject to specific conditions, the tax authorities might reduce the withholding tax rate to create an incentive to become a REIT.[10]

### 2.2.2 Organisational structure

When applying for REIT status, the set-up of the company must be consistent with country-specific regulatory provisions. In this regard, the launch of a REIT has to take place in a legal form prescribed by the corresponding REIT regime. In addition, depending on the legal form, a REIT candidate might need to raise a certain minimum share capital and must set up an internal management board, potentially consisting of a minimum number of board members.[11]

Furthermore, the following types of REITs can be differentiated.

Some REITs do not aspire or have the permission to manage properties on their own. In this case, REITs rather represent a passive investment vehicle without the intention to perform operating activities with cash flows simply passed on to investors. Alternatively, REITs can be structured as entities that are typically acting as vertically integrated firms.[12]

The previous differentiation is closely connected to the observation of REITs being either internally or externally managed on the one hand, and internally or externally advised on the other hand. In this context, the role of an advisor typically involves the hiring of managers as well as the leasing of agents and other independent contractors. In a few cases, the advisor also acts as a manager of the real estate assets. In contrast, the management of the regular operations of the properties owned by the

[10] EPRA (2010). However, foreign shareholders might have to pay a lower withholding tax than the numbers considered in this study, in case of a double tax treaty. [EPRA (2010).]

[11] CADMUS (2003), p. 197; EPRA (2010).

[12] BECK (2000), p. 154f; CAPOZZA/SEGUIN (2003), p. 307; CHAN/ERICKSON/WANG (2003), p. 55 & 248; CONNER/LIANG (2005), p. 7-18.

REIT is carried out through an internal or an external manager. Generally, a trend from externally managed to internally managed REIT vehicles and from externally advised to internally advised firms has been observed.[13]

Evidence shows that REITs have several advantages when they are internally managed and advised. Specifically, internal advisers and executives can mitigate agency problems with regard to revenue allocation and self-dealing. Another potential advantage is observed in increased managerial efficiency. In terms of stock performance, previous studies have shown that internally managed REITs predominantly yielded higher returns compared to externally managed REITs.[14]

Referring to the previously described REIT sample, Figure 2.3[15] shows that a relatively large share (85.48%) of the sampled REITs are internally advised, with a lower fraction of firms being internally managed (72.37%). Notably, firms belonging to the Japanese REIT regime are neither internally advised nor internally managed. This finding can be explained through the legal requirement that a REIT regulated in Japan has to act as an asset-holding vehicle that is required to outsource asset management, asset custody and administrative activities to third-party professionals.[16]

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[13] CANNON/VOGT (1995), p. 298; CHAN/ERICKSON/WANG (2003), p. 56 & 248; CONNER/LIANG (2005), p. 7-18. For example, with the Taxpayer Relief Act in 1986, REITs domiciled in the United States were allowed to be internally managed and were authorised to carry out certain property-related services to tenants instead of providing these through independent contractors. [BEHRENS (1994), p. 150; CADMUS (2003), p. 199; CHAN/ERICKSON/WANG (2003), p. 26; JANDURA (2003), p. 32.]

[14] ALLEN/MADURA/SPRINGER (2000), p. 146; CHAN/ERICKSON/WANG (2003), p. 27-70; CONNER/LIANG (2005), p. 7; KENG (2004), p. 7.

[15] Based on a scarcity of data, 67 firms were excluded from the sample investigating the management, whereas data on 33 firms have not been available regarding the analysis of the advisory structure.

[16] EPRA (2010).

***Figure 2.3: Advisory and management structure of REITs.***

| | Number of sampled REITs | | Self-advised? | | Percentage of self-advised REITs | Self-managed? | | Percentage of self-managed REITs |
|---|---|---|---|---|---|---|---|---|
| | Self-advised | Self-managed | Yes | No | | Yes | No | |
| **Total** | **186** | **152** | **159** | **27** | **85.48%** | **110** | **42** | **72.37%** |
| **Australia** | 18 | 8 | 17 | 1 | 94.44% | 5 | 3 | 62.50% |
| **Belgium** | 7 | 2 | 7 | 0 | 100.00% | 2 | 0 | 100.00% |
| **Canada** | 20 | 16 | 16 | 4 | 80.00% | 11 | 5 | 68.75% |
| **France** | 8 | 3 | 8 | 0 | 100.00% | 3 | 0 | 100.00% |
| **Japan** | 11 | 10 | 0 | 11 | 0.00% | 0 | 10 | 0.00% |
| **Netherlands** | 6 | 3 | 6 | 0 | 100.00% | 1 | 2 | 33.33% |
| **New Zealand** | 3 | 2 | 3 | 0 | 100.00% | 2 | 0 | 100.00% |
| **Singapore** | 6 | 5 | 4 | 2 | 66.67% | 3 | 2 | 60.00% |
| **South Africa** | 1 | 0 | 1 | 0 | 100.00% | 0 | 0 | --- |
| **Turkey** | 3 | 0 | 3 | 0 | 100.00% | 0 | 0 | --- |
| **USA** | 103 | 103 | 94 | 9 | 91.26% | 83 | 20 | 80.58% |

*Source: Own calculations based on the total sample (186/152 of 218 REITs) and data retrieved from SNL Financial*
*Notes: A REIT is self-advised if the firm provides its own asset management services (i.e., real estate acquisition or disposition decisions) or when the advisor is a subsidiary. A REIT is self-managed if it manages the regular operations of its own properties or the firm that does manage the properties is a subsidiary.*

### 2.2.3 Stock exchange listing and the shareholder base

The listing of a REIT on a stock exchange represents one of the critical issues with respect to the implications for corporate valuation. Generally, all regimes allow a REIT to have its shares traded on a stock exchange. With regard to 16 of the 27 REIT regimes introduced before, a listing on a stock exchange is required.[17] In addition, some REITs have obtained a secondary listing in a country outside their domicile.[18] If listed, the company is subject to the respective stock exchange's supervision and has to fulfil specific disclosure requirements. In several countries, a market for unlisted REITs has emerged. Considering the scarce amount of publicly available information, unlisted REITs, which are also named private REITs, are not included in this study.[19]

Despite a stock exchange listing, a REIT stock might have a low liquidity. Limitations regarding the liquidity of a REIT investment can be justified through a reduced market capitalisation or through a small part of the share capital being traded on the stock exchange. In this context, 15 of the 27 REIT regimes limit the number of shares held by a single equityholder. In addition, shareholdings are limited through a threshold representing a specific share of the total shares outstanding. Concurrently, the shareholder base of a REIT can be subject to limitations. In nine of the 27 REIT regimes, the shares of the REIT must be held by a minimum number of equityholders.[20]

### 2.2.4 Asset base

Considering the name Real Estate Investment Trust, these entities should mainly hold real estate assets in their balance sheets. This assumption is affirmed through regulatory requirements regarding the asset base of a Real Estate Investment Trust, explained in Section 2.2.4.1. Indications pertaining to the actual allocation of assets

[17] See Appendix 2.2.
[18] A secondary listing has been obtained through the French REIT Unibail-Rodamco and the Dutch REIT Wereldhave, for example.
[19] BRITT (2003), p. 1-6; WETTESKIND/SOMMER (1998), p. 754.
[20] Appendix 2.2; CADMUS (2003), p. 197; CHAN/ERICKSON/WANG (2003), p. 27-36; EPRA (2010); SCHARPENACK/NACK/HAUB (1998), p. 664-675.

are provided in Section 2.2.4.2 through an empirical analysis of the previously introduced REIT sample.

#### 2.2.4.1 Requirements imposed by country-specific REIT legislation

Each country that has REIT legislation in place demands that real estate assets must account for the bulk of the assets owned by a REIT.[21] To address the intention that REITs should be firms primarily investing in real estate, numerous REIT regimes have specified a threshold regarding a minimum ratio of real estate-to-total assets, which ranges between 50% and 95%.[22]

In addition, some countries regulate the real estate portfolio allocation. In particular, seven of the 27 regimes restrict the degree of real estate investments outside the country in which the REIT status is maintained. Specifically, foreign investments are either restricted by means of a maximum share of total assets to be invested abroad or through the requirement that the foreign country exhibits a credit rating or a membership with an international organisation.[23] Additionally, four REIT regimes limit the maximum value of a single property, depending on the total portfolio value, to ensure a minimum degree of portfolio diversification.[24]

#### 2.2.4.2 Empirical analysis

Considering that the legal restrictions demand a comparatively high share of assets comprising real estate, it is supposed that the property portfolio represents an important constituent of a REIT. To address this importance, particular attention is devoted to the real estate portfolio pertaining to the sampled REITs.

Specifically, an analysis of the real estate assets that are not occupied by the REIT employees will be presented. A major categorisation can be made between REITs primarily participating in real estate assets through equity capital, named Equity-

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[21] As a variation, the Dutch REIT regime confines assets to any type of passive investment.

[22] Appendix 2.2.

[23] In addition, legal advice is required when a firm maintaining a REIT status in South Korea intends to invest in real estate assets outside their country of residence [see Appendix 2.2].

[24] In particular, the Belgian, the British, the Spanish and the Arabic regimes restrict the size of a single property investment [see Appendix 2.2].

REITs; through debt capital, named Mortgage-REITs;[25] or by a combination of both, classified as Hybrid-REITs[26]. Given the clear prevalence of Equity-REITs across all REIT regimes,[27] in connection with considerable differences between the three categories, only Equity-REITs were analysed in this study. The sub-sample utilised in this section covers 120 Equity-REITs[28] collected from the total sample previously described. Only those REITs have been chosen that have published information on their real estate portfolios in the respective financial statements.[29] This requirement led to the exclusion of several REITs. However, data were partly obtained for 81 further entities which have been considered in the analyses in the following chapters in terms of their regional and property type classification.[30] The property data were collected in the currency of the country where the REIT is domiciled. This procedure can lead to distortions regarding real estate values if a REIT owns properties in countries using another currency. Another distortion in the examination of portfolio data is associated with differences in accounting principles: depending on the REIT, the property assets included in the sample are reported in the respective REITs' financial statements at book values,[31] at fair values,[32] at market values[33], at rental values[34], at the number of sites[35] or at the number of rooms.[36] Given the large

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[25] Mortgage-REITs predominantly offer debt instruments that are secured by real estate assets. Specifically, they hold mortgages and mortgage-backed securities (MBS) or lend money to property owners. Thus, interest rate payments generated from these debt vehicles represent the main source of revenue. [FUNK/SCHULZ-EICKHORST (2002), p. 793; WETTESKIND/SOMMER (1998), p. 748.]

[26] Hybrid-REITs represent a combination of Equity-REITs and Mortgage-REITs. [WETTESKIND/SOMMER (1998), p. 748.]

[27] Mortgage- and Hybrid-REITs only exist in Canada, the Netherlands, the United States and Singapore. Even in countries where Mortgage-REITs exist, a shift in investments towards Equity-REITs has been documented in recent years. [CAPOZZA/SEGUIN (2003), p. 306; McDONALD (2005), p. 10; REIT annual reports]

[28] The business activities pursued by Equity-REITs do not refrain from using debt for the acquisition of properties. Rather, Equity-REITs often use a combination of debt and equity. [WETTESKIND/SOMMER (1998), p. 746.]

[29] Values of non-operating assets, such as the value of the headquarters owned and used by the REIT, are not included in the sample.

[30] Portfolio data on the 81 REITs that are not considered in the following analyses are available upon request.

[31] The bulk of REITs domiciled in Australia and in the United States report the book value.

[32] Fair values are reported by REITs domiciled in Australia and Belgium.

[33] Market values are reported by REITs from Australia, Japan, the Netherlands, New Zealand, Singapore, South Africa and Turkey.

[34] Rental values are reported by REITs domiciled in Australia, Belgium, France, the Netherlands, New Zealand and the United States.

[35] The number of sites is reported by REITs from France and the United States.

amount of information in connection with a restricted availability of real estate portfolio data, the analysis is focused on the property holdings as of the fiscal year ending at any date during the calendar year 2007. Thus, alterations in the real estate portfolio allocation over time have not been captured in the analysis, although the composition of assets might be subject to reduced variations over time, as properties are typically held over the long term.

In total, the sampled Equity-REITs hold ownership stakes[37] in 17,103 properties. The REITs included in the sample own an average of 142 properties. The number of properties per sampled REIT varies between one and 2,270. Although most regimes do not demand a minimum number of real estate assets owned by a REIT, the bulk of REITs hold more than one property.

Nevertheless, a portfolio including a large number of properties does not necessarily lead to the observation that the respective REIT has spread risks through a regional or sectoral diversification of its real estate assets. Scientific research has been devoted to the question of whether REITs should focus their investments on a particular property type or a certain region. Numerous studies have documented that these companies often concentrate on a specific real estate sector, with commercial properties accounting for the major share. In addition, several studies have pointed to an increase in the set of REITs that are focused on a property type.[38]

Property types will differentiate the analysis of the real estate portfolios held by REITs. This discrimination helps to investigate the return determinants, which are supposed to vary between real estate sectors.[39] In addition, the distinction according to property types is beneficial concerning the calculation of leverage ratios, business activities, expenses and other items discussed in some of the following sections.

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[36] The number of rooms is reported by REITs from Canada and the United States.

[37] Some REITs considered in the sample participate in real estate investments through a joint venture. To approximate the share of the property held by the REIT, the reported unit attached to the property is multiplied by the rate of ownership.

[38] BARKHAM (1997), p. 442; FUNK/SCHULZ-EICKHORST (2002), p. 795; SCHLAG (1995), p. 168. Studying REITs domiciled in the United States with data between 1985 and 1991, CAPOZZA/LEE (1995, p. 370f) showed that the concentration by property type increased over the period under consideration and exceeded the degree of concentration by region. A scientific study on Australian REITs documented an increase in specialisation by property type, whereas the regional focus remained fairly stable or experienced a slight increase. [HEDANDER (2005), p. 15.]

[39] See, for example, HARDIN/CARR (2005).

In this study, a REIT is supposed to be focused on a certain property type if the property assets allocated to a single real estate sector exceed a share of 50.00% of the total real estate assets.[40]

In terms of the regional portfolio allocation, the properties in the sample are classified by country, region and city.

Generally, the definition of regions is based on the first-level administrative division of the respective country. Adapting this distinction to the United States regime, for example, results in the differentiation of 50 states, five districts and two territories. To achieve a higher comparability between countries, the number of regions actually employed is measured and corrected for depending on the size of the population. The adjustment involves the selection of a relatively small divisional fragmentation of a country with a relatively small population and the choice of a higher level of fragmentation in the case of a country exhibiting a comparatively high population.[41] Considering a positive connection between the economic activity of a region and the size of the population, the criticism by HARTZELL/SHULMAN/WURTZEBACH (1987, p. 85), i.e., that regional property portfolio classifications in real estate research are often not related to economic activity,[42] is partially addressed. In total, the properties are spread over 1,176 regions, each belonging to one of the 33 countries.[43] Accordingly, some REITs invest in properties outside the country in which they maintain their REIT status. Concentrations within particular cities were investigated as well. A REIT is supposed to be focused on a certain country, region or city if it owns a share of more than 50.00% of the total portfolio of real estate assets held by the entity.

[40] The share is measured with the respective unit at which properties are stated in the balance sheet.

[41] Accordingly, a more fragmented division was chosen for countries such as China and South Africa, as otherwise the region would become less comparable to other countries in terms of population. The average population per region is 1.9 million people. (Source: Own calculations based on data published in the CIA World Factbook.)

[42] Similarly, MALIZIA/SIMONS (1991, p. 65f) argued that homogenous diversification categories should build upon the analysis of economic characteristics pertaining to specific regions.

[43] REITs of the sample are invested in Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Luxembourg, Malaysia, Mexico, the Netherlands, New Zealand, Poland, Portugal, Singapore, Slovak Republic, South Africa, Spain, Sweden, Turkey, Ukraine, United Kingdom and the United States.

With respect to individual property types, the following categories will be distinguished: apartments, community centres, free standing, health care, industrial, land lease, lodging and resorts, merchandise centres, neighbourhood centres, offices, self-storage properties, specialty, diversified and other.

Residential properties are subdivided into apartments and land lease communities. REITs usually acquire apartment communities to generate rental income.[44] In contrast, single-family homes have not been a type of property investment that has experienced a high demand from Equity-REITs.[45] One potential explanation for this finding is based on the observation that development companies that often cannot obtain a REIT status typically construct single-family homes and sell these assets to individuals.
Land lease communities, also named manufactured homes, represent low-cost and transportable residential buildings. REITs investing in land lease communities usually receive rental payments from the residents, who are concurrently the owners of the property.[46] The analysis of the total sample reveals that land lease properties are held by REITs domiciled in the United States only.

In this study, retail properties are subdivided into free standing, also referred to as single-user retail; neighbourhood centres; community centres and merchandise centres. This differentiation has been chosen as the analysis of the property portfolio indicates that REITs partly concentrate on one of these property types.[47]

Unlike other retail sectors considered in the present work, single-user retail properties do not represent a group of retail or other commercial establishments. Typical forms of single-user retail properties include restaurants, pubs, retail warehouses and

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[44] JAFFE (2002), p. 5; SCHLAG (1995), p. 168; WETTESKIND/SOMMER (1998), p. 749*;* www.nareit.*com*.
[45] Instead, Mortgage-REITs focus their activity on offering mortgages to individuals who purchase single-family homes. Mortgage-REITs were excluded from this study, as they follow business activities that differ from those carried out by Equity-REITs.
[46] SCHARPENACK/NACK/HAUB (1998), p. 749.
[47] Figure 2.7 also shows groups of REITs that hold a combination of neighbourhood and community shopping centres as well as of single-user retail properties, merchandise, neighbourhood and community centres. These combinations have been created to account for the allocation of REIT portfolios that did not focus on a single retail property type.

high street shops. Exhibiting a Herfindahl-Hirschman[48] index of 0.73, the analysis reveals that REITs tend to be highly focused on single-user retail properties and avoid investments in other retail-related sectors. In contrast, a concentration on regions or cities is not observable with REITs devoting their business activities to single-user retail properties. Notably, the average number of single-user retail properties owned by REITs is comparatively high, whereas the lot sizes of these properties remain relatively low when compared to other forms of retail properties.

Neighbourhood shopping centres typically accommodate a leasable area of 30,000 to 150,000 square feet. Presumably, a share between 60% and 80% of the turnover is generated due to inhabitants living within a three-mile vicinity of the venue. These centres are designed for placing convenience goods at their disposal. Common anchor tenants are supermarkets or sometimes drugstores. Neighbourhood centres are usually configured in a row of stores that may be connected through a canopy but usually do not have an enclosed walkway.[49] Figure 2.4 shows that REITs holding neighbourhood shopping centres in their portfolios do not possess high concentration ratios with regard to this property type (Herfindahl-Hirschman index: 0.52).

Community shopping centres typically include a leasable area between 100,000 and 350,000 square feet, serving a catchment area comprising 40,000 to 150,000 inhabitants. In this sense, between 60% and 80% of the shopping centre sales are supposed to be generated through a population living in a circumference of three to six miles. These centres typically offer both convenience and merchandise goods. Anchor tenants of community centres are often small department stores, supermarkets or drugstores.[50] HARDIN/CARR (2005) analysed the determinants of both neighbourhood and community shopping centre rents and concluded that both shopping centre types should be distinguished. Indeed, the results of the examination indicate that REITs holding community centres are not highly focused on this property type (Herfindahl-Hirschman Index: 0.51). Rather, it has been observed that REITs tend to spread their portfolios over neighbourhood and community shopping centres.

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[48] The statistical properties of the Herfindahl-Hirschman index are discussed in HIRSCHMAN (1964).
[49] INTERNATIONAL COUNCIL OF SHOPPING CENTERS (1999); REIT annual reports.
[50] SCHARPENACK/NACK/HAUB (1998), p. 749.

***Figure 2.4: Analysis of property portfolios by property type.***

| Sectoral focus | Number of REITs | Average number of properties | Herfindahl-Hirschman indices | | | |
|---|---|---|---|---|---|---|
| | | | Property type | Country | Region | City |
| **Apartments** | 12 | 118 | **0.95** | **0.99** | 0.37 | 0.17 |
| **Community centres** | 9 | 99 | 0.51 | 0.93 | 0.29 | 0.09 |
| **Free standing** | 5 | 803 | 0.73 | 0.85 | 0.16 | 0.01 |
| **Health care** | 5 | 439 | **1.00** | **0.97** | 0.11 | 0.03 |
| **Industrial** | 8 | 118 | 0.91 | 0.91 | **0.42** | 0.12 |
| **Land lease** | 4 | 108 | **1.00** | **1.00** | 0.31 | 0.03 |
| **Lodging and resorts** | 9 | 55 | **1.00** | 0.88 | 0.19 | 0.06 |
| **Merchandise centres** | 15 | 57 | 0.79 | **0.99** | 0.39 | 0.32 |
| **Neighbourhood centres** | 5 | 116 | 0.52 | 0.90 | 0.23 | 0.03 |
| **Office** | 29 | 88 | 0.77 | 0.94 | **0.51** | **0.31** |
| **Self-storage** | 3 | 350 | **1.00** | **1.00** | 0.11 | 0.00 |
| **Specialty** | 1 | 119 | 0.91 | 0.80 | 0.07 | 0.01 |
| **Diversified** | 8 | 102 | 0.31 | 0.83 | 0.25 | 0.19 |
| **Neighbourhood centres/community centres** | 2 | 27 | 0.35 | 0.66 | 0.20 | 0.09 |
| **Free standing/merchandise centres/ neighbourhood centres/community centres** | 5 | 126 | 0.30 | 0.71 | 0.21 | 0.12 |

*Source: Own calculations based on the total sample (120 of 218 REITs) and annual financial statements of REITs*

Aart from neighbourhood and community centres, which, to a certain extent, offer convenience goods, the International Council of Shopping Centers (ICSC) distinguishes further forms of shopping centres that concentrate on the disposal of non-convenience goods. These include regional centres, super-regional centres, fashion/specialty centres, power centres, theme/festival centres and outlet centres.[51] Unlike neighbourhood and community centres, these centre types usually serve a supra-regional group of customers. In this study, these centres are summarised as merchandise centres. This approach helps to cluster the specific retail sectors, which are supposed to share similar characteristics. Furthermore, merchandise centres might have to be differentiated from neighbourhood and community centres due to unequal determinants regarding turnover and profitability. The results of the analysis indicate that a summary of the centres focusing on the placement of non-convenience goods seems to be carried out by the sampled REITs as well: the real estate portfolios of the REITs employed in this study exhibit a higher level of concentration on merchandise centres (Herfindahl-Hirschman Index: 0.79) when compared to REITs investing in community and neighbourhood shopping centres.

A share of 2.5% of the total sample (see Figure 2.1) holds an ownership in self-storage properties. These properties are offered for storing stock goods of firms or individuals. Self-storage buildings usually include units typically ranging in size from 5x5 to 20x20 feet to store personal files, furniture or other items.[52] The analysis shows that REITs mainly invested in self-storage properties are highly focused on this property type (Herfindahl-Hirschman Index: 1.00). This concentration ratio points to the assumption that the demands on the management of self-storage properties may differ from those regarding the administration of other property types. REITs concentrating their real estate portfolios on self-storage properties exhibit a relatively large average number of lots spread over numerous regions and cities.

Furthermore, nine REITs included in the sample invest in lodging and resort properties. Given the specific demands regarding the operation of lodging and resort build-

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[51] INTERNATIONAL COUNCIL OF SHOPPING CENTERS (1999), p. 1-4, REIT annual reports; SCHARPENACK/NACK/HAUB (1998), p. 749.

[52] BLOCK (2006), p. 79f; REIT annual reports; SCHARPENACK/NACK/HAUB (1998), p. 750.

ings, REITs usually decide to outsource the management of a property to a hotel operator. Lodging and resort properties can be subdivided into limited-service, upscale and luxury facilities. Limited-service facilities charge relatively low room rates but often do not offer amenities such as conference rooms or restaurants. Upscale and luxury facilities include vacation resorts and convention destinations, which provide a wide range of amenities at the expense of comparatively high room rates.[53] The analysis of the sample shows that REITs holding lodging and resort properties are highly focused on this sector (Herfindahl-Hirschman Index: 1.00) and are spread over regions and cities. The bulk of properties in the sample belong to the luxury segment, usually possessing relatively large lot sizes.

The bulk of REITs in the sample hold an ownership in office properties. REITs prefer to invest in buildings in prime (Class A) or secondary (Class B) locations, with business parks held to a minor extent.[54] Figure 2.4 indicates that the level of sector concentration with REITs primarily owning office properties is relatively high (Herfindahl-Hirschman Index: 0.77). Furthermore, REITs with real estate portfolios focused on office buildings possess the highest level of concentration on cities (Herfindahl-Hirschman Index: 0.31). This finding can be explained through the observation that many REITs invest in office properties located in cities with sufficient availability of investable real estate assets.

A group of eight REITs is mainly invested in industrial properties. In the sample, industrial properties comprise distribution centres, bulk warehouse space, light-manufacturing facilities, research and development facilities, small offices and flexible space for sales and administrative functions as well as temperature-controlled logistics. REITs investing in industrial properties exhibit a distinct focus on this property class (Herfindahl-Hirschman Index: 0.91) in connection with a relatively high degree of regional concentration (Herfindahl-Hirschman Index: 0.42).

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[53] BLOCK (2006), p. 82f; REIT annual reports; SCHARPENACK/NACK/HAUB (1998), p. 750.
[54] SCHARPENACK/NACK/HAUB (1998), p. 750.

REITs with holdings in health care properties often participate in hospitals. However, the study revealed that REITs also invest in other types of health care real estate, such as medical office buildings, life science facilities, rehabilitation/trauma centres, assisted living facilities, nursing homes, continuing care retirement communities and senior housing communities. REITs mainly invested in health care facilities are highly focused on this property type (Herfindahl-Hirschman Index: 1.00) but not on regions or cities. The sectoral focus might be explained by the specific expertise needed to operate health care properties. A lack of regional concentration might be associated with the restricted demand for these properties in a certain region when compared to retail or office properties, for example.
Further, a small fraction of Real Estate Investment Trusts invest in specialty real estate. Examples of specialty properties include golf courses, prisons, vineyards, timberland or railway lines. These properties share individual return determinants with their analysis requiring specific knowledge. For this reason, REITs focusing their real estate portfolio on specialty properties are largely excluded from this study.

Apart from commercial, residential and other property types, a property portfolio of a REIT can also include unimproved land. Usually, the sampled REITs hold unimproved land for the purpose of developing real estate assets. However, this type of asset will not be considered further in this study.

Figure 2.5 summarises the regional portfolio allocation of REITs according to their countries of origin.
Regarding the concentration of portfolios on a particular property type, REITs headquartered in the United States show the highest level of concentration, followed by those domiciled in Australia, Canada and France. Accordingly, investors participating in REITs regulated under United States law can preferably channel their investments towards a specific property type while also being able to choose from the largest spectrum of property types.
In terms of the regional allocation, REITs domiciled in the United States are less focused than REITs headquartered in the bulk of the remaining countries. While few REITs founded in Singapore or Turkey possess a real estate portfolio focused on one

***Figure 2.5: Analysis of property portfolios by country.***

| Country of origin | Number of REITs | Average number of properties | Herfindahl-Hirschman indices | | | |
|---|---|---|---|---|---|---|
| | | | Property type | Country | Region | City |
| **Australia** | 8 | 61 | 0.79 | 0.85 | 0.36 | 0.20 |
| **Belgium** | 4 | 66 | 0.63 | 0.70 | 0.27 | 0.19 |
| **Canada** | 11 | 86 | 0.76 | **1.00** | 0.40 | 0.19 |
| **France** | 8 | 145 | 0.75 | 0.67 | 0.48 | 0.27 |
| **Japan** | 3 | 45 | 0.59 | **1.00** | 0.47 | 0.47 |
| **Netherlands** | 5 | 239 | 0.43 | 0.47 | 0.11 | 0.04 |
| **New Zealand** | 6 | 38 | 0.57 | **1.00** | 0.56 | 0.43 |
| **Singapore** | 4 | 45 | 0.70 | 0.95 | **0.76** | 0.51 |
| **South Africa** | 3 | 141 | 0.28 | **1.00** | 0.23 | 0.22 |
| **Turkey** | 2 | 9 | 0.50 | **1.00** | 0.75 | **0.75** |
| **United States** | 66 | 182 | **0.84** | 0.98 | 0.27 | 0.09 |

*Source: Own calculations based on the total sample (120 of 218 REITs) and annual financial statements of REITs* city, the REITs domiciled in the United States exhibit a comparatively low degree of concentration at either the regional or city levels. This finding can be partly explained through the observation that the United States possesses a very large and dispersed real estate market, whereas other countries such as Turkey and Singapore are confined to a single city or very few cities that offer a sufficient amount of investable real estate assets.

In summary, the findings reveal that REITs are typically focused on property types that square with but also complement the outcomes of previous research. These results are consistent with the argument that a REIT portfolio focused on a specific property type offers the opportunity to invest in a well-defined sector, with the task of diversification being outsourced to the shareholders.[55] Although REITs are rather focused on countries, concentrations on a specific region are rare, except for REITs domiciled in Singapore and Turkey.

### 2.2.5 Business activities

In the previous section, real estate assets were identified as the main component of the assets owned by REITs. Although several regimes set only a few restrictions regarding the extent of business activities carried out by a REIT, the limitations regarding the asset base limit the dimension of business activities pursued by a REIT. Consequently, if a corporation or a trust wants to choose REIT status, it has to ensure that the main business activities are associated with real estate assets. As illustrated in Figure 2.6, Equity-REITs are mainly engaged in the real estate holding, management and operating business. Figure 2.6 categorises the previously introduced REIT sample by the business activities reported in financial statements.[56] Considering annual mean values over a time period between 1990 and 2009, the revenues assigned to the real estate holding, management and operating business accounted for an average share of 95.31% of the revenues derived from real estate-

[55] FUNK/SCHULZ-EICKHORST (2002), p. 796; VÄTH (2002), p. 834.

[56] Missing data led to the exclusion of 41 REITs, leaving a sample of 178 REITs, with each firm domiciled in any of the eleven countries.

related activities[57]. However, the mean values vary depending on the REIT regime, with firms that have a REIT status in Australia exhibiting an average share of 74.88%, while firms headquartered in South Africa or New Zealand generate all of their revenues from the real estate holding, management and operating business (see Appendix 2.3).

With regard to the concentration on a specific property type, both REITs focusing on lodging and resort properties (mean share of 73.54%) and firms diversifying their portfolios across various property types (mean share of 82.09%) possessed the lowest share of revenues attached to the real estate holding, management and operating business. In contrast, the sampled firms concentrating their portfolios on other property sectors exhibited revenues generated by the real estate holding, management and operating business that accounted for at least 91% of the total real estate-specific revenues (see Appendix 2.3).

The concentration of the operations on the real estate holding, management and operating business represents a consequence of country-specific REIT legislations that confine activities except for the real estate holding, management and operating business. Accordingly, REITs focus on the holding, management and operating business for the purpose of generating rental or real estate operating income. Additionally, active management of a property portfolio offers the opportunity to realise profits as a result of appreciations in property values. Potential value enhancements are measured through property appraisals that are usually carried out through independent appraisers. Depending on the REIT, property valuations are usually prepared following the acquisition of real estate assets and in regular or irregular time intervals during the ongoing management of the properties.

As an extension of the real estate holding and management business, some property holdings typically require specific knowledge for operation. Operating properties include lodging and resort buildings or senior housing facilities.[58]

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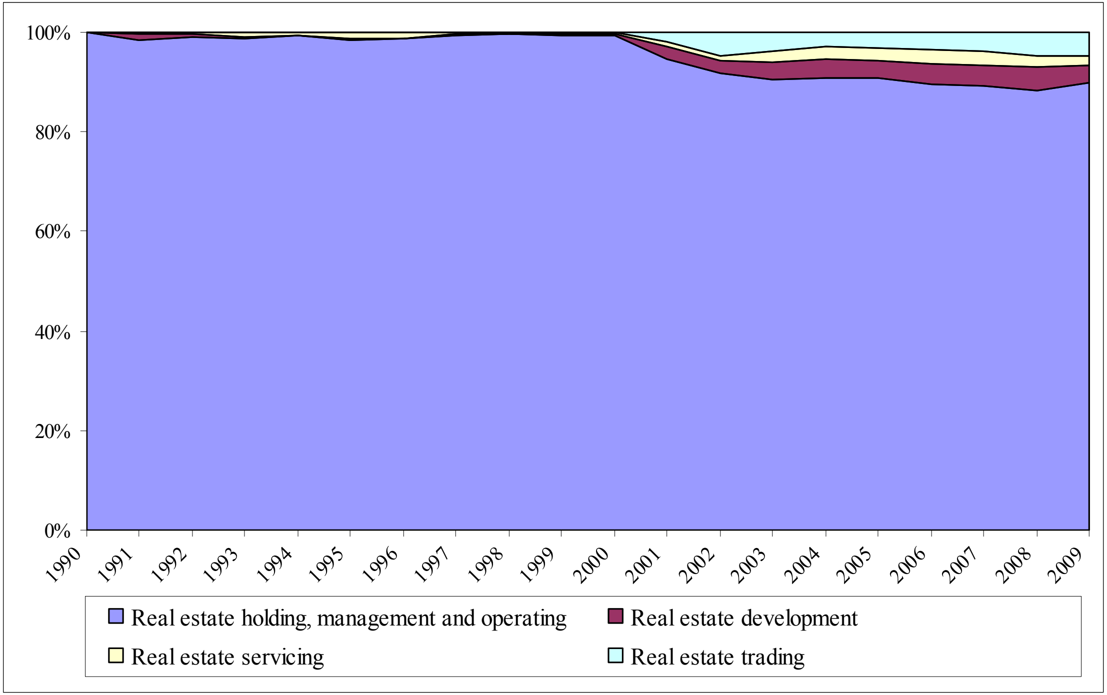
[57] Real estate-related activities include real estate trading, real estate servicing, real estate development and real estate holding, management and operating activities. Revenue data on all activities were retrieved from SNL Financial.

[58] REIT annual reports; VON FREYEND (2000), p. 19.

***Figure 2.6: Composition of revenues derived from real estate-related activities.***




*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

In summary, the property holding, management and operating business usually corresponds to long-term investments in real estate with medium-risk profiles.[59]

Apart from the holding, management and operating of properties, REITs occasionally follow other real estate-related activities that can be confined by legal restrictions. Considering Figure 2.6, activities other than the real estate holding, management and operating business seem to account for a relatively small share of the revenues generated by real estate-specific activities. Excluding the real estate holding, management and operating business, Figure 2.7 documents the variations regarding the shares associated with the trading, the servicing and the development business between 1990 and 2009.

In the case of property development activities, a REIT finances the construction of a new building, primarily for the purpose of expanding the existing property portfolio and partially to generate sales proceeds.[60] Additionally, when combining the property management and development businesses, a REIT can assign another use to an existing building. In this case, the development profit equals the sales price minus the cost of development.
Development activities usually carry a high-risk profile, being heavily dependent on the cycle of the real estate market.[61] Given the increased risk profile, 17 of the 27 REIT regimes explicitly restrict or even prohibit development activities by REITs. According to Figure 2.7, the share of development activities carried out by REITs indicates cyclicality, with reductions in the share especially during the two recessions at the beginning of the 1990s and from the end of 2007 onwards.[62]

Furthermore, Figure 2.8 reveals differences in revenues generated from real estate development activities expressed as shares of the total real estate-specific revenues. Specifically, there exists some evidence that countries exhibiting a relatively large

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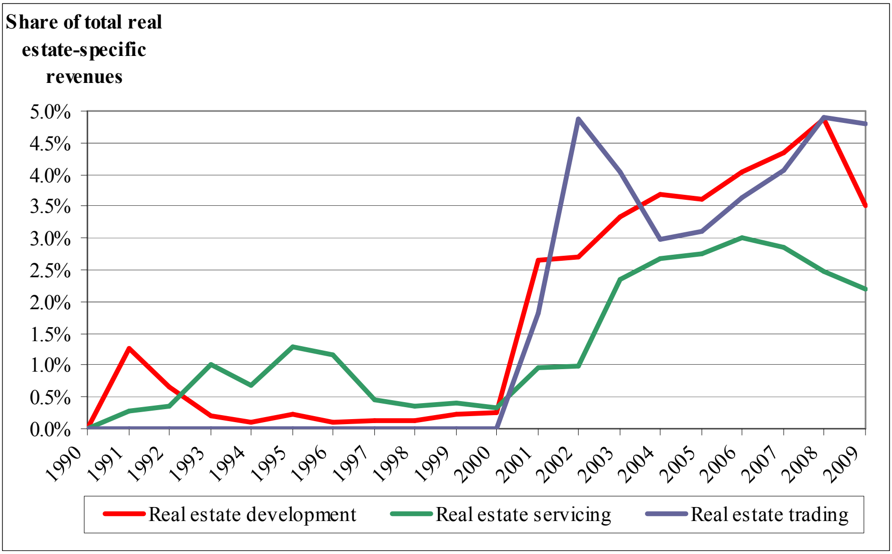
[59] REIT annual reports; BARKHAM (1997), p. 441f; EILRICH (2000), p. 110; MAURER/SEBASTIAN (1998), p. 4; SCHLAG (1995), p. 167.
[60] REIT annual reports.
[61] See, for example, PHYRR/ROULAC/BORN (1999) concerning a review of scientific studies investigating real estate cycles and SAGALYN (1990), who addresses the linkage between REITs and the business cycle.
[62] EILRICH (2000), p. 110; JANDURA (2003), p. 16; VON FREYEND (2000), p. 14.

listed real estate market expressed as a share of the size of the total real estate market are likely to include REITs generating a relatively high share of real estate development revenues.

Potentially, countries such as Australia and Singapore offer a comparatively low amount of investable real estate assets, which rather motivates the REITs domiciled in these countries to develop real estate assets themselves.

***Figure 2.7: Composition of revenues derived from real estate-related activities except of the real estate holding, management and operating business.***




*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

REITs primarily investing in lodging and resorts (8.57%) and industrial properties (7.26%) as well as firms diversifying their assets across several property types (7.87%) all exhibited a comparatively high share of revenues obtained from real estate development activities.

However, Appendix 2.3 reveals that these numbers are dependent on the REIT regime. For example, lodging and resort properties are primarily developed by REITs domiciled in Australia, whereas only REITs that are headquartered in the United

States invest and concurrently develop industrial properties. In addition, REITs focusing on certain property types, such as health care, land lease and self-storage, did not report revenues from development activities.

Property trading activity involves the acquisition and concurring sale of properties in the short term. Property trading is followed for the purpose of deriving profits through acquiring properties at relatively low prices and selling them at comparatively high prices. Activities generating sales profits include restructuring leases, refurbishments or the receipt of planning consents.[63]

***Figure 2.8: Revenues derived from the real estate development business.***

| Data as of 12/31/2009 | Size of the real estate market (RE; in bn. USD) | Size of the listed real estate market (LRE; in bn. USD) | LRE/RE | Mean value of the share of development activities as of real estate-specific activities (2005-2009) |
|---|---|---|---|---|
| Singapore | **129.32** | **38.00** | **29.38%** | **22.36%** |
| Australia | **333.23** | **65.00** | **19.51%** | **16.63%** |
| South Africa | 70.33 | 8.62 | 12.26% | 0.00% |
| Japan | 1996.88 | 154.00 | 7.71% | 0.23% |
| Canada | 558.27 | 42.00 | 7.52% | 0.00% |
| USA | 5885.43 | 362.00 | 6.15% | 0.71% |
| New Zealand | 56.39 | 3.15 | 5.59% | 0.00% |
| France | 1058.24 | 57.00 | 5.39% | 15.44% |
| Netherlands | 312.75 | 12.00 | 3.84% | 0.00% |
| Belgium | 185.1 | 6.00 | 3.24% | 0.01% |
| Turkey | 170.02 | 0.90 | 0.53% | 17.88% |

*Source: Own calculations based on data retrieved from SNL Financial and EPRA*

Considering a cyclical development of property prices, the trading of properties can be associated with a relatively high risk profile.[64] Indeed, Figure 2.7 points to variations in the share of the trading activities that might be a consequence of the cyclical development of property prices. According to Appendix 2.3, REITs domiciled in three (Australia, France and Turkey) of the four countries exhibiting the highest

[63] BARKHAM (1997), p. 442; BARKHAM/WARD (1999), p. 291; SCHARPENACK/NACK/HAUB (1998), p. 663.

[64] BARKHAM (1997), p. 442; EILRICH (2000), p. 110; SCHARPENACK/NACK/HAUB (1998), p. 663; VON FREYEND (2000), p. 16.

mean shares of development-based revenues also possessed the largest amount of trade-specific revenues expressed as shares of total real estate-related revenues. This finding might be partly explained by the similar risk profiles of development and trading activities, which both demand an enhanced degree of risk propensity by a REIT. In this regard, REITs domiciled in Australia that are diversified across property types exhibited the highest shares of revenues from trading activities (52.94%). In addition, the trading of real estate assets might be restricted by legislation. However, the explanations in Appendix 2.3 reveal that five REIT regimes explicitly restrict or even prohibit the real estate trading business, whereas the bulk of regimes do not explicitly address the real estate trading business. Nevertheless, the reduced holding period associated with a property trading business might induce a taxation of sales proceeds.

Apart from that, REITs may provide real estate-related services, such as brokerage and facility management[65] activities. In this sense, REITs primarily carry out commercial facility management[66] but try to outsource technical facility management[67] to a third party. These activities provide an additional benefit to REITs as they are in close relation to their properties. The resulting earnings typically exhibit a higher independence from the real estate investment markets and usually exhibit a relatively low risk profile.[68]
Indeed, Figure 2.7 reveals a relatively smooth movement of the share of real estate servicing-based revenues in comparison to the revenues generated from other real estate-related activities. In addition, REITs focusing their portfolios on lodging and resort properties or firms that hold portfolios diversified across property sectors exhibited the highest mean shares of real estate servicing revenues based on the total real estate-specific revenues. Notably, the high share of real estate servicing revenues for REITs holding diversified portfolios is observed across several REIT re-

[65] Facility management activities include leasing contract management, tenant support and cost recording. The facility management can be subdivided into technical, commercial and infrastructural facility management. [JANDURA (2003), p. 16; MOOG (2005), p. 162; VON FREYEND (2000), p. 14.]
[66] Activities being referred to as commercial facility management activities include contract management, property-specific financial accounting or leasing, for example. [MOOG (2005), p. 163.]
[67] Typical activities classified as technical facility management include construction management, energy management and waste disposal. [MOOG (2005), p. 163.]
[68] BECK (2000), p. 54-56.

gimes. This finding indicates that REITs may not need to build up exceptional knowledge about a single property type to carry out servicing activities for third parties (see Appendix 2.2).

A further REIT business activity that is followed by a minority of REITs entails the purchase of shares in other real estate companies. If not prohibited by REIT legislation, firms partly participate through shares in other REITs, similar to a fund-of-funds situation. The generation of income from other non-real estate activities, such as security and bond investments, can be restricted.[69]
In addition, REITs explore additional sources of revenues that may lead to an outsourcing of activities, instead of acting as fully integrated real estate operating companies. Specifically, REITs have pursued participation in joint ventures and the merging with or the acquisition of other companies.[70]

### 2.2.6 Capital structure

The capital structure of a firm has received much attention in the scientific research on corporate valuation. Preceding consideration of capital structure effects within the valuation tool, the capital structure of REITs is analysed by means of the following steps.
First, the limitations regarding the capital structure choice by REITs set by country-specific legislations are explained (2.2.6.1). Second, scientific research on REITs is considered and complemented through results of the calculations based on the sample used in this study (2.2.6.2).

#### 2.2.6.1 Requirements imposed by country-specific REIT legislation

Country-specific legislation includes several requirements that restrict the capital structure decisions made by REITs.

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[69] EPRA (2010); SCHLAG (1995), p. 168.
[70] CAPOZZA/LEE (1995), p. 375; CHAN/ERICKSON/WANG (2003), p. 32-35 & 254; CONNER/LIANG (2005), p. 50; KENG (2004), p. 6.

Foremost, 18 of the 27 REIT regimes explicitly limit the use of debt by REITs.[71] Specifically, a certain threshold confines the leverage ratio. However, the comparability of the restrictions imposed by country-specific legislation is reduced, as no uniform definition of the leverage ratio exists. In this regard, measures such as the debt-to-total assets ratio, earnings before interest, taxes, depreciation and amortisation (EBITDA)-to-interest expense ratio, the comparison between annual interest costs and total annual profits are used to limit exposure to debt financing.[72]

#### 2.2.6.2 Empirical analysis

Apart from the restrictions set by legislation, the capital structure choice of REITs has been subject to scientific examinations.

Several authors have documented that REITs have exhibited leverage ratios that exceeded those of firms belonging to other industries.[73] In summary, numerous studies on REITs domiciled in the United States have documented historical leverage ratios in a range between 35% and 65%, whereas most firms employ a maximum ratio of 50%.[74] Additionally, few studies ascertain that this range should be valid with REITs founded in regimes other than that of the United States.[75] Nevertheless,

[71] In addition, the Bulgarian REIT regime limits the use of short-term loans only. [Appendix 2.2.]

[72] Appendix 2.2.

[73] See, for example, BARCLAY/HEITZMAN/SMITH (2008, p. 3), who compared REITs to taxable real estate firms and companies belonging to other industries over a time interval from 1984 until 2006. The authors found that the mean leverage ratio, measured as the average value of the total book value of debt divided by the market value of total assets, of REITs is the highest (42.5%), followed by that of taxable real estate corporations (39.6%) and the ratio associated with firms belonging to other industries (18.13%). [BARCLAY/HEITZMAN/SMITH (2008), p. 9f & 28.]

[74] Analysing 48 REITs during the year 1988, BROWN (2000, p. 476) observed an average share of debt obligations to the book value of total assets of 35.6%. Subsequently, CAPOZZA/SEGUIN (1999b, p. 28) examined a sample of REITs over a time period between 1989 and 1998 and detected an average ratio of total debt-to-total assets of 48%. Studying REITs over a time period between 1991 and 2003, FENG/GHOSH/SIRMANS (2007, p. 90f) documented that the total book debt-to-total assets ratio ranges between 50% and 65%. Investigating a time period between 1997 and 2006, BOUDRY/KALLBERG/LIU (2010, p. 108) identified a ratio of total debt plus preferred equity-to-total market capital of 45.4%. ERTUGRUL/GIAMBONA (2010, p. 8-12) ascertained an average leverage ratio of 45.8% when considering 186 REITs over a sample period between 1998 and 2004. The authors calculated the leverage ratio by means of dividing the market value of the firm by the total debt. [ERTUGRUL/GIAMBONA (2010), p. 8-12.] MORRI/BERETTA (2008, p. 17) discovered an average ratio of total debt-to-total assets of 43.1% when analysing REITs over a time period between 2002 and 2005.

[75] MORRI/CRISTANZIANI (2009, p. 327) observed an average total debt-to-total assets ratio attached to REITs incepted under the law of single European countries of 35.0%. The comparatively small sample includes 37 firms with and without a REIT status over the time period between 2002 and 2006 that are

this assumption cannot be proven due to the absence of sufficient research findings, albeit some evidence indicates that European firms, concentrating their business activities on real estate, have historically displayed relatively high ratios as well.[76] Instead of the REIT status, the business activity carried out by the firm might be the reason for the magnitude of the REIT leverage ratio.

Apart from a contingent dependency of the REIT leverage ratio on the country of the REIT regime, further relationships have been considered.

The analyses regarding a potential connection between the size of the leverage ratio and the property type focus of a REIT have provided inconsistent results.[77] Examining British property companies, BARKHAM (1997, p. 449) observed that firms primarily engaged in the real estate trading business tend to use a higher leverage ratio than companies mainly concerned with the holding, management and operations of real estate assets. In this regard, the size of the leverage ratio conceivably depends on the composition of business activities carried out by a REIT.

Following the recommendation by BARCLAY/SMITH/MORELLEC (2006, p. 54), the leverage ratio used in the present study was calculated by dividing the book value of total debt by the book value of total assets, which is named book measure of leverage.[78] The results of the calculation of historical mean leverage ratios of the

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domiciled in Belgium, France, Germany, Greece, the Netherlands or in the United Kingdom. [MORRI/CRISTANZIANI (2009), p. 327 & 372.] One exception refers to Turkish REITs that are tax-exempt on a corporate level and only need to distribute 20% of their annual profits. EROL (2008, p. 13f) observed that Turkish REITs possessed a ratio of total debt-to-book value of total assets of 22.6%, when considering data during the period from 1998 until 2007.

[76] MORRI/CRISTANZIANI (2009, p. 327) documented that real estate firms devoid of a REIT status possessed a higher average total debt-to-total assets ratio (46.6%) in comparison to REITs (35.0%).

[77] ERTUGRUL/GIAMBONA (2010, p. 8-13) concluded that the property sector focus of a REIT does not provide an explanation regarding the size of the leverage ratio. CAPOZZA/SEGUIN (1999b, p. 2) observed that REITs concentrating their business activities on the holding and management of apartments displayed a ratio of debt-to-total assets that exceeded the average share for other REITs by 7% to 9%. Focusing on firms domiciled in the United States, the authors studied a dataset including 58 Equity-REITs between 1985 and 1992 and 197 Equity-REITs from 1989 until 1998. [CAPOZZA/SEGUIN (1999b), p. 5.]

[78] The book value of total assets constitutes the sum of total assets and liabilities and shareholders' equity. In contrast, the market measure of leverage is calculated by dividing the book value of total debt by the market value of total assets. [BARCLAY/HEITZMAN/SMITH (2008), p. 9f; BARCLAY/SMITH/MORELLEC (2006), p. 49; ERTUGRUL/GIAMBONA (2010), p. 20.] Indeed, the use of an appropriate measure of leverage has been debated in the scientific literature. Some authors prefer the use of the book measure of leverage [see, for example, BARCLAY/SMITH/MORELLEC (2006, p. 54)], whereas other researchers have proposed the application of the market measure of leverage [see, for example, WELCH (2004, p. 125)]. In terms of the examination of REITs, several scientists have employed the book measure of leverage [see, for example, BROWN/RIDDIOUGH (2003, p. 326f) or CA-

previously introduced REIT sample over a time period between 2004 and 2008 are summarised in Figure 2.9.[79] Accordingly, the mean leverage ratio has a value of 27.98% but varies between both countries and property type focus. Notably, REITs focusing their portfolio on health care, self-storage and specialty properties possessed rather low levels of leverage. In contrast, REITs focusing their activities on residential properties employed relatively high book measures of leverage. Analysing firms belonging to various industries that are listed on a Japanese stock exchange, SUZUKI/WRIGHT (1985, p. 97f) observed relatively low equity ratios compared to those of companies domiciled in other countries. This finding can be explained through different accounting practices, a unique stock issue system and the observation that Japanese firms tend to hold a relatively close relationship with their lenders.[80] Indeed, Figure 2.9 documents a comparatively high leverage ratio with REITs belonging to the Japanese REIT regime.

Considering the historical development of the book measure of leverage (Figure 2.10), a ratio in a range between 20% and 40% has been predominantly employed by REITs included in the sample. Notably, REITs domiciled in Australia have typically utilised leverage ratios below those used by REITs headquartered in the Netherlands or in the United States. Apart from a potential connection between the leverage ratio and the cost of debt, REITs domiciled in Australia may try to compensate for the enhanced risk profile associated with real estate trading and development business by means of a reduced leverage ratio.

POZZA/SEGUIN (1999b, p. 26)], whereas other authors have utilised the market measure of leverage [i.e., BARCLAY/HEITZMAN/SMITH (2008, p. 9f) or GIAMBONA/HARDING/SIRMANS (2008, p. 126)]. However, some authors have obtained similar results when using both the market and the book measure of leverage [see, for example, ERTUGRUL/GIAMBONA (2010, p. 20) or FENG/GHOSH/SIRMANS (2007, p. 102)].

[79] The analysis of the book measure of leverage includes 189 of the 218 previously introduced REITs. In this regard, 30 REITs had to be excluded due to missing data.

[80] SUZUKI/WRIGHT (1985), p. 99-101.

***Figure 2.9: Leverage ratio by country of origin and property type focus.***

| | Total | Australia | Canada | Belgium | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa[1] | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | 27.98% | 22.70% | 34.52% | 23.77% | 34.10% | 32.04% | 21.81% | 17.73% | 18.75% | 6.98% | 11.24% | 30.37% |
| **Apartments** | 35.32% | 32.13% | 39.47% | --- | --- | 32.32% | --- | --- | 19.47% | --- | --- | 34.51% |
| **Community centres** | 29.96% | 32.88% | 33.15% | --- | --- | --- | --- | --- | --- | --- | --- | 28.80% |
| **Free standing** | 25.09% | 27.93% | --- | --- | --- | --- | 20.95% | --- | --- | --- | --- | 23.89% |
| **Health care** | 22.04% | 25.48% | --- | 10.63% | --- | --- | --- | --- | --- | --- | --- | 22.84% |
| **Industrial** | 28.34% | 20.83% | 29.38% | 25.17% | --- | --- | --- | --- | --- | --- | --- | 30.17% |
| **Land lease** | 40.31% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 40.31% |
| **Lodging and resorts** | 30.31% | 25.38% | 36.94% | --- | --- | --- | --- | --- | --- | --- | --- | 29.39% |
| **Merchandise centres** | 30.65% | 16.10% | 30.02% | 30.91% | --- | 33.18% | --- | --- | 19.50% | 4.97% | --- | 41.26% |
| **Neighbourhood centres** | 28.60% | 19.85% | --- | 20.62% | --- | --- | --- | --- | --- | --- | --- | 34.18% |
| **Offices** | 27.05% | 21.75% | 31.62% | 25.90% | 10.35% | 32.34% | 24.15% | 18.72% | 17.28% | --- | --- | 29.53% |
| **Self storage** | 21.76% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 21.76% |
| **Specialty** | 21.62% | 17.92% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 25.32% |
| **Diversified** | 25.45% | 19.03% | 32.92% | --- | 36.59% | 25.93% | 21.31% | 16.74% | --- | 7.99% | --- | 29.48% |

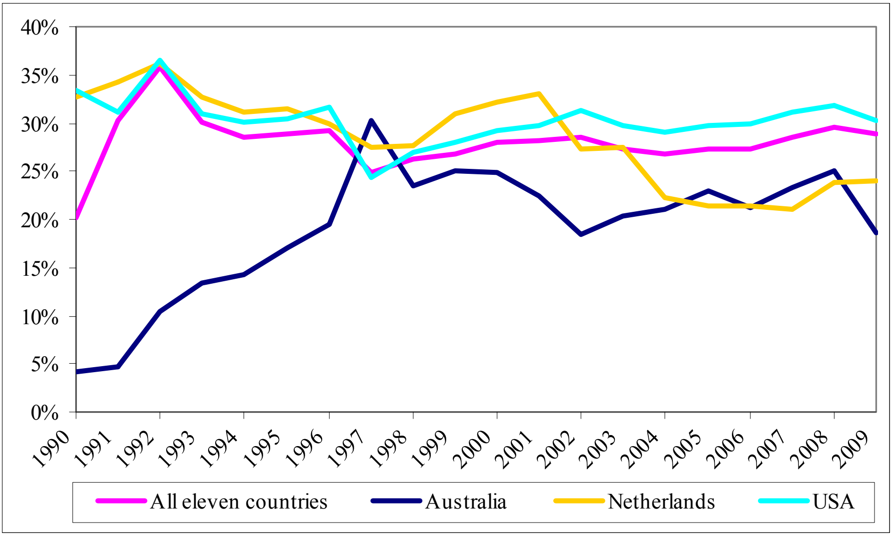
*Source: Own calculations based on the total sample (189 of 218 REITs) and data retrieved from Bloomberg*

*[1]Given data limitations, the ratios pertaining to REITs domiciled in South Africa are based on a data range between 1999 and 2003.*

*Notes: The sign --- means that no corresponding REITs have been sampled.*

Except for equity, REITs typically employ long-term[81] and short-term debt[82] as major financing sources, with preferred stock[83] and retained earnings[84] used as external funds to a reduced extent.

***Figure 2.10: Path of the leverage ratio by country of origin.***




*Source: Own calculations based on the total sample (189 of 218 REITs) and data retrieved from Bloomberg*

Long-term debt can account for an average share of up to 50% of the book value of total assets.[85] Consequently, long-term debt constitutes the most important capital

[81] Long-term debt may refer to a long-term loan obtained from a financial institution or a long-term bond that the REIT issues to financial markets. These financing sources are supposed to have a maturity of more than one year. [DAMODARAN (2002), p. 35f; ROSS/WESTERFIELD/JAFFE (2002), p. 563.]
[82] Included in the current liabilities item, short-term debt typically comprises loans with maturities of less than one year that are used to finance business operations. Short-term debt can entail the fraction of long-term debt that is coming due in the following year. [DAMODARAN (2002), p. 35.]
[83] Preferred stock is classified as a hybrid security, as it shares both a debt characteristic, namely, a preferred dividend that is distributed prior to common dividends, and an equity symptom, in the sense that the preferred dividend is not tax-deductible. [DAMODARAN (2002), p. 212.]
[84] Measured over the whole life of the firm, retained earnings equal the cumulative surplus of net income over dividends. Consequently, the earnings not distributed as dividends are aggregated in the retained earnings position. In contrast, a net loss generated by the firm reduces the balance of retained earnings. [STICKNEY/WEIL/SCHIPPER (2009), p. 60 & 159.]
[85] OTT/RIDDIOUGH/YI (2005, p. 215f) found that long-term debt has comprised between 30% and 50% of the book value of total assets. The authors analysed 244 Equity-REITs domiciled in the United States over a sample period from 1981 until 1999. [OTT/RIDDIOUGH/YI (2005), p. 206.] Contributing to these

source used by REITs, assuming equity is not considered. One explanation concerning this finding is based on the assumption that REITs try to match the maturity of debt to the lease term of the respective properties.[86] Indeed, a comparison with industrial firms reveals that REITs typically employ debt exhibiting a much longer average maturity.[87] Considering that long-term debt should account for a large share of total assets, the bulk of debt might be associated with fixed interest rate obligations.[88]

In this sense, it has been documented that the capital structure of REITs has changed over time, also becoming more complex.[89] Accordingly, some Equity-REITs have already complemented more traditional sources of financing, such as bank funding, with newer forms of financing, such as commercial mortgage-backed securities (CMBS) and medium-term notes. HARDIN/WU (2009, p. 2) asserted that REITs extend their financing sources, which initially comprised secured debt such as mortgages[90] only, to debt obtained from public capital markets. Public debt offerings mostly represent straight fixed-rate coupon bonds not secured by real estate assets.[91] The likelihood of issuing public bonds seems to increase with firm size.[92] Further, evidence indicates that REITs domiciled in the United States issued public debt with

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findings, CAPOZZA/SEGUIN (1999b, p. 28) detected that the average long-term debt-to-total assets ratio is 36% when analysing 197 REITs headquartered in the United States over a time period between 1989 and 1998. MORRI/BERETTA (2008, p. 17) observed that the long-term debt accounts for a share of 38.8% of the total assets, when measuring equity at market value. Employing book values, MORRI/CRISTANZIANI (2009, p. 327) identified that European REITs possess a long-term debt-to-total assets ratio of 31.1%.

[86] Adapted from WU/RIDDIOUGH (2005, p. 7).

[87] GIAMBONA/HARDING/SIRMANS (2008), p. 128.

[88] Indeed, CAPOZZA/SEGUIN (1999b, p. 27) found that 13% of the total REIT assets have been financed by debt with a variable interest rate and 29% consist of debt adherent to fixed interest rate payments. In addition, the ratio of fixed interest rate-to-variable interest rate debt potentially shows variations by property type focus. For example, apartment REITs employed a higher ratio of fixed-to-variable interest rate debt when compared to other REITs. [CAPOZZA/SEGUIN (1999b), p. 2.]

[89] OTT/RIDDIOUGH/YI (2005), p. 204.

[90] HARDIN/WU (2009, p. 3f) argued that the debt financing by means of mortgages includes liens against individual properties. A disadvantage of this form of financing refers to limitations regarding the acquisition and sale of properties, which ultimately confine the strategic and operating options available to management. [HARDIN/WU (2009), p. 3f.]

[91] BROWN/RIDDIOUGH (2003), p. 317; HARDIN/WU (2009), p. 4. Scientific evidence indicates that REITs exhibit a reduced probability to choose public debt financing if they have already borrowed comparatively high amounts of secured debt. [BROWN/RIDDIOUGH (2003), p. 316.]

[92] A positive relationship between the firm size and access to public debt markets was observed by BROWN/RIDDIOUGH (2003, p. 316) and HARDIN/WU (2009, p. 18). Considering relatively high costs associated with an equity or a long-term debt issue, small-capitalised firms tend to prefer short-term debt, which results in lower fixed costs. [MORRI/BERETTA (2008), p. 18; SMITH (1977), p. 275-281.]

a mean size of approximately 150 million US-Dollars and an average maturity of ten years. The proceeds from the offer of public debt are typically used to purchase back bank and senior secured debt instead of to pursue new investments.[93]
The issuance of unsecured debt[94] resulted in a higher demand for credit ratings by independent agencies.[95] The analysis by ERTUGRUL/GIAMBONA (2010, p. 11f) revealed that 45% of the sampled 186 Equity-REITs headquartered in the United States have obtained a debt rating. This observation is complemented by an examination of REIT credit ratings during the evaluation of the probability of bankruptcy in Chapter Eight.

Short-term debt should account for a share of the book value of total assets remaining in a range between 0 and 15%.[96] This funding source primarily comprises private credit facilities, such as loan commitments[97]. Loan commitments are requested

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[93] Analysing data regarding REITs listed on a stock exchange in the United States between 1992 and 2004, HARDIN/WU (2009, p. 35) documented that a share of 30.0% of all public debt issued by REITs is employed to pay down bank debt, while a share of 2.2% of all public financing is utilised for property acquisitions. BROWN/RIDDIOUGH (2003, p. 317) analysed 120 public debt offerings by REITs domiciled in the United States over a time period between 1993 and 1998. The bonds under consideration had a mean size of 133 million US-Dollars, a maturity ranging from 4.3 to 30 years with an average of 10.6 years and a premium of 124 basis points above the yield on treasury bonds with a comparable maturity. [BROWN/RIDDIOUGH (2003), p. 318.] BOUDRY/KALLBERG/LIU (2010, p. 100) examined 433 REIT debt offerings by REITs headquartered in the United States between 1997 and 2006 and revealed that the average issue size is at 142 million US-Dollars for public debt and accounts for 287 million US-Dollars of private debt.

[94] Unsecured debt represents general obligation bonds. In this regard, the lender has a claim on the assets of the firm. [AMBROSE/BOND/OOI (2010), p. 4.]

[95] OTT/RIDDIOUGH/YI (2005), p. 215.

[96] CAPOZZA/SEGUIN (1999b, p. 28) found that the average short-term debt-to-total assets ratio accounted for 6%. MORRI/BERETTA (2008, p. 17) discovered a mean ratio of short-term debt-to-total assets of 4.2% when measuring equity at market value. OTT/RIDDIOUGH/YI (2005, p. 215f) documented that the share of short-term debt remained in a corridor between 0 and 15% of the book value of total assets. Using book values, MORRI/CRISTANZIANI (2009, p. 327) ascertained that REITs headquartered in one of numerous European countries exhibited a short-term debt-to-total assets ratio of 6.1%. Analysing REITs domiciled in Turkey, EROL (2008, p. 1) asserted that these firms employed short-term debt to a minor extent only. The author argued that Turkish REITs largely ignore the use of short-term debt due to the restricted requirement of income distribution. [EROL (2008), p. 1.]

[97] Loan commitments constitute the contractual promise granted by a financial institution to a borrower to lend money upon request over a certain period of time. Loan commitments can be differentiated into revolving credit arrangements and lines of credit. A revolving credit arrangement entails the renewal of a loan commitment with a potentially long duration, secured by a formal agreement made between a bank and a firm. Lines of credit represent forward commitments. Specifically, the lending institution issues an option that provides the borrower with the right to draw up to a certain amount of funds if needed over a specified period of time at predetermined conditions. [CAMPBELL/DEVOS/SPIELER (2008), p. 1; LEV/RYAN (2004), p. 2; McDONALD (1994), p. 23.]

if property acquisitions need to be made quickly, thus representing bridge financing prior to the funding of properties through long-term debt or equity.[98] The relevance of using short-term debt becomes obvious when considering the assertion by HARDIN/WU (2009, p. 6), who viewed the possibility to quickly finance acquisitions as one reason why REITs employ debt.[99]

Specifically, REITs acquire loan commitments, named lines of credit. Lines of credit employed by REITs typically have a maturity of one year and are charged at a variable interest rate.[100] WU/RIDDIOUGH (2005, p. 1) observed that REITs use bank lines of credit more frequently than firms belonging to other industries with these facilities, accounting for approximately 80% of the total REIT bank debt.[101]

Measured as a share of the book value of total assets, preferred stock may account for a value in the range between 0% and 5%, whereas retained earnings possibly exhibit a relatively low amount.[102]

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[98] REIT annual reports.

[99] HOWE/SHILING (1988, p. 992) documented a positive information effect of REIT announcements of short-term debt, including lines of credit and short-term bank agreements.

[100] CAMPBELL et al. (2008), p. 195; REIT annual reports; WU/RIDDIOUGH (2005), p. 7. The lending institutions generally charge a combination of front-end set-up, annual or usage fees. [ELAYAN/MEYER/LI (2004), p. 64f; SHOCKLEY/THAKOR (1997), p. 519-521; WU/RIDDIOUGH (2005), p. 7.] ELAYAN/MEYER/LI (2004, p. 64f) collected data on 61 loan commitments that had been priced with 151 basis points in excess of the London interbank offered rate (LIBOR), whereas 48 loan commitments involved an average interest rate of 74 basis points above the prime rate. Thirty-three institutions introduced average commitment fees of 0.40%, typically based on the unused balance of the loan commitment. [ELAYAN/MEYER/LI (2004), p. 64f.] WU/RIDDIOUGH (2005, p. 35) found that the commitment fees charged to REITs had been ten basis points lower in comparison to fees paid by firms belonging to other industries. These cost savings might be partly a result of the high level of asset tangibility associated with REITs.

[101] WU/RIDDIOUGH (2005, p. 10) examined lines of credit obtained by REITs between 1990 and 2003 and documented that the average ratio of these facilities-to-total assets is 9.2% for REITs and 4.5% for public firms belonging to other industries. Analysing 130 announcements by REITs over a period between 1994 and 2004, CAMPBELL/DEVOS/SPIELER (2008, p. 3) found that lines of credit possessed a mean volume of 186.3 million US-Dollars, which represents an average share of 26.1% of the total assets.

[102] REIT annual reports. According to OTT/RIDDIOUGH/YI (2005, p. 215f), the share of preferred stock to the book value of total assets remained in a range between 0% and 5%. Further, the authors documented that retained earnings accounted for a mean share of 7% of the total investments made by the respective REITs. [OTT/RIDDIOUGH/YI (2005), p. 215f.] Analysing general stocks over comparable time periods, FAMA/FRENCH (1998, p. 1953f) found that retained cash earnings accounted for a share of 59.52% (1987-1991), of 71.82% (1992-1996), and of 83.80% (1982-1986) of the investments after dividend and interest payments. The differences in the ratios of REITs and general stocks may represent a consequence of the requirement of REITs to distribute a large share of earnings to shareholders.

### 2.2.7 Distribution requirements

A major characteristic of a REIT refers to the requirement to distribute the bulk of its earnings to shareholders. In summary, 24 of the 27 REIT regimes demand the distribution of income to shareholders, at a certain share that is enumerated by the REIT regime and often has a value between 80% and 100%. However, the inter-country comparability of this requirement is reduced, as the type of the income measure used to determine the size of the distributions shows variations across regimes. Consequently, the actual magnitude of the amount to be distributed is not comparable between REIT regimes.

With regard to the capital gains, a distribution or a reinvestment of gains into new assets has been prescribed by several REIT regimes to ascertain that the REIT receives tax benefits. Capital gains occur in infrequent intervals as a consequence of the sale of properties.

In terms of the frequency, the REIT regimes typically require annual income distributions. In this sense, the distribution should usually take place at a maximum of one year after the taxation year. This requirement entails that the distribution of earnings is tied to the year of their generation.[103]

The distribution requirement limits the ability of a REIT to commit capital to existing assets or to carry out new investments.[104] GYOURKO/SINAI (1999, p. 359) offered evidence that this legal restriction represents the most important cost associated with being structured as a REIT vehicle.

## 2.3 Distinctive features of REITs in comparison to alternative forms of real estate entities

Taking the previous explanations regarding major features of Real Estate Investment Trusts into consideration, this section aims to distinguish REITs from alternative forms of real estate entities. Although a variety of real estate investment vehicles have been introduced worldwide during recent years, the present study concentrates on two alternative forms of stock exchange-listed and actively managed real estate

[103] EPRA (2010).
[104] CONNER/LIANG (2005), p. 40; GENTRY/JONES/MAYER (2004), p. 3.

entities, i.e., real estate companies without a REIT status and real estate mutual funds.[105] Real estate companies without a REIT status may act as real estate owners, managers and operators, development companies or construction firms and are referred to as real estate operating companies (REOCs) in this study. Real estate mutual funds (REMFs) represent specialised mutual funds that typically invest in real estate securities, such as REOCs or REITs. REMFs may or may not be listed on a stock exchange; however, as they are investing in listed securities, they are dependent on the development of the stock markets as well.[106]
In the following, the features that have been discussed in Section 2.2 are used to distinguish between REITs and the alternative forms of real estate entities considered in this study.

Referring to the taxation at the company level, it has been documented that REITs are typically exempt from taxes that are due on income as well as on potential capital gains, which are both distributed to shareholders as dividends. The tax exemption is granted to companies that fulfil the requirements prescribed by the respective REIT regime. REMFs can be exempt from taxes on income and capital gains distributed to unitholders. In contrast, a REOC usually does not receive a tax exemption.[107]

In terms of the organisational structure, a REIT must comply with country-specific regulatory provisions; for example, regarding its legal form or its minimum share capital. In contrast, the legal form of a REOC typically does not differ from that chosen by a non-real estate stock exchange-listed company with the minimum share capital probably dependent on the legal form. Similarly, REMFs typically do not

[105] To ensure comparability with stock exchange-listed Equity-REITs examined in this work, only actively managed and listed real estate entities are considered in this section. For example, vehicles focusing on debt positions such as CMBS are excluded from the comparison.
[106] BAUM (2008), p. 10f; KALLBERG/LIU/TRZCINKA (2000), p. 389; PEARCE/NEWELL (1998), p. 1. Analysing 402 real estate mutual funds worldwide, EICHHOLTZ/KOK/MARGARITOVA (2009, p. 2) find that few REMFs included in the sample also invest directly in properties, in unlisted property funds, or in other asset classes.
[107] ADAMUSCIN (2010), p. 33; PRICE (2006), p. 7; REMFs' prospectuses. As an exception, REOCs domiciled in the United States and structured as a master limited partnership are not subject to double taxation. [CHAN/ERICKSON/WANG (2003), p. 27f & 46-48; KALLBERG/LIU/TRZCINKA (2000), p. 389.]

have to comply with country-specific regulatory provisions. A REIT might be structured in the sense that it is both internally advised and internally managed. Although a REOC may choose to be either internally or externally managed or advised as well, there obviously does not exist sufficient academic research regarding the management and advisor preferences of these firms. A real estate mutual fund, which usually invests in REITs or REOCs, is often actively managed, i.e., securities are bought and sold instead of replicating a real estate index for example. However, the manager of the fund typically does not perform asset or property management activities as might be the case with REITs or REOCs.[108]

Furthermore, a stock exchange-listing of a REIT can be compulsory, depending on the REIT regime. Although REOCs are often listed on a stock exchange, a listing is typically not required by legislation. Referring to REITs, the minimum number of equityholders or the maximum number of shares held by a single equityholder may be regulated by law, depending on the REIT regime. These requirements may promote high liquidity in a REIT investment. In comparison, REMFs could exhibit an even higher liquidity as these funds may invest in several REITs, thus probably being diversified across property types and regions.[109] Scientific evidence shows that REMFs can be grouped according to continents, with some funds investing globally and thus offering a much broader regional diversification than REITs which are probably focused on a single region or city.[110] In contrast, investments in REMFs can be associated with reduced liquidity if redemption periods exist or in cases where the REMFs' holdings exhibit illiquidity.[111] Furthermore, the shareholder base of REOCs is typically not regulated by law, with some firms exhibiting a relatively low free float.[112]

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[108] BLACK/ROTTKE/BECKER (2006), p. 10f; DELCOURE/DICKENS (2004), p. 239; HARTZELL/MÜHLHOFER/TITMAN (2007), p. 1; REMFs' prospectuses.

[109] KALLBERG/LIU/TRZCINKA (2000), p. 389. However, the liquidity of the real estate mutual fund may be restricted in the case of a relatively low liquidity of the REITs or REOCs held by a real estate mutual fund. [PRICE (2006), p. 16.]

[110] Particularly, EICHOLTZ/KOK/MARGARITOVA (2009, p. 2f) grouped REITs on the basis of four continents (America, Asia, Australia and Europe).

[111] PRICE (2006), p. 16. For example, the eleven real estate mutual funds domiciled in Australia, which were analysed by PEARCE/NEWELL (1998, p. 6), exhibit redemption periods between five and 60 days.

[112] DELCOURE/DICKENS (2004), p. 238. See for example BLACK/ROTTKE/BECKER (2006, p. 11) with regard to listed German real estate companies.

REITs belonging to one of the 27 REIT regimes must possess a minimum ratio of real estate-to-total assets, which ranges between 50% and 95%, depending on country-specific REIT legislation. In the case of REMFs, the types of assets held by the fund may be specified through investment objectives listed in the prospectus. However, the adherence to these rules is typically not required by law but voluntarily. Furthermore, REOCs are usually not limited regarding their asset base.[113]

The minimum ratio of real estate-to-total assets limits the dimension of business activities pursued by a REIT. According to Figure 2.6, the real estate holding, management and operating business accounts for 95.31% of the real estate-related activities performed by a REIT. In contrast, REOCs may pursue other real estate-related activities such as the real estate development or the real estate trading business without limitations. Accordingly, several listed real estate companies concentrate either on trading with real estate assets or on the development of properties or on both activities. In contrast, real estate mutual fund managers are concerned about buying and selling REOCs or REITs.[114]

As explained above, 18 of the 27 REIT regimes explicitly restrict the capital structure decisions made by REITs with the leverage ratio limited by a certain threshold. Real estate mutual funds typically use little or no leverage.[115] Comparing the leverage ratios of REOCs to those of REITs, some scientific evidence points to lower leverage ratios[116] while other research observes higher leverage ratios of REOCs[117]. REOCs might partly exhibit higher leverage ratios because REITs domiciled in several countries are confronted with restrictions regarding their maximum leverage ratio. On the contrary, REITs may exhibit higher leverage ratios as the distribution requirement impairs the build-up of retained earnings and could necessitate a more

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[113] DELCOURE/DICKENS (2004), p. 238; GALLO/LOCKWOOD/RUTHERFORD (2000), p. 166; REMFs' prospectuses.

[114] BARKHAM (1997), p. 442; HARTZELL/MÜHLHOFER/TITMAN (2007), p. 1; VELD (2005), p. 16f.

[115] EICHOLTZ/KOK/MARGARITOVA (2009), p. 4.

[116] DELCOURE/DICKENS (2004, p. 242) observe that the ratios of long-term debt-to-total assets and of variable debt-to-total debt are higher with REITs in comparison to REOCs.

[117] VELD (2005, p. 16) finds that real estate companies with a REIT status exhibit a lower leverage ratio than real estate companies without a REIT status.

extensive use of debt funding.[118] Furthermore, some evidence shows that the degree of leverage used by REOCs seems to be dependent on whether the company pursues real estate holding, management and operating, property development or trading activities.[119]

Depending on the REIT regime, a value between 80% and 100% of income has to be distributed to shareholders. In comparison, as REOCs are usually not required to distribute income to shareholders, they are likely to have a higher probability of growing their business without external funding. Referring to REMFs, the distribution of income is usually not required by legislation. Rather, the investor may choose between an accumulating and a distributing fund tranche.[120]

Taking the recent comparison into account, the decision of whether or not to opt for a REIT status should generally be based on the consideration of the tax advantage on the one hand and the restrictions, varying by REIT regime, on the other. In addition, a comparison of REITs and REOCs in terms of risk and return data helps to examine the attractiveness of the entities from an investor perspective. In this context, scientific evidence seems to corroborate a lower risk profile of REITs[121] which could be attributed to the REIT regimes that partly restrict leverage ratios and to development and trading activities for example.[122] Further, scientific research documents higher[123]

[118] Adapted from DELCOURE/DICKENS (2004, p. 239).

[119] BARKHAM (1997, p. 449) observes that real estate companies without a REIT status that carry out property trading activities exhibit much higher levels of leverage in comparison to companies pursuing the real estate holding and management business.

[120] DELCOURE/DICKENS (2004), p. 237-239; REMFs' prospectuses.

[121] Analysing REITs and REOCs domiciled in the United States between 1997 and 2002, DELCOURE/DICKENS (2004, p. 241f) observe that REITs exhibit lower beta values than REOCs. Similarly, VELD (2005, p. 15) finds that REITs, as tax transparent companies, showed approximately only half of the volatility of taxpaying real estate companies without a REIT status. Analysing real estate companies domiciled in the United States over a time period between 1962 and 1990, GYOURKO/KEIM (1992, p. 478-480) observe that the betas of portfolios including building companies or development firms are much higher in comparison to the beta of a portfolio of REITs. Comparing real estate companies without a REIT status to Equity-REITs over a period beginning in 1973 and ending in 1987, SAGALYN (1990, p. 211f) finds that real estate companies without a REIT status exhibit considerably higher volatilities than REITs.

[122] In this sense, ADAMUSCIN (2010, p. 35) argues that the common aim of legal restrictions regarding REITs is to ensure that REITs act as companies with a reduced risk. A similar argument is made by VELD (2005, p. 6).

but also lower[124] stock returns of REOCs when compared to those of REITs. A potential reason for more favourable returns delivered by REITs refers to a higher investor attention towards REITs as these entities represent a rather standardised form of indirect real estate investment which is well-established in an international context.

[123] GYOURKO/KEIM (1992, p. 471-475) find that the returns of portfolios including building companies on the one hand and development firms on the other both exceed those of a portfolio of REITs.

[124] Analysing real estate limited partnerships (RELPs) as a form of REOCs, and Equity-REITs over the time period from 1987 until 1990 and comparing the performance of these entities through a generalised stochastic dominance methodology, MARTIN/COOK (1991, p. 200) observe that investors prefer Equity-REITs to RELPs when considering past performance. SAGALYN (1990, p. 207-212) categorised real estate companies into commercial property investment and development companies on the one hand and into homebuilding firms on the other. The author finds that homebuilding firms achieved the highest average quarterly total return (4.42%) followed by Equity-REITs (4.10%) and commercial property investment and development firms (3.26%).

# 3 Fundamentals of corporate valuation

In the following paragraphs, conventional corporate valuation approaches are introduced.

The fundamentals of corporate valuation will proceed in several steps. First, the rationale for corporate valuation is identified while addressing the research subquestion of which objectives are associated with an approach to REIT valuation (3.1). Second, principles attached to the corporate valuation are collected (3.2). Third, models that are commonly employed in corporate valuation are classified (3.3).

## 3.1 Rationale for a corporate valuation

In an economic sense, PINTO et al. (2010, p. 1) described valuation as the "[...] estimation of an asset's value based on variables perceived to be related to future investment returns, on comparisons with similar assets, or, when relevant, on estimates of immediate liquidation proceeds." In this regard, a valuation represents the allocation of a value by a valuing entity[1] to a valuation object[2].[3]

The primary task of corporate valuation concerns the determination of potential prices[4] attached to a company or parts of it. The identification of a company's actual price does not represent a task for corporate valuation but can be accomplished through stock exchange trading, for example. The aim of stock valuation is to find an intrinsic value to evaluate the profitability of a stock investment. Stock valuation presumes that deviations between the stock price and the intrinsic value of a share are likely. Factors contributing to deviations include speculative influences, random-

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[1] A valuation is carried out from the perspective of a valuing entity, often representing a natural or legal person or a group of people. The entity can be real or abstract and typically refers to an analyst, appraiser or a potential buyer or seller of the company. In the case in which a third party carries out the valuation, the sponsor of the valuation task is referred to as the valuing entity. [GEBHARDT/DASKE (2005), p. 650; MATSCHKE/BRÖSEL (2007), p. 3.]

[2] The valuation object, as the item to be valued, equals the whole company or definable parts of it. The company constitutes a complex and individual conglomerate of both material and immaterial goods. The collaboration of the parts of a company contributes to an increase in the value. Definable parts of the company can represent complex sub-units or shares of the firm. [MATSCHKE/BRÖSEL (2007), p. 4.]

[3] MATSCHKE/BRÖSEL (2007), p. 3.

[4] Potential prices represent those prices that are most likely to represent a sales profit at the key valuation date. [BELLINGER/VAHL (1992), p. 33.]

based turnover, political events, rumours or psychological moments. In contrast, corporate valuation does not focus on psychological price determinants but represents an assessment of the future development of a company in a highly aggregated form.[5]

Over the long term, a reversion to equilibrium between the calculated value and the actual stock price is assumed. In the pursuit of a comparison between the actual stock price and the estimated value, it is recommended to buy or hold a share if the determined value is clearly above the market price and to sell or not to purchase a stock if the actual price exceeds the estimated value. In this regard, company valuation can also be a useful tool in terms of stock analysis.[6]

According to the efficient market hypothesis (EMH) in its strongest form, all relevant information is reflected in share prices. Assuming the validity of the EMH, the purpose of company valuation is challenged, as the generation of an excess return seems to be impossible. Despite this, criticism has emerged against the EMH with regard to the actual information processing taking place in the markets. Even in the case that an efficient information flow does occur, the market participants probably cannot process the information.[7]

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[5] HÜFNER (2000), p. 18; KUP (2007), p. 129; PEEMÖLLER (2005a), p. 3; PERRIDON/STEINER (2007), p. 197 & 221; POPP (2005), p. 105; RIEGGER (1999), p. 1890; RODLOFF (1999), p. 1150; STEINER/BRUNS (2002), p. 228f; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 367. In this context, SHILLER (1989, p. 291f & 421f) argued that fluctuations of share prices, measured by their volatility, yield to an excess volatility, which is much higher than fundamental information about the company that might justify this share price.

[6] HÜFNER (2000), p. 19; STEINER (1993), col. 2165.

[7] FAMA (1970), p. 409-412; HÜFNER (2000), p. 20; RIEGGER (1999), p. 1890. In addition, GROSSMAN/STIGLITZ (1976, 1980) attenuated the EMH and assumed the possibility for market participants to generate an excess return through the collection of information when other market participants are not completely informed about stock prices. Further, the existence of anomalies on the stock market has raised concerns about the EMH. Anomalies include seasonal and fundamental factors, such as the company size, the dividend yield or the price-to-earnings ratio (PER). [See, for example, HÜFNER (2000, p. 22) for further information.]

## 3.2 Principles of corporate valuation

The principles of corporate valuation should represent a system of norms that are unambiguous and that serve to control the process of corporate valuation.[8] These norms should be considered in the course of the development of a new approach to REIT valuation. Based on a review of the scientific literature, the following principles have primarily been suggested.

First, the the assumptions about the size of the financial surplus and the subsequent discounting are dependent on the purpose of the valuation. The determination of the valuation purpose relies on the valuation request in connection with the objectives and the guidelines provided by the valuing entity.[9]
Second, the valuation object equals the whole company or definable parts of it. This object comprises all parts of the firm that contribute to future financial surpluses. Although the valuation object is typically confined by means of the legal form, its identification can be associated with difficulties if the object does not square with the legal entity.[10]
Third, the valuation date confines the point in time that appoints the financial surplus included in the corporate valuation. This approach demarcates the date at which the financial surplus is assigned to the future owners of the company.[11]
Fourth, the operating assets need to be assessed. This requirement involves the valuation of cash flows that are available to the owners. Historical company results can be analysed before estimating cash flows. In terms of forecasting cash flows, the implications of the principle of future orientation[12], such as uncertainties, length of the planning period and economic justifiability, have to be considered. To transfer future cash flows to the present, a discount rate, which is dependent on the valuation methodology and the function of the valuing entity, should be employed.[13]

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[8] MATSCHKE/BRÖSEL (2007), p. 719f.
[9] PEEMÖLLER (2005c), p. 30.
[10] BALLWIESER (2007), p. 6; PEEMÖLLER (2005c), p. 30f; POPP (2005), p. 116.
[11] PEEMÖLLER (2005c), p. 31.
[12] With regard to the principle of future orientation, only the future benefit to the valuing entity, which is delivered by the company, is considered. [MATSCHKE/BRÖSEL (2007), p. 19.]
[13] PEEMÖLLER (2005c), p. 31-41.

Fifth, the non-operating assets should be considered separately at their liquidation values[14], discounted to the present.[15]
Sixth, an assessment of both opportunities and risks regarding the development of the company ought to be implemented. Accordingly, valuation and accounting regulations or provisions that potentially lead to an unbalanced consideration of opportunities and risk should be disregarded.[16]
Seventh, the valuation approach utilised has to be intelligible. In this regard, it should be distinguished between the assumptions made by the valuing entity and the assumptions made by the management of the valuation object and third parties.[17]

## 3.3 A taxonomy for corporate valuation approaches

MATSCHKE/BRÖSEL (2007, p. 84) postulated that the completion of corporate valuation needs to be based on accurately defined starting situations. Hence, a classification of corporate valuation approaches is introduced in the following section.
As illustrated in Figure 3.1, the classification comprises the motive (3.3.1), the purpose (3.3.2) and the methodology (3.3.3) attached to a corporate valuation. The motive can affect the purpose of a corporate valuation. The specification of the purpose potentially confines the spectrum of valuation methodologies to those that are appropriate for solving the valuation task. In the end, the result of the valuation should be assessed under consideration of both the purpose and the motive of the valuation.[18]

### 3.3.1 Motive of a corporate valuation model

Systematisation helps to carry out an in-depth analysis of the motives pertaining to company valuation and to derive implications for a purposive approach. The choice of motive assists a reasonable operationalisation of the valuation purpose. Although

[14] See Section 3.3.3.1 regarding a definition of the liquidation value.
[15] PEEMÖLLER (2005c), p. 41.
[16] PEEMÖLLER (2005c), p. 41.
[17] PEEMÖLLER (2005c), p. 42.
[18] MATSCHKE/BRÖSEL (2007), p. 84 & 117; PEEMÖLLER (2005b), p. 17 & 24.

***Figure 3.1: Classification of a corporate valuation model.***

**Motive**

***1. Stage in the life cycle***

- **launch**
- **merger**
- **spin-off/carve-out**
- **recapitalisation**
- **liquidation**

***2. Form of valuation***

- **statutory obligations**
- **agreements under private law**
- **other motives**

***3. Decision-making***

- **dominant/non-dominant**
- **voluntary/non-voluntary**
- **internal/external**

***4. Transfer of ownership***

- **with transfer of ownership/ without transfer of ownership**

**Purpose**

***Concept of value***

- **controlling value**
- **decision value**
- **contract value**
- **taxation value**
- **market value**

**Methodology**

***1. Course of action***

- **partial valuation methods**
- **comprehensive valuation methods**
- **combined methods**
- **market data-based methods**

***2. Form***

- **payoff-oriented approaches**
- **market-oriented approaches**
- **cost-oriented approaches**
- **real options-based approaches**

*Adapted from SEPPELFRICKE (2005, p. 2-8).*

the variety of motives prevents an unambiguous classification, motives can be sorted according to the following groups.[19]

A first group of motives addresses the stage of the company in its life cycle. Generally, the company can be valued at any point in time during its life cycle, i.e., between its launch and its liquidation.[20]

The stage in the life cycle is closely connected to the form of the valuation as a second class of motives. Basically, the form of valuation can be differentiated into statutory obligations[21], agreements under private law[22] and other motives[23].[24]

A third group of motives explicitly considers the decision-making situation. In this regard, conflict situations may or may not be dominant. In a dominant conflict situation, a party possesses the ability to decide upon a change in proprietorship, even without the consent of the counterparty. The non-dominant party might be able to influence the conditions of the enforcement of the ownership structure. A dominant conflict situation either involves a direct[25] or an indirect[26] change in proprietorship. In a conflict situation that is not dominant, no party can enforce a change in ownership structure regarding the valuation object without the approval of the counter-

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[19] MATSCHKE/BRÖSEL (2007), p. 84; PEEMÖLLER (2005b), p. 17.

[20] PEEMÖLLER (2005b), p. 17; SEPPELFRICKE (2005), p. 2-4.

[21] Statutory obligations include squeeze-outs, mergers, cash compensations or valuations as a basis to determine a succession duty. [FERNÁNDEZ (2002), p. 23; SEPPELFRICKE (2005), p. 2-4.]

[22] Agreements under private law entail the entrance or exit of major shareholders or an arbiter's award. [FERNÁNDEZ (2002), p. 23; SEPPELFRICKE (2005), p. 2-4.]

[23] Other motives include initial public offerings, spin-offs, stock valuations or ratings regarding the creditworthiness of a company. [FERNÁNDEZ (2002), p. 23; SEPPELFRICKE (2005), p. 2-4.]

[24] FERNÁNDEZ (2002), p. 23; SEPPELFRICKE (2005), p. 2-4.

[25] A direct change in proprietorship can entail the notice of cancellation by a partner of the company. [KUP (2007), p. 139; MATSCHKE/BRÖSEL (2007), p. 90f.]

[26] Indirect changes in proprietorship may comprise the exclusion of a partner through a judicial decision. [KUP (2007), p. 39; MATSCHKE/BRÖSEL (2007), p. 90f.]

party. Examples of non-dominant conflict situations include acquisitions and sales[27] as well as mergers[28] and demergers[29].[30]

A fourth class of motives distinguishes between corporate valuations that are and are not carried out for the purpose of a transfer of ownership. A transfer of ownership is usually associated with the resolution of interpersonal conflicts. A change in ownership structure may result from a change in ownership due to the acquisition or sale of the firm. In addition, there occur situations in which there is no change in ownership but instead an alteration of the ownership structure such as a merger, a demerger or a spin-off.[31]

Apart from the preceding classification of corporate valuation motives, a variety of other approaches to discriminate between motives have been proposed.[32]

### 3.3.2 Purpose of a corporate valuation model

The value of a company is dependent upon the purpose of the valuation task. Taking this connection into account, corporate valuation needs to conform to the respective determination of objectives. The adequacy of the purpose represents a main principle of corporate valuation. In this context, several concepts of value can be differentiated.[33]

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[27] Referring to acquisitions and sales, the seller transfers its ownership of the company to the buyer for a return. Usually, this involves the transaction of an entire company or parts of it, the expropriation of companies or the privatisation of public firms. [MATSCHKE/BRÖSEL (2007), p. 87.]

[28] A merger involves the fusion of several corporations, including a change in ownership structure, to ensure that the owners of the firms hold a direct or an indirect ownership in the new entity. [MATSCHKE/BRÖSEL (2007), p. 87f.]

[29] A demerger is associated with a physical partitioning of a company or the divestment of parts of the company to the previous owners. [MATSCHKE/BRÖSEL (2007), p. 88.]

[30] BARTHEL (1990), p. 1145; KUP (2007), p. 319; MATSCHKE/BRÖSEL (2007), p. 90f; SEPPELFRICKE (2005), p. 4.

[31] BARTHEL (1990), p. 1145; KUP (2007), p. 137; MATSCHKE/BRÖSEL (2007), p. 51 & 84 & 105; SEPPELFRICKE (2005), p. 4.

[32] Further differentiations were introduced by MATSCHKE/BRÖSEL (2007, p. 98-106) and OLBRICH (2005, p. 227f).

[33] COENENBERG/SCHULTZE (2002), p. 599; MOXTER (1983), p. 5; PEEMÖLLER (2005b), p. 17; SEPPELFRICKE (2005), p. 5. Although the classification of the purposes of a company valuation task have been carried out by several researchers [see, for example, BALLWIESER (2007) or COENENBERG/SCHULTZE (2002)], no standard form of categorisation exists.

The controlling value is determined for the purpose of the internal controlling of the company. The decision value represents the mean value in the scope of decision-making between the marginal values of both the selling and the buying parties. A contract value should serve as a basis when formulating a contract, whereas the taxation value should deliver a basis for the calculation of taxes. The market value, determined from the perspective of the capital markets, represents one of the most important concepts of value.[34]

### 3.3.3 Corporate valuation methodologies

Corporate valuation methodologies represent procedures of determining corporate value. Generally, the application of two or a few valuation methodologies is suggested to attain the option to evaluate the plausibility of the valuation results.[35]
The selection of a tool to derive a firm's value can be based on the consideration of both the course of action (3.3.3.1) and the form (3.3.3.2) of the valuation methodology, which are both explained in the following paragraphs. In this regard, Figure 3.2 illustrates the connection between the course of action and the form of the valuation methodology.

#### 3.3.3.1 Course of action

In terms of the course of action associated with corporate valuation methodologies, partial valuation methods, comprehensive valuation methods, combined methods and methods based on market data have been differentiated.[36]

With regard to partial valuation methods, which principally rely on the balance sheet scheme, the firm value equals the result of subtracting the total liabilities from the total assets of a company. Partial valuation methods rely on the determination of either a substance or a liquidation value. Assuming liquidation of the company, the

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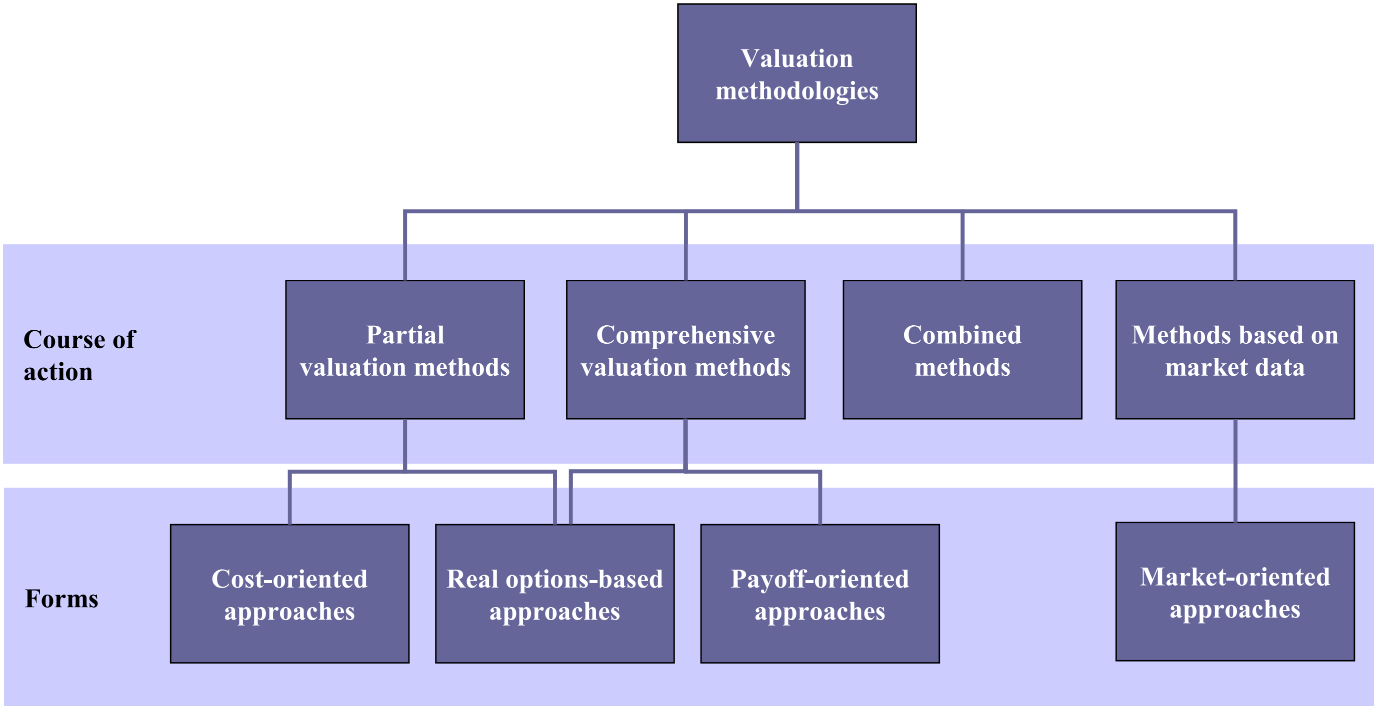
[34] DRUKARCZYK (2003), p. 132; MATSCHKE/BRÖSEL (2007), p. 25&32; SEPPELFRICKE (2005), p. 6f.
[35] MATSCHKE/BRÖSEL (2007), p. 117; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 371.
[36] BALLWIESER (2007), p. 8; SEPPELFRICKE (2005), p. 14.

***Figure 3.2: Classification of corporate valuation methodologies.***




*Adapted from BALLWIESER (2007, p. 8), KUP (2007, p. 154) and SEPPELFRICKE (2005, p. 12)* liquidation value results from the proceeds of the sale of individual assets and the collection of receivables after the deduction of liabilities. The liquidation value is viewed as a price floor from the perspective of a seller. Partial valuation methods employing the substance value assume a reproduction of the company on the basis of the existing balance sheet structure. The substance value can be classified as the sum of the assets and liabilities at their respective replacement costs.[37]

Comprehensive valuation methods rely on the assumption that the company represents an economic unit instead of the sum of the individual parts of the firm. Accordingly, positive effects, such as economies of scope or negative effects on the valuation resulting from the combination of parts of the company are considered.[38]

Combined methods represent a unification of partial and comprehensive valuation methods. These methods involve the pooling of the substance value with the earnings value.[39]

Methods based on market data typically entail the use of market prices regarding past transactions to derive an estimation of a present value. These methods may employ data on comparable firms to estimate the value attached to a valuation object.[40]

#### 3.3.3.2 Forms

The following sections discuss common forms of corporate valuation methodologies. Specifically, market-oriented (3.3.3.2.1) and payoff-oriented valuation approaches (3.3.3.2.2) are discussed, as these forms are predominantly considered in

[37] BALLWIESER (2007), p. 10; COENENBERG/SCHULTZE (2006), p. 477; KUP (2007), p. 155; MOXTER (1983), p. 41.
[38] BALLWIESER (2007), p. 8.
[39] BALLWIESER (2007), p. 10; KUP (2007), p. 158.
[40] BALLWIESER (2007), p. 10.

the present work. Forms that will not be subject to the present elaborations include cost-oriented[41] and real options-based valuation approaches[42].

#### 3.3.3.2.1 Market-oriented valuation approaches

Market-oriented valuation approaches involve the estimation of company's value on the basis of market prices. These approaches comprise the analysis of aggregated supply and demand relationships to interpret prices of realised transactions. Though it is possible to use the market-oriented company valuation approaches to derive an absolute valuation measure, this form is primarily used for relative valuations. Instead of considering subjective influencing factors, market-oriented approaches rely on objective industry experience.[43]

Generally, market-oriented approaches can be processed in three steps.

In the first step, comparable companies are identified. Likewise, differences as well as similarities can be detected by means of comparing the valuation object to other corporations belonging to the same or to a different industry. The investigation of the comparability should be based on a weighting of both sector influences and corporate characteristics.[44]

In a second step, a multiplier[45] is derived using a specific variable. The selection of the variable should be mainly contingent upon the assumption of a high correlation between the variable and the firm value. Market-oriented approaches can lead to the determination of the equity value or the total firm value. In terms of equity value multipliers, financial variables such as the net income, the book value or the after-

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[41] Cost-oriented approaches refer to the principle of partial valuation. These approaches pursue the determination of the company value by means of measuring the costs accrued due to the set-up of the company [see SEPPELFRICKE (2005, p. 12-15) for further information].

[42] Real options-based valuation approaches involve the estimation of the company value through the option value assigned to potential strategic activities [see, for example, SEPPELFRICKE (2005, p. 12-15) for further information].

[43] ACHLEITNER/DRESIG (2002), col. 2436f; HOMMEL/BRAUN/SCHMOTZ (2001), p. 342; MANDL/RABEL (1997), p. 274; MOXTER (1983), p. 134. Market-oriented approaches are also referred to as multiplier methods or comparable company approaches. [ACHLEITNER/DRESIG (2002), col. 2433.]

[44] ACHLEITNER/DRESIG (2002), col. 2433-2441. To investigate the comparability of firms, major characteristics include the sector affiliation, company size, business activities and management. [LODERER (2005), p. 753 & 766; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 369.]

[45] A multiplier measures the amount of money that will be compensated by the market for one unit of the chosen variable. [LODERER (2005), p. 753.]

tax operating cash flow can be used. With regard to the total firm value, exemplary variables are the turnover, the earnings before interest and taxes (EBIT), the EBITDA or the free cash flow (FCF). Subsequently, the corresponding equity or firm value of the comparable firm is divided by the respective financial variable to obtain a multiplier.[46]

In a third step, the total firm value or the equity value is calculated by multiplying the respective variable attached to the valuation object with the multiplier derived from a comparable entity.[47]

In terms of the interpretation of the multiplier, low ratios may suggest increasing stock values, whereas high ratios may reflect an overvaluation together with a reduced short-term stock performance.[48]

A major advantage associated with the market-oriented valuation approach is attached to its relatively simple application. The ease of use can be partly explained by the fact that assumptions about the discount rate, including inflation, interest rate and cash flow expectations, do not have to be made explicitly. Instead, these suppositions are made implicitly in a market-oriented approach. As a drawback, a correct application of the market-oriented approach would demand that all parameters pertaining to the valuation object are identical to those observed with a comparable entity. If parameters show dissimilarities, adjustments need to be made. The use of current metrics does not take temporal variations of the multiplier into account. In reality, the multiplier may fluctuate due to temporary variations of the underlying variable.[49] To examine the quality of reference prices, an assumption has to be made regarding the degree of market efficiency. In the case of efficient markets, the multipliers represent a meaningful average size of the company valuation; otherwise, the pricing system shares limited informational value. Furthermore, this approach can be susceptible to manipulations if it is observed that a conscious accounting policy

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[46] ACHLEITNER/DRESIG (2002), col. 2442; LODERER (2005), p. 366 & 634 & 753 & 766; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 369.

[47] LODERER (2005), p. 753.

[48] BLOCK (2006), p. 229.

[49] COENENBERG/SCHULTZE (2006), p. 478-480; DAMODARAN (2010), p. 105f; LODERER (2005), p. 635; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 368. Additionally, the values of the respective year of valuation might have occurred by chance, thus probably not being representative. [PEEMÖLLER (2005c), p. 42; STEINER/BRUNS (2002), p. 268.]

immediately before the date of valuation may lead to an improvement of the valuation result.[50]

In summary, it has been recommended to employ market-oriented approaches as a plausibility check on the results obtained from the use of other valuation approaches. Nevertheless, it is argued that a market-oriented valuation approach cannot substitute a profound company valuation.[51]

#### 3.3.3.2.2 Payoff-oriented valuation approaches

The application of payoff-oriented approaches involves the forecast of payoffs generated by the company over a certain time span, usually called explicit planning period. The cash flows accrued in the period following the explicit planning period, which is called the implicit planning period, are usually summarised in a single value. However, future cash inflows typically do not equal present cash inflows. To address this issue, it is necessary to discount future cash inflows to the present. Specifically, cash flows are discounted to the present at a rate that approximates the required total return from an investment in the respective company.[52]

Discounted cash flow models represent one form of payoff-oriented valuation approaches that has gained exceptional recognition in scientific research. The neoclassical theory of finance provides a theoretical foundation for the determination of the company value by means of a DCF model.[53]

Initially, all FCFs are estimated over an explicit planning period with a typical length between three and ten years. In this environment, the FCF constitutes the cash flow generated by the operations of the company after taxes, without considering the use of debt. Accordingly, the FCF is calculated when a firm is assumed to be completely equity financed. The derivation of free cash flows can be handled by either a direct or an indirect method. The more common indirect method has been used with

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[50] ACHLEITNER/DRESIG (2002), col. 2437-2443. In an efficient market, the relative positioning of a company can be derived from benchmarking against comparable firms. [ACHLEITNER/DRESIG (2002), col. 2438f.]

[51] BARTHEL (1996), p. 149-151.

[52] COPELAND/KOLLER/MURRIN (2000), p. 367; COENENBERG/SCHULTZE (2006), p. 482f. KÜTING/EIDEL (1999), p. 226f; PERRIDON/STEINER (2007), p. 207; SEPPELFRICKE (2005), p. 21.

[53] KUP (2007), p. 159; KRAG/KASPERZYK (2000), p. 83-86.

cash flows being developed on the basis of an earnings measure. In contrast, the direct method includes the collection of all cash in- and outflows affecting payments. Assuming a correct application, both approaches lead to the same result.[54] Formula 3.1 represents an example of the calculation of FCFs through the indirect method.

The compilation of items pertaining to the cash flow calculation is based on information that is included either in the balance sheet or in the profit and loss statement.

The EBIT describes the operational profitability of the company. Cash taxes that have to be paid by the firm are deducted from EBIT to arrive at the NOPLAT.[55]

| | | |
|---|---|---|
| | **Earnings before interest and taxes (EBIT)** | **(3.1)**[56] |
| - | **Cash taxes on EBIT** | |
| = | **Net operating profit less adjusted taxes (NOPLAT)** | |
| +/- | **Depreciations/appreciations** | |
| = | **Gross cash flow** | |
| -/+ | **Increase/decrease of working capital** | |
| - | **Capital expenditures** | |
| -/+ | **Increase/decrease in other net assets** | |
| = | **Operating free cash flow (OFCF)** | |
| + | **Cash flow from non-operating investments** | |
| = | **Free cash flow (FCF)** | |
| + | **Tax savings** | |
| = | **Total cash flow (TCF)** | |

[54] BAETGE/NIEMEYER/KÜMMEL (2005), p. 281f; COPELAND/KOLLER/MURRIN (2000), p. 167; FERNÁNDEZ (2002), p. 16; KRAG/KASPERZYK (2000), p. 104; LODERER (2005), p. 636; STEINER/BRUNS (2002), p. 247.

[55] LODERER (2005), p. 598 & 620; STEINER/BRUNS (2002), p. 268.

[56] BALLWIESER (2007), p. 117; FERNÁNDEZ (2002), p. 17; PERRIDON/STEINER (2007), p. 555; SEPPELFRICKE (2005), p. 24.

As depreciation items are not considered as cash outflows that affect payments in the respective period, they are plowed back to the NOPLAT to arrive at the gross cash flow. The gross cash flow equals the amount that has been generated by the operations of a company and is available for reinvestment in the firm.[57]

Subsequently, the amount associated with the increase in the working capital item is subtracted, whereas the sum pertaining to the decrease in working capital is added to the cash flow calculation. The working capital item equals the difference between current assets[58] and current liabilities[59] and thus reveals changes in liquidity. Capital expenditures include, for example, the aggregated progression of the net property, plant and equipment positions, and they are subtracted from the gross cash flow. Furthermore, the increase in other net assets is subtracted, whereas a potential decrease in assets is added to the gross cash flow. Increases and decreases in other net assets are associated with expenditures on other operating assets. This item includes deferred expenses and is expressed as the net of increases in non-current- and non-interest-bearing liabilities. The preceding calculations are summarised in the OFCF, which reflects the cash flow obtained from the operating assets.[60]

To determine the cash flow reflecting the internal financing ability of the firm, the cash flow from non-operating investments should be added to the OFCF. The cash flow from non-operating investments equals the after-tax cash flow derived from items that are not related to operations. This item may include extraordinary gains and losses, cash flows from investments in unconsolidated subsidiaries or cash flows from discontinued operations.[61]

Addition of the tax savings to the FCF results in the total cash flow. Typically, the company tax savings are largely stemming from the tax deductibility of interest

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[57] COPELAND/KOLLER/MURRIN (2000), p. 168; LODERER (2005), p. 595; MATSCHKE/BRÖSEL (2007), p. 667. The deductibility of interest rates from the tax assessment basis and the resulting tax advantages are included in the discount rate. [BALLWIESER (2007), p. 117; MATSCHKE/BRÖSEL (2007), p. 667.]

[58] Current assets consist of the cash required for operations, accounts receivable, inventories, prepaid expenses and marketable securities. [THAM/PAREJA (2004), p. 90f.]

[59] Current liabilities include accounts payable, accrued expenses, taxes payable, short-term notes payable and the current part of long-term debt. [THAM/PAREJA (2004), p. 91.]

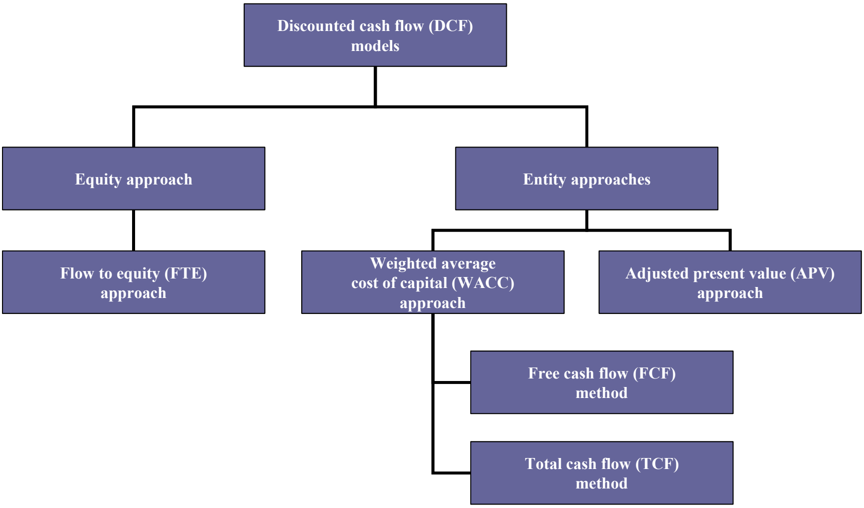
[60] COPELAND/KOLLER/MURRIN (2000), p. 169; PERRIDON/STEINER (2007), p. 547f; THAM/PAREJA (2004), p. 150. An increase in working capital represents a rise in long-term financing, while new investments are financed with matching maturities when a decrease or a stable working capital is observed. [PERRIDON/STEINER (2007), p. 548.]

[61] COPELAND/KOLLER/MURRIN (2000), p. 169; EBERHARDT (1998), p. 96f.

rates. As a consequence, the total cash flow directly considers the tax effect of leverage.[62]

Discounted cash flow approaches can be distinguished into one equity approach and two entity approaches (see Figure 3.3).[63]

***Figure 3.3: Categorisation of discounted cash flow models.***




*Adapted from KRAG/KASPERZYK (2000, p. 84) and MATSCHKE/BRÖSEL (2007, p. 660).*

Equity approaches assume a direct estimation of the equity value. The cash flows to the equity investors are forecast and then discounted at a rate that reflects the return requirements of equityholders.[64] The equity value can be calculated as follows:

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[62] BALLWIESER (2007), p. 117; KRAG/KASPERZYK (2000), p. 85; MATSCHKE/BRÖSEL (2007), p. 659.

[63] Assuming that the cost of equity is adjusted depending on the leverage ratio with all other assumptions remaining equal, the entity and equity approaches can produce identical results. [BALLWIESER (2007), p. 183.]

[64] BALLWIESER (2007), p. 116; COPELAND/KOLLER/MURRIN (2000), p. 150; KRAG/KASPERZYK (2000), p. 85; MATSCHKE/BRÖSEL (2007), p. 59; LODERER (2005), p. 586; STEINER/BRUNS (2002), p. 245.

$$V_e = \sum_{t=1}^{T} \frac{FCF_t - c_d \times D_{t-1} \times (1-t) + (D_t - D_{t-1})}{\left(1 + c_{el}\right)^t} + \frac{FCF_{T+1} - c_d \times D_{t-1} \times (1-t)}{c_{el} \times \left(1 + c_{el}\right)^T} \quad \textbf{(3.2)}$$ [65]

where

| | |
|---|---|
| $V_e$ = | value of equity |
| $FCF_t$ = | free cash flow in period $t$ |
| $T$ = | length of the explicit planning period |
| $D_t$ = | value of debt in period $t$ |
| $D_{t-1}$ = | value of debt in period $t-1$ |
| $c_d$ = | cost of debt |
| $t$ = | tax rate on a corporate level |
| $c_{el}$ = | cost of equity of a leveraged firm |

Entity approaches imply the determination of the total firm value by means of considering the cash flows generated by the company that are available to both debt and equity investors.[66]

Different entity approaches have been discussed in the scientific literature. The approaches deviate from each other in terms of their calculation scheme but should theoretically lead to the same result. The weighted average cost of capital and adjusted present value approaches, which represent two common entity approaches, will be explained in the following paragraphs.[67]

In terms of the WACC approach, the cash flows being assigned to equity- and debtholders are discounted at a rate that reflects both the cost of equity and the cost of debt.[68]

The FCF is discounted at the WACC, which is employed over the entire explicit forecasting period.[69] The WACC can be calculated as follows:

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65 KRAG/KASPERZYK (2000), p. 109; PERRIDON/STEINER (2007), p. 213.

66 BALLWIESER (2007), p. 116; BELLINGER/VAHL (1992), p. 85; KRAG/KASPERZYK (2000), p. 85; LODERER (2005), p. 586.

67 BALLWIESER (1998), p. 81f; KÜTING/EIDEL (1999), p. 227; STEINER/BRUNS (2002), p. 209.

68 MATSCHKE/BRÖSEL (2007), p. 672; PERRIDON/STEINER (2007), p. 207.

69 BALLWIESER (2007), p. 117; COPELAND/KOLLER/MURRIN (2000), p. 203.

$$WACC = c_{el} \times \frac{E}{E+D} + [c_d \times (1-t)] \times \frac{D}{E+D} \qquad \textbf{(3.3)}$$ [70]

where

$E$ = value of equity
$D$ = value of debt

Instead of employing data regarding the current capital structure, the respective equity and debt ratios should reflect long-term planning. As the WACC approach assumes a constant leverage ratio over the planning period, the amount of debt capital has to be adjusted for changes in the company value. The term *(1-t)* reflects the tax reduction effect attached to debt capital. The cost of debt $c_d$ should represent a weighted average of the debt costs arising from the different leverage instruments used by the company. The determination of the cost of equity $c_{el}$ has been the subject of intensive academic scrutiny. Typically, this cost equals the sum of a risk-free investment and a risk premium. Particular attention has been devoted to the capital asset pricing model (CAPM), which will be considered at a later stage.[71] To obtain the value of the explicit planning period, the FCFs are discounted at the WACC by means of the following formula:

$$V_{ep} = \sum_{t=1}^{T} \frac{FCF_t}{(1+WACC)^t} \qquad \textbf{(3.4)}$$ [72]

where

$V_{ep}$ = total firm value pertaining to the explicit planning period

The length of the explicit planning period is dependent on the quality of the information available, the market dynamics and the size, structure and sector affiliation of

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[70] BALLWIESER (2007), p. 145; SCHREIER (2002), p. 318; STEINER/BRUNS (2002), p. 249.
[71] BALLWIESER (1998), p. 85; COPELAND/KOLLER/MURRIN (2000), p. 203; KRAG/KASPERZYK (2000), p. 97; KUP (2007), p. 161; KÜTING/EIDEL (1999), p. 227; PEEMÖLLER (2005c), p. 39. See MODIGLIANI/MILLER (1958, 1963) and SHARPE (1964) for further information.
[72] KRAG/KASPERZYK (2000), p. 105; PERRIDON/STEINER (2007), p. 212.

the company. Principally, the length of the forecasting period rises with an increase in the ability to predict the cash flows of the company. In contrast, the certainty of the estimation will be reduced as the length of the planning period increases.[73]
Following the explicit planning period, the company is either wound up, resulting in a liquidation value[74], or a going-concern value is calculated.[75] DRUKARCZYK (2003, p. 223) documented that the going-concern value of valuations utilising an explicit planning period of six to eight years can account for a share of 60% to 70% of the total firm value. Accordingly, particular attention should be paid to the calculation of this value. The going-concern value is also called terminal or residual value and can be estimated through the capitalisation of a normalised FCF. A normalised FCF is derived on the basis of making normalising, steady-state assumptions regarding future cash flows. The implicit planning period might be characterised by growth rates and margins that differ from those generated during the explicit planning period. Consequently, the cash flow forecasts based on the explicit planning period do not automatically serve as good approximations for normalised cash flows. Specifically, an analysis of the operating income as a percentage of sales, the capital expenditures as a percentage of sales and the change in working capital as a percentage of a change in sales can be carried out. Based on the findings of this analysis, the FCF should be modified to compute a normalised cash flow level.[76]

The value component derived from the implicit forecasting period can be calculated by the following equation, which is called GORDON growth model:

$$V_{ip} = \frac{FCF_{T+1}}{(WACC - g_i)} \qquad \textbf{(3.5)}^{77}$$

[73] LODERER (2005), p. 617 & 636; PEEMÖLLER (2005c), p. 37; PERRIDON/STEINER (2007), p. 212.
[74] This approach is usually employed when a liquidation of the firm is likely to happen after the explicit forecasting period. [COPELAND/KOLLER/MURRIN (2000), p. 284.]
[75] LODERER (2005), p. 617.
[76] HUNT (2007), p. 50f; KÜTING/EIDEL (1999), p. 227.
[77] This model is based on the findings of GORDON (1959) and GORDON/SHAPIRO (1956).

where

$V_{ip}$ = total firm value pertaining to the implicit planning period

$FCF_{T+1}$ = normalised free cash flow in the first year of the implicit planning period

$g_i$ = nominal annual growth rate of $FCF_{T+1}$

Considering this formula in more detail, the terminal value shows a high sensitivity to the nominal growth rate of the free cash flow. Generally viewed, the growth rate is affected by the expected long-term real rate of growth of the economy and the industry, the anticipated long-term inflation rate and the competitive position of the company within its industry. The growth rate of the implicit planning period is usually lower than the corresponding rate associated with the explicit planning period.[78] The long-term growth rate of the implicit planning period may be estimated by means of one of the following two approaches.

First, the expected long-term inflation rate can be used as an approximation for the long-term growth rate implying a zero long-term real rate of growth. This approach assumes that a company can pass along increases in costs but might be not able to grow its FCFs. In addition, because firms may suffer from reductions in their degree of competitiveness over time, it is argued that companies usually have difficulties sustaining long-term growth rates above inflation.[79]

Second, the nominal growth rate of the gross domestic product (GDP) may be used as an approximation of the long-term growth rate. Accordingly, the company is supposed to pass along increases in costs while being able to rise its free cash flows at a rate that equals the real growth rate of the economy. This approach is based on the view that a firm can sustain a growth rate higher than inflation while it is able to maintain its competitive position.

If high growth or cyclical companies shall be valued, the forecasting period might have to be longer to reach a relatively mature stage. Whereas an extension of the explicit planning period would be associated with disproportionately high outlay, a so-called H model may be applied. Following this model, a high growth rate is as-

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[78] COPELAND/KOLLER/MURRIN (2000), p. 278; HUNT (2007), p. 51.

[79] HUNT (2007), p. 51.

signed to the beginning of the implicit planning period, which declines linearly over a specific period until a stable, perpetual growth rate is reached.[80]

Having calculated the value components of both the implicit and explicit planning periods, the value of equity is calculated by means of the following formula:

$$V_e = V - D = V_{ep} + V_{ip} - D \qquad \textbf{(3.6)}^{81}$$

where

$V =$ total value of the firm

The adjusted present value approach represents another possibility for calculating the entity value. This method employs a multi-stage procedure for the determination of the equity value. In principle, cash flows generated from the company are separated and valued individually.[82]

In a first step, the expected cash flows to both equity- and debtholders, irrespective of effects arising due to the use of debt, are discounted at an unleveraged cost of equity.[83] In this framework, the value of a company without considering the use of debt can be expressed as follows:

$$V_{ul} = \sum_{t=1}^{T} \frac{FCF_t}{(1+c_{eul})^t} + \frac{FCF_{T+1}}{e_{ul} \times (1+c_{eul})^T} \qquad \textbf{(3.7)}^{84}$$

where

$V_{ul} =$ value of an unleveraged firm

$c_{eul} =$ cost of equity of an unleveraged firm

[80] COPELAND/KOLLER/MURRIN (2000), p. 234; HITCHNER (2006), p. 128; HUNT (2007), p. 51. In addition, COPELAND/KOLLER/MURRIN (2000, p. 279) suggested that the growth rate can be estimated by adding the inflation rate to the long-term rate of consumption growth regarding the products of a specific industry.

[81] Adapted from PERRIDON/STEINER (2007, p. 212).

[82] BALLWIESER (2007), p. 118; COPELAND/KOLLER/MURRIN (2000), p. 146.

[83] SCHACHT/FACKLER (2009), p. 210-225.

[84] KRAG/KASPERZYK (2000), p. 99f; PERRIDON/STEINER (2007), p. 212; STRAUCH/LÜTKE-UHLENBROCK (2002), p. 368.

The cost of equity $c_{eul}$ associated with an unleveraged firm is typically not observable on the capital markets. Consequently, the scientific literature has suggested that $c_{eul}$ be derived from the cost of equity of a leveraged company $c_{el}$.[85] A formula to derive $c_{eul}$ from the cost of equity $c_{el}$ and the cost of debt $c_d$ was proposed by MODIGLIANI/MILLER (1963):

$$c_{el} = c_{eul} + (c_{eul} - c_d) \times (1-t) \times \frac{D}{E} \qquad \textbf{(3.8)}^{86}$$

$$\Longleftrightarrow \qquad c_{eul} = \frac{c_{el} + c_d \times (1-t) \times \frac{D}{E}}{1 + (1-t) \times \frac{D}{E}} \qquad \textbf{(3.9)}$$

where

$\frac{D}{E}$ = financial leverage ratio

In a second step, both the advantages and disadvantages of employing debt capital are considered. In the context of the APV model, the amount of future debt capital is fixed. Considering that tax advantages are associated with the same degree of uncertainty as the leverage employed by a firm, both the value component of the debt financing and the tax advantages are discounted at the cost of debt.[87] This can be expressed through the following formula:

$$V_d = \sum_{t=1}^{T} \frac{t \times c_d \times D_{t-1}}{(1+c_d)^t} + \frac{D_T \times t}{(1+c_d)^T} \qquad \textbf{(3.10)}^{88}$$

where

$V_d$ = value of debt financing

[85] MATSCHKE/BRÖSEL (2007), p. 681; STEINER/BRUNS (2002), p. 252.
[86] BALLWIESER (2007), p. 134; KRAG/KASPERZYK (2000), p. 102f; MATSCHKE/BRÖSEL (2007), p. 680; STEINER/BRUNS (2002), p. 252f.
[87] PERRIDON/STEINER (2007), p. 212. However, there exists no consensus regarding the riskiness of tax shields. [LUEHRMANN (1997), p. 151.] Considering that the future debt capital is fixed with the resulting tax advantages being known, some authors recommend the use of the risk-free rate of interest as a discount rate [see, for example, STEINER/BRUNS (2002, p. 252)].
[88] PERRIDON/STEINER (2007), p. 212.

In a third step, the value of equity is determined. The net effect arising from the use of debt is included by adding the advantages of debt and subtracting the disadvantages of debt together with the value of debt being subtracted from the value of the all-equity firm.[89] The calculation of the equity value $V_e$ can be accomplished through the following formula:

$$V_e = V - D = V_{ul} + V_d - D \qquad \textbf{(3.11)}^{90}$$

Having calculated the value of equity by means of an equity approach or through any of the entity approaches, $V_e$ should be divided by the number of shares to arrive at an estimated intrinsic value of the company on a per share basis. The intrinsic value per share is compared to the stock price. If the stock price is trading below the calculated equity value per share, the security should be purchased. In case the stock price is trading above the equity value per share, the share should be sold if it is already owned; otherwise, it should not be purchased.[91]

The application of payoff-oriented valuation models has been subject to extensive academic scrutiny.

The projection of FCFs represents a critical feature of the payoff-oriented models. For example, the EBIT measure can be subject to arbitrariness in valuation approaches. Thus, the EBIT measure is only partially appropriate for the evaluation of the actual profit for the period. Furthermore, it is difficult to determine a growth rate that correctly reflects the future development of cash flows. Additionally, determining the length of the forecasting period can be difficult. Although the terminal value is not forecast in the same detail as the value pertaining to the explicit planning period, it can represent a large share of the total value. Specifically, the terminal value may exhibit a high sensitivity to the growth rate.[92]

In addition, the specific forms of DCF approaches have been critically examined.

[89] RICHTER (1997), p. 228.

[90] BALLWIESER (2007), p. 118f.

[91] PERRIDON/STEINER (2007), p. 200; STEINER/BRUNS (2002), p. 229.

[92] COPELAND/KOLLER/MURRIN (2000), p. 267 & 277; LODERER (2005), p. 622f; PERRIDON/STEINER (2007), p. 198 & 555; STEINER/BRUNS (2002), p. 242.

The equity method is beset with a problem of circularity. Although the equity value is dependent on the value of debt, the latter can only be determined when the company value is known, as both components are connected with each other due to a constant leverage ratio. However, the company value constitutes an unknown variable. In the case that a valuation of business units should be carried out, the equity approach requires the allocation of debt, including its costs to each business unit, which requires high outlay.[93]

Considering the WACC, all investments made by the company have to be financed proportionally to the company value. Accordingly, the amount of debt used for the investment has to be determined on the basis of the total value impact of the investment instead of the investment itself, which seems to be unrealistic.[94]
Within the WACC approach, the interest payments are assumed to reduce the tax assessment basis. In this context, the uniform tax rate on a company level and the full tax deductibility probably do not correspond to the actual taxation system. Furthermore, Formula 3.3 demands that tax advantages remain constant. Indeed, the tax advantages are uncertain, as the amount of debt capital may vary because it is linked to the total company value.[95]

With regard to the APV approach, the determination of the unleveraged cost of equity $e_{ul}$ in Formula 3.8 implies a problem of circularity. Specifically, $e_{ul}$ depends on the market value of equity.[96]
Additionally, both the equity and the entity approaches typically rely on the application of the CAPM, which has been subject to criticism as well.[97]

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[93] COPELAND/KOLLER/MURRIN (2000), p. 152; KRAG/KASPERZYK (2000), p. 110; STEINER/BRUNS (2002), p. 254.
[94] BALLWIESER (2007), p. 151; HACHMEISTER (2000), p. 106.
[95] KRAG/KASPERZYK (2000), p. 106; PERRIDON/STEINER (2007), p. 211f.
[96] COPELAND/KOLLER/MURRIN (2000), p. 151; KRAG/KASPERZYK (2000), p. 103. In this case, the specification of a certain financing strategy can be used to circumvent the problem of circularity. [MATSCHKE/BRÖSEL (2007), p. 315.]
[97] An evaluation of the CAPM is carried out in Section 7.3.1.2.

# 4 Conventional approaches to REIT valuation

The academic literature has suggested a choice of methodologies that are deemed appropriate for the valuation of Real Estate Investment Trusts. Specifically, scientific research on REITs has suggested tools that represent extensions of the corporate valuation methodologies previously reviewed. Prior to the recommendation of a new REIT valuation tool, it seems beneficial to examine existing approaches. Particularly, the research sub-question asking for the results of an assessment of existing REIT valuation tools is addressed in the following. Similarly, the findings obtained in this section should be considered in the development of a new approach to REIT valuation.

In this work, particular attention will be devoted to the net asset value approach (4.1), a funds from operations-based market-oriented valuation approach (4.2) and models based on the discounted cash flow methodology (4.3), with each approach being explained and critically evaluated in the following sub-sections.

## 4.1 Net asset value approach

A large share of scientific work on REIT valuation has considered the net asset value[1] approach. This approach was first introduced in the Anglo-American region at the beginning of the 1990s, when a growing demand for REITs from institutional investors with substantial analyst following led to an increasing need for REIT valuation models.[2] In terms of the recent classification of valuation models, the NAV approach represents a cost-oriented valuation approach that relies on the principle of partial valuation.

Subsequent to a critical assessment of the approach pursued in the following (4.1.4), the methodology of the tool is explained (4.1.1), its extensions are reviewed (4.1.2) and deviations between the stock price and the NAV per share are discussed (4.1.3).

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[1] The net asset value equals a replacement value and refers to the sum of individual assets. The operating assets represent the starting point in the calculation of a net asset value. If liabilities are not deducted from the operating assets, this is called the gross asset value. The net asset value can be derived by adding the non-operating capital at liquidation values to and subtracting the liabilities from the gross asset value. [BELLINGER/VAHL (1992), p. 21f.]

[2] CLAYTON/MacKINNON (2000), p. 11; HARRIS/FOSTER/U'REEN (1997), p. 460-463.

### 4.1.1 Valuation methodology

The sensitivity of the market value of a REIT to the real estate assets owned by the firm represents a main assumption of the NAV approach. This tool will help to answer the question of whether or not the fundamental value of the REIT conforms to the stock price to detect contingent over- or undervaluations.[3]

The valuation of a REIT by means of the NAV approach can be calculated in three steps.

In the first step, the NAV of a REIT is calculated. Although there are variations concerning the determination of the NAV, the measure can be derived in the following form:

| | | |
|---|---|---|
| | **Market values of the real estate assets** | **(4.1)**[4] |
| + | **Other assets** | |
| - | **Liabilities** | |
| = | **Net asset value (NAV)** | |

The derivation of market values pertaining to the real estate assets constitutes an essential component of the NAV. It is assumed that the real estate assets are exploited in terms of the holding, management and operating business of the REIT. In this regard, the market values attached to the properties probably exceed the corresponding book values by a substantial amount. In comparison to book values, market values are supposed to reflect actual property prices more closely. Consequently, the real estate assets should be included in the NAV calculation at their market values.[5]

The market values of the real estate assets may be determined through a bottom-up or a top-down approach. The bottom-up approach involves the summation of the market values of all properties to arrive at an aggregated value of the entire real estate portfolio. The market values of the properties are obtained from appraisals,

[3] CADMUS (2003), p. 201; GENTRY/JONES/MAYER (2004), p. 1; REHKUGLER (2003a), p. 218; REHKUGLER (2006), p. 91.
[4] THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 61.
[5] COPELAND/KOLLER/MURRIN (2000), p. 184; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 61.

which are typically carried out on a regular basis. A second procedure, the top-down approach, involves the summation of the net operating income (NOI)[6] of all properties and the division of the aggregated amount by a single capitalisation rate.[7]

Having determined the market value of the property portfolio, other assets, including current and fixed assets, are added.[8]

Fixed assets include real estate assets such as unimproved land or the headquarters of the REIT. To reduce estimation outlay, fixed assets can be included in the NAV calculation at their book values. This approach is recommended, as there usually exist minor deviations between book and market values of fixed assets. In addition, items classified as fixed assets, such as investments in unconsolidated subsidiaries, joint ventures and other interests, should be considered at their market values, as these often clearly exceed the respective book values.[9]

Current assets typically comprise cash and cash equivalents, trade and other receivables, property loans, other financial assets and a specific share of the property portfolio. For example, properties held for construction are generally stated as current assets. To capture the value assigned to real estate development activities in the calculation, the total construction costs have to be subtracted from the expected sales proceeds of the completed property development. The result of the preceding calculation is discounted to the present at a rate that corresponds to the required return on a property development. Furthermore, other current assets such as receivables, inventories and liquid funds can be customarily considered at their book values. This approach is recommended, as the deviations of book values from market values are expected to be moderate.[10]

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[6] The net operating income usually equals the rental income plus other income less operating expenses such as real estate taxes, insurance, repair and maintenance or management and leasing expenses. [BRUEGGEMAN/FISHER (2005), p. 261f.]

[7] CADMUS (2000), p. 98; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 63-67. The capitalisation rate, also called the initial yield, represents the ratio of the property's current income to its current value. This rate can be derived from the sale of comparable real estate assets. The capitalisation rate can be adjusted with premiums or discounts to consider property-specific characteristics like the building quality or the occupancy rate. [BALL/LIZIERI/MacGREGOR (2001), p. 228; CAPOZZA/LEE (1995), p. 366f; CLAYTON/MacKINNON (2002), p. 12; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 67.]

[8] THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 61-67; YUNGMANN (2002), p. 1f.

[9] THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 61-67; YUNGMANN (2002), p. 1f.

[10] REIT annual reports; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 61f.

Finally, the liabilities of the REIT have to be subtracted from the sum of the previously determined assets. Long-term liabilities should be considered at their present values, as changing interest rates may increase or decrease the market value of the liabilities. Pension obligations as well as short-term and long-term accrued liabilities can be reflected at their respective book values, which tend to largely conform to market values.[11]

Subsequent to the calculation of the net asset value figure in the first step, the NAV per share is derived in the second step. The NAV per share can be calculated as follows:

$$NAV\ per\ share = \frac{Total\ NAV}{Number\ of\ common\ shares + convertible\ partnership\ units} \quad \textbf{(4.2)}$$

The denominator includes the number of common shares, which is added to the convertible partnership units.[12]

In the third step, the NAV per share is compared to the stock price of the REIT. This comparison shows whether the stock price is lower than, referred to as a discount, or higher than, referred to as a premium, or equals the net asset value per share.[13] A discount or a premium of a REIT can be calculated as follows:

$$Premium/discount\ of\ stock\ price\ to\ NAV = \frac{Stock\ price - NAV\ per\ share}{NAV\ per\ share} \quad \textbf{(4.3)}$$

By comparing the stock price with the NAV per share, Formula 4.3 helps to detect contingent under- or overvaluations attached to a REIT. Findings of scientific real estate literature indicate that the ratio between prices and NAVs per share is mean-

[11] THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 62.
[12] CAPOZZA/LEE (1996), p. 523; JAFFE (2002), p. 2. Ideally, both the number of common shares and the number of convertible partnership units are stated on a diluted basis. This approach accounts for the existence of convertible units, which would otherwise dilute the earnings per common share. [YUNGMANN (2002), p. 2f.]
[13] GERING (2002), p. 5.

reverting. Over the long term, REITs domiciled in the United States have generated a premium on the NAV per share of approximately 10%, on average. In case of a premium of stock price to the NAV per share, the entity is valued higher than its underlying assets net of liabilities.[14] However, it has been argued that the stock price could trade between a discount of 35% and a premium of 35% to the NAV per share. For an investor, a simple investment decision involves the purchase of a REIT share primarily when the stock price is trading at a discounted stock price to the NAV per share, whereas the REIT stock is probably too expensive if it is trading at a considerable premium stock price to the NAV per share. In this context, there exists some evidence that trading strategies based on the comparison between the NAV per share and the stock price resulted in excess returns even after the consideration of trading costs.[15]

### 4.1.2 Extensions

The previously explained NAV methodology represents one valuation tool that is conventionally discussed in the literature on REITs. However, no standardised form of calculating the approach with REITs is available. Indeed, several modifications of the approach have been proposed, which are briefly discussed in the following.

Miscellaneous recommendations have been made regarding the calculation of the market value of the real estate portfolio held by the REIT.
CAPOZZA/LEE (1995, p. 366) suggested the application of a weighted instead of a single capitalisation rate. The authors recommended grouping real estate assets according to their property-specific similarities and assigning a customised capitalisa-

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[14] CADMUS (2003), p. 209; GENTRY/JONES/MAYER (2004), p. 13. This premium has been calculated for REITs headquartered in the United States over a period between 1990 and 2001. It has been argued that this premium can serve as an indication for a long-term average value over other periods as well. [CADMUS (2003), p. 207.]

[15] BLOCK (2006), p. 228; CADMUS (2000), p. 105; STARKMAN (2005), p. 3. GENTRY/JONES/MAYER (2004, p. 1) showed that trading strategies based on the results from the NAV approach such as buying shares at a discount of the stock price to the NAV per share and selling short at a premium resulted in excess returns with trading costs and short-sale restrictions being unprohibitive. KIRBY (2004, p. 1) observed that a sample of REITs attached to the quartile with the companies exhibiting the largest discounts outperformed REITs that have been assigned to the quartile of firms possessing the highest premiums and vice versa. The annual excess returns resulting from the trading strategy had been located in a range between 14 and 22%. [KIRBY (2004), p. 1.]

tion rate to each category. To reflect property-specific characteristics, the capitalisation rate should be adjusted through premiums or discounts. Likewise, a capitalisation rate can be employed that not only captures property-specific information but that also reflects the equity and bond risk to shareholders.[16]

As a variation of the NAV measure, the so-called triple net asset value (NNNAV) has been recommended by the European Public Real Estate Association (EPRA). Principally, the NNNAV equals the NAV adjusted for the fair value of financial instruments, the fair value of debt as well as deferred taxes.[17]

Furthermore, it has been recommended that the NAV derived in Equation 4.1 should be adjusted. Specifically, the value associated with the ability of management to create value as well as the value of structural balance sheet features are either added to or subtracted from the NAV. These and further modifications are made on the basis of the belief that certain factors are influencing the intrinsic value of a REIT but have not been considered in the NAV calculation described in the previous section.[18]

### 4.1.3 Interpretation of deviations between the stock price and the net asset value per share

The issue of deviations between a REIT stock price and the corresponding NAV per share has received considerable attention in academic research. In this sense, the scientific literature has provided a variety of reasons for these deviations. In essence, five factors have emerged that can deliver explanatory power regarding the deviations between both measures. Particularly, the deviations may result from the development of real estate markets, the real estate portfolio, the consequences of securitising the portfolio through a REIT, noise and informed trading.

First, it has been suggested that fundamental data pertaining to the property markets have been responsible for deviations. For example, CLAYTON and MacKINNON

[16] CAPOZZA/LEE (1995), p. 366f; CLAYTON/MacKINNON (2002), p. 12.
[17] EPRA (2006), p. 39.
[18] See *www.greenstreetadvisors.com* for further information.

(2000, p. 17) found that the REIT NAV premium is related to real estate market fundamentals, approximated through appraisal-based data.

Second, deviations are likely to result from the features of the real estate assets owned by a REIT. In this context, several studies have documented that REITs holding the bulk of assets of the same property type trade at higher REIT premiums or lower discounts than REITs that hold portfolios being diversified across property types. CAPOZZA/LEE (1995, p. 371) documented that the size of the discount of the stock price to the NAV per share is dependent not only on a diversification or a concentration of the portfolio but also on the type(s) of property held by the REIT.[19]

Third, deviations between the stock price and the NAV per share may follow from the securitisation of real estate assets by means of the REIT vehicle. As the REIT investor participates indirectly in real estate assets, factors such as liquidity[20], size[21], management quality[22], legal restrictions[23], tax payments[24], conflicts of interest be-

[19] The authors found that REITs focusing their portfolios on warehouse properties exhibited the highest discount of stock prices to NAVs per share (-24.2%) whereas REITs being primarily invested in retail properties possessed the lowest discounts (-1.1%). CAPOZZA/LEE (1995, p. 371) examined 75 REITs domiciled in the United States over a time period from 1985 to 1992.

[20] CLAYTON/MacKINNON (2002, p. 7) found that the premium of stock price to NAV per share for REITs headquartered in the United States was partly driven by the value that investors allocate to liquidity.

[21] CAPOZZA/LEE (1995, p. 376) detected that small-capitalised REITs trade at a high discount while REITs possessing a large capitalisation trade at a premium of the stock price to the NAV per share. Similarly, CLAYTON/MacKINNON (2000, p. 1) documented that REITs owning a high market capitalisation traded at higher premiums or lower discounts when compared to small-capitalised REITs between 1996 and 1999. This difference is exceptionally large in cases of a premium of the REIT stock price to its NAV per share. [CLAYTON/MacKINNON (2000), p. 17.]

[22] CHAY/TRZCINKA (1999, p. 379) showed that the expected management performance can be a reason for differences between the NAV per share and the stock price. Basically, a REIT having a management generating profits that exceed the management costs could result in a share price exceeding the NAV per share. [CHAY/TRZCINKA (1999), p. 379.]

[23] It is assumed that REITs trade less often at a discount to the net asset value per share when compared to real estate companies devoid of a REIT status. One reason for this finding is based on the legal restrictions that confine the business activities and possibly reduce the risk profile as well. [TSE (2003), p. 1.]

[24] BRICKLEY/MANASTER/SCHALLHEIM (1991, p. 308f) found that tax liabilities together with the timing of tax payments possess an explanatory power regarding deviations between the stock price and the NAV per share. The exemption of income taxes at least on a corporate level could result in a NAV premium. [BIGMAN/CHIU (2004), p. 3.]

tween the REIT management and the shareholders[25] and other effects[26] may contribute to deviations between the REIT stock price and the NAV per share.
Fourth, according to the noise theory, deviations between NAVs per share and stock prices are a consequence of investor sentiments. Irrational investors are trading securities not only on the basis of fundamental data but also due to market sentiments. Accordingly, stock prices can diverge from their fundamental values in the short term. However, noise trader reactions are viewed as mean-reverting, implying that the REIT price should eventually approach its long-term average premium or discount relative to the NAV per share. As the investor sentiment is supposed to be unpredictable, rational investors cannot arbitrage away a possible mispricing and are therefore beset with noise trader risk. When studying closed-ended funds (CEFs), LEE/SCHLEIFER/THALER (1991, p. 75f) found that discounts may represent an outcome of sentiment-based trading by some investors. Despite the differences between CEFs and REITs, it has been observed that investor sentiments result in trading activities that ultimately lead to deviations between REIT stock prices and NAVs per share as well.[27]

Fifth, the information theory proposes that rational investors use current information on market fundamentals to derive unbiased estimates concerning future earnings. Consequently, a fall or a rise in REIT stock prices can rationally reflect future return expectations. Within the context of information theory, some empirical studies demonstrate price discovery among REITs. In detail, the studies have found that the stock prices formed at REIT markets tend to precede the prices of direct real estate assets and are thus supposed to be more efficient.[28]

[25] A conflict of interest probably contributing to a discount of stock price to the NAV per share may arise if the REIT management follows activities beyond their core competence. In contrast, the reduction of conflicts of interests through compensation plans for example can contribute to a NAV premium. [CADMUS (2000), p. 101f; GENTRY/JONES/MAYER (2004), p. 7.]
[26] Other effects that are likely to result in up- or downward movements of prices relative to net asset values per share include analyst recommendations on the sell-side, dividend declarations or earnings announcements. [GENTRY/JONES/MAYER (2004), p. 15.]
[27] BARKHAM/WARD (1999), p. 299; CLAYTON/MacKINNON (2000), p. 2; CLAYTON/MacKINNON (2002), p. 7 & 17.
[28] BARKHAM/WARD (1999), p. 299; CLAYTON/MacKINNON (2000), p. 3.

### 4.1.4 Critical assessment

The critical assessment of the NAV approach will be carried out both from the perspective of conventional corporate valuation models and the applicability of the tool to Real Estate Investment Trusts.

The application of the NAV approach with REITs is challenged, as the model reflects a liquidation value. As previously documented, the liquidation value may serve as a floor-end value. Furthermore, the NAV approach is criticised for being backward-looking and static. One exception is the valuation of REIT properties, especially when independent appraisers accommodate the future profitability of the real estate assets in their appraisals.[29]

With regard to the perspective of its applicability to REITs, several arguments have been proposed both for and against the use of the NAV. REITs represent entities with their ability to generate earnings being dependent on real estate assets. Taking this assumption into consideration, it is argued that REITs are particularly conducive to the NAV approach. The NAV approach is primarily appropriate for the valuation of REITs that are engaged in the holding, management and operation of real estate assets. Furthermore, it is appreciated that the NAV approach uncovers hidden reserves if market values are determined. Random disturbances of the respective accounting period due to a high but unsustainable growth typically do not have a deteriorating impact on the valuation. However, in terms of company growth, the NAV approach considers internal growth[30] only to a certain extent, while the external growth[31] of a company is rather neglected. Moreover, it is argued that the NAV does not accurately reflect parts of the firm that may affect the surplus of the company but are not derived from the holding, management and operation of real estate assets.[32]

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[29] CADMUS (2000), p. 97; KIRBY (2001), p. 2; REHKUGLER/SCHULZ-WULKOW (2003), p. 119; SCHREIER (2002), p. 263; STARKMAN (2005), p. 3.

[30] Internal growth of a REIT refers to the optimisation of the real estate portfolio due to the rental hikes or the reduction of property-related administration costs as a consequence of active management. [REHKUGLER/SCHULZ-WULKOW (2003), p. 106.]

[31] External growth can be realised through the re-grouping of the property portfolio, the inclusion or the development of new properties. [REHKUGLER/SCHULZ-WULKOW (2003), p. 106.]

[32] BLOCK (2006), p. 213-216; CADMUS (2000), p. 96; KIRBY (2001), p. 2; REHKUGLER (2006), p. 91; REHKUGLER/SCHULZ-WULKOW (2003), p. 119; SCHREIER (2002), p. 263-279; STARKMAN (2005), p. 4; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 58-62.

Further, it is questioned whether or not the different types of risks, such as operational and financial risks, are reflected in an accurate manner.[33] Taking into account that the NAV summarises the independent valuations of individual properties, financial risks are not considered, as it is assumed that the properties are completely financed by equity.[34] In the CAPM framework, only systematic risk, not unsystematic risk, is rewarded through a higher return. An example of unsystematic risk is that associated with a single property. In contrast, the real estate-specific risk is considered by the NAV approach. Furthermore, additional risks emerging on a corporate level, such as the possibility of agency conflicts or the threat of bankruptcy, are not explicitly considered in the NAV calculation. Apart from potential risks, opportunities that arise from the combination of properties in a portfolio are not scrutinised in the NAV approach.[35]

Furthermore, it is criticised that the NAV approach does not sufficiently reflect the franchise value[36] of a real estate company. Notwithstanding, intangible assets, such as profitable management decision-making, potentially account for a significant share of the total REIT stock value. At most, an indication regarding the quality of management is included through the selected property portfolio.[37]

Principally, the NAV approach demands that the users possess sufficient real estate knowledge, particularly when a single capitalisation rate is used within the top-down approach.[38]

In terms of the availability of data, market values of the properties are often not published in financial reports. The lack of information leads to difficulties when trying

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[33] BLOCK (2006), p. 217; KÜTING/EIDEL (1999), p. 230.

[34] According to the mathematic proofs of MODIGLIANI/MILLER (1958), the risk to equityholders is positively connected with the degree of leverage. Assuming that investors demand a higher return when they have to accept a higher risk, the return required by equityholders will be positively related to the magnitude of the leverage ratio.

[35] REHKUGLER/SCHULZ-WULKOW (2003), p. 115-119.

[36] The franchise value can be defined as the ability of a company to create shareholder value. [GERING (2002), p. 2-4.]

[37] FUNK/SCHULZ-EICKHORST (2002), p. 805; REHKUGLER (2006), p. 91f; WOKER (2005), p. 3.

[38] CLAYTON/MacKINNON (2002), p. 13; REHKUGLER (2006), p. 92; SCHREIER (2002), p. 279; THOMASCHOWSKI/REHKUGLER/NACK (2003), p. 63-70.

to derive a portfolio value by means of the bottom-up approach. Likewise, the NOI is not always included in the financial statements. Alternatively, the collection of the data needed to calculate the NOI can be hampered by restraints regarding the availability of information.[39]

Although the assumptions and inputs made regarding a NAV calculation are multifaceted, they are less extensive than those attached to a DCF model, for example. Similarly, the cost associated with the calculation of the NAV per share can be limited. Fortunately, some REITs already calculate and provide their net asset values per share in the financial statements. However, the comparability between NAV estimates is restricted, as no standardised form of this approach has evolved.[40]
In summary, despite the studies that have investigated the deviations of stock price from the NAV, no adequate approach concluding with a holistic explanation has been established. Rather, there exist a variety of explanation attempts.
Although the NAV approach exhibits several benefits when used for the valuation of REITs, the considerable deviations between the stock prices and the NAVs per share indicate that this model exhibits weaknesses with respect to delivering an intrinsic REIT value. Instead, the NAV may serve as a floor-end value when estimating the REITs' intrinsic value.[41]

## 4.2 Market-oriented valuation approach based on funds from operations

Another conventional REIT valuation tool refers to a market-oriented approach using funds from operations (FFO). The FFO represents a REIT-specific earnings measure. Several academic researchers have suggested the application of this measure in market-oriented approaches.[42]

[39] CLAYTON/MacKINNON (2000), p. 10. In particular, REITs domiciled in the United States list their properties in the financial statements at book instead of market values. [REIT annual reports.]
[40] GERING (2002), p. 5; WOKER (2005), p. 3; YUNGMANN (2002), p. 1.
[41] WETTESKIND/SOMMER (1998), p. 761.
[42] See, for example, BLOCK (2006, p. 220) or VINCENT (1999, p. 75).

In the following, the methodology is explained at the beginning (4.2.1), a possible extension of the FFO-based market-oriented valuation approach is introduced (4.2.2) and a final evaluation of the tool and its extension (4.2.3) concludes the review.

### 4.2.1 Valuation methodology

The FFO used within a market-oriented valuation approach has its foundation in the United States. In 1991, the National Association of Real Estate Investment Trusts (NAREIT) explicitly defined the FFO and suggested it as a measure for use in REIT analysis. The main motivation for the development of the FFO relates to the argument that the net income derived from Generally Accepted Accounting Principles (GAAP) does not serve as an accurate profitability measure for REITs.[43] In the years 1995[44] and 1999,[45] the FFO measure was modified to deliver an improved reflection of the specific earnings characteristics associated with REITs. To employ the FFO-based valuation approach in a REIT valuation task, three steps have to be followed.

In the first step, the FFO measure can be calculated in the following form:

| | | |
|---|---|---|
| | **Net income** | **(4.4)**[46] |
| -/+ | **Gains/losses on real estate sales** | |
| + | **Depreciation and amortisation** | |
| + | **Adjustments for unconsolidated partnerships and joint venture holdings** | |
| = | **Funds from operations (FFO)** | |

Using the indirect method of cash flow calculation, the estimation of the FFO begins with the net income measure, which can be retrieved from the annual report.

[43] HIGGINS/OTT/VAN NESS (2005), p. 2; YUNGMANN/TAUBE (2001), p. 1.

[44] In 1995, the definition of FFO was modified in the sense that it specified the elements to be included and the positions to be excluded in a FFO calculation to foster a greater disclosure of information regarding FFO items. [VINCENT (1999), p. 74.]

[45] In 1999, the FFO was adjusted to include non-recurring items with the exception of extraordinary items under the US-GAAP. [HIGGINS/OTT/VAN NESS (2005), p. 2f.]

[46] SCHREIER (2002), p. 325.

Possible effects from gains and losses due to the sale of real estate assets are eliminated from the net income. This adjustment is necessary because the FFO measure focuses on the income from the holding, management and operation of real estate assets.[47] Gains or losses from the sale of real estate assets are classified as irregular income, which does not constitute a part of the REITs' main business activities.
A further adjustment to the net income has to be made regarding the depreciation and amortisation components. The standard net income measure typically assumes a steady erosion of a company's assets, which has to be considered through income statement-related accounting effects. While the depreciation component has been deducted from the REIT revenues to ultimately arrive at the net income, this item is plowed back in the FFO calculation. This procedure relies on the assumption that an active management of real estate assets helps to sustain property values over time. Specifically, only depreciation and amortisation for items belonging to the real estate portfolio, such as the depreciation of buildings, the amortisation of capitalised leasing expenses or the amortisation of tenant improvements[48], are plowed back.[49]
Finally, adjustments for unconsolidated partnerships and joint ventures are made to simplify comparisons between the FFO measures of several REITs.[50]

In the second step, the FFO is translated into the FFO per share to ensure comparability between REITs. This conversion can be handled by means of the following formula:

$$FFO\ per\ share = \frac{Total\ FFO}{Number\ of\ common\ shares + convertible\ partnership\ units} \qquad \mathbf{(4.5)}$$[51]

[47] FUNK/SCHULZ-EICKHORST (2002), p. 806; SCHREIER (2002), p. 226.
[48] Tenant improvements represent concessions to tenants made by the REIT as the property owner. Usually, commercial tenants reconfigure their space in order to make it more suitable to their operations. The costs associated with these improvements might be partly borne by the REIT. [BRUEGGEMAN/FISHER (2005), p. 591.]
[49] SCHREIER (2002), p. 326; WETTESKIND/SOMMER (1998), p. 759. On the contrary, items that are not directly related to the REITs' property portfolio such as the depreciation of a REIT's own office improvements and the amortisation of deferred financing costs are not included in the figure that is added to the net income to ultimately arrive at the FFO. [VINCENT (1999), p. 74.]
[50] VINCENT (1999), p. 74.
[51] Given the recent considerations regarding the NAV per share, the number of common shares as well as the convertible partnership units should be expressed on a diluted basis.

The third step involves the use of the FFO per share in a market-oriented valuation approach. The NAREIT organisation encouraged users to employ the price-to-FFO ratio instead of the PER when valuing REITs.[52]

### 4.2.2 Extension

Based on the FFO and subsequent discussions of its meaningfulness as an earnings measure for REITs, another measure, called adjusted funds from operations (AFFO), was developed. In comparison to the FFO, the AFFO should reflect the real estate-related characteristics of REITs more precisely.[53] To derive the AFFO measure, the FFO needs to be adjusted according to the following items:

| | | |
|---|---|---|
| | **FFO** | **(4.6)**[54] |
| - | **Capital expenditures** | |
| - | **Tenant improvements** | |
| - | **Leasing commissions** | |
| + | **Adjustments for straight-line rents** | |
| = | **Adjusted funds from operations (AFFO)** | |

Although capital expenditures do not arise on a regular basis, they are usually incurred in the case of building enhancements, for example, thus representing an outflow that should be deducted from the FFO.[55]

Expenditures for tenant improvements, which are usually included in the depreciation and amortisation expenses of the financial statements, represent a cash outflow. Whereas depreciation and amortisation expenses, including expenditures for tenant improvements, are plowed back to the net income in the FFO calculation, this approach rather overstates the actual earnings capability of a REIT. Hence, tenant improvements have to be subtracted from the FFO in the AFFO calculation.[56]

[52] BLOCK (2006), p. 220; SCHREIER (2002), p. 326; VINCENT (1999), p. 75.
[53] SCHREIER (2002), p. 327.
[54] FUNK/SCHULZ-EICKHORST (2002), p. 806; SCHREIER (2002), p. 327f.
[55] SCHREIER (2002), p. 325-328.
[56] GRAHAM/KNIGHT (2000), p. 21.

Likewise, leasing commissions are included in the depreciation and amortisation expenses published in the income statement. Comparable to the tenant improvements, leasing commissions are considered in the AFFO calculation as a cash outflow.[57] Adjustments for straight-line rents are made to prevent large disparities between rents actually received and rents stated in the balance sheet. In cases of long-term leasing contracts, REITs fix the rate by which rents will grow over the lease term in their balance sheet, while the growth in rents contractually agreed to may differ due to regular adjustments to market rents. [58]

As in the case of the FFO-based market-oriented valuation approach, a price-to-AFFO multiple can be calculated to compare REITs.[59]

### 4.2.3 Critical assessment

A critical assessment of the market-oriented valuation approach based on FFO should entail an evaluation of both the valuation methodology and the FFO measure. The tool using FFO has been classified as a market-oriented valuation approach. Accordingly, the advantages and disadvantages associated with the market-oriented valuation approaches, which have been previously discussed, are supposed to be transferable to the evaluation of the FFO-based tool.

In addition, the FFO measure has been subject to both approval and criticism.
A major advantage of the FFO measure concerns its aspiration to reflect the specific features of REITs, for example, through plowing back the depreciation item, which would otherwise account for a considerable share of a REIT's expenses. Furthermore, it is argued that the FFO corrects the earnings measure for those balance sheet positions that can be easily manipulated.[60]

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[57] GRAHAM/KNIGHT (2000), p. 21f.
[58] GRAHAM/KNIGHT (2000), p. 21; SCHREIER (2002), p. 327.
[59] BLOCK (2006), p. 229f. The price-to-AFFO multiple is influenced by factors such as the risk perceived by investors, interest rates, growth prospects, property values or capitalisation rates observed in direct real estate markets. Higher price-to-AFFO multiples can be a consequence of low capitalisation rates, low interest rates or above-average prospects regarding the growth of a REIT and vice versa. [BLOCK (2006), p. 230.]
[60] SCHREIER (2002), p. 326; VINCENT (1999), p. 75f.

Nevertheless, it has been criticised that the FFO measure does not capture the creation or destruction of value through property disposals. Similarly, it has been contended that the FFO may overstate the true income derived from operations, as irregular occurring costs, such as capital expenditures, leasing commissions or tenant improvements, are not deducted.[61]

In terms of the explanatory power of the FFO measure regarding stock prices, the findings of the real estate literature are mixed. Some studies have concluded that the FFO measure provides information content beyond that of other income measures[62], whereas other studies have documented that standard income measures exhibit an equal, or even higher information content when compared to the FFO[63]. In total, there exists no proven superiority of the FFO measure beyond standard net income measures in terms of information content. In addition, there is little evidence that gains or losses from the sale of real estate assets are likely to affect stock returns but are not considered in the FFO measure.

With adoption of the FFO in the financial statements by many firms maintaining REIT status in the United States, these companies have accepted the FFO as an appropriate profitability measure. Nevertheless, the measure is sometimes reported in a different way than that prescribed by the NAREIT organisation. As a consequence, the comparability of the FFO measure is reduced. Although the analysis of financial reports shows that numerous REITs domiciled in Canada and Japan report the FFO, the bulk of the countries with REIT regimes included in the previously described sample do not report the FFO measure. In addition, the calculation of the measure by means of Formula 4.4 can be invalidated as the disclosures of REITs may not necessarily comprise all items needed for the calculation of the FFO.[64]

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[61] FOSHEIM (2004), p. 1; MOGHADAM (2004), p. 1; STARKMAN (2005), p. 2; VINCENT (1999), p. 75-77.

[62] GRAHAM/KNIGHT (2000, p. 17) demonstrated that the FFO measure captures a higher relative information content when compared to the net income measure while carrying incremental information content beyond that of the net income measure. GORE/STOTT (1998, p. 323) investigated a sample of 202 Equity-REITs domiciled in the United States between 1991 and 1996 and found that the FFO is more closely linked to stock returns than the GAAP-based net income. Specifically the authors observed that the depreciation expenses are not associated with stock returns while potential gains and losses from the sale of real estate share a significant relationship with stock returns. [GORE/STOTT (1998), p. 323.]

[63] See, for example, STUNDA/TYPPO (2004) or VINCENT (1999).

[64] VINCENT (1999), p. 77.

Compared to the FFO measure, the AFFO measure is assumed to capture the specific features of a REIT more accurately, especially due to the adjustments made for capital expenditures. Apart from that, the AFFO is supposed to be burdened with the disadvantages that have been identified concerning the FFO measure. Additionally, no standard calculation regarding the AFFO measure has been suggested, with the number of REITs reporting the AFFO values being lower than those publishing FFO values. Considering that more items need to be collected to derive the AFFO in comparison to the FFO measure, the likelihood of the availability of all data needed to calculate the extension is potentially reduced.[65]

In summary, multipliers based on the FFO measure and its extension are potentially the most useful for a relative valuation approach, i.e., when one REIT is scrutinised against comparable firms. Similar to the NAV approach, the FFO-based valuation approach should be used in conjunction with other valuation models.[66]

## 4.3 Discounted cash flow approach

Apart from the NAV approach, which has been classified as a cost-oriented valuation approach, and the FFO-based valuation approach, categorised as a market-oriented valuation methodology, the application of payoff-oriented valuation methodologies with REITs has been proposed. In this regard, the previously introduced DCF approach is modified to reflect specific REIT features.

In the following, the use of the methodology with REITs is explained (4.3.1), the dividend discount model (DDM) as an extension of the DCF approach is discussed (4.3.2), and, in conclusion, the use of both the DCF model and the DDM with REITs is critically evaluated (4.3.3).

### 4.3.1 Valuation methodology

Principally, the previously explained DCF methodology can be adopted with the valuation of REITs as well. In particular, the application of an entity valuation ap-

[65] BLOCK (2006), p. 219; FOSHEIM (2004), p. 1.
[66] BLOCK (2006), p. 220 & 230.

proach using the WACC as the discount rate has been suggested. In addition, some researchers have proposed specific adjustments to account for the unique features of REITs.

The free cash flows that are generated by a REIT can be estimated through the valuation scheme illustrated in the review of payoff-oriented valuation approaches. In this regard, the valuing entity potentially adjusts the FCFs according to individual expectations while also considering REIT-specific features. As a variation of the calculation of FCFs, as previously suggested, the calculation scheme is substituted by the estimation of the AFFO explained in Formula 4.6.[67]

Further, instead of using the WACC to transfer cash flows to the present, an average capitalisation rate concerning the REIT property portfolio could be used as a discount rate.[68]

### 4.3.2 Extension

The dividend discount model represents an extension of the DCF approach and has received considerable recognition in scientific research. The underlying principle of the DCF approach, i.e., to discount future benefits to the present, is adopted by the DDM. This model determines the value of a stock on the basis of the expected future dividend payments. The DDM focuses on the dividend-generating ability as well as on the growth prospects of a REIT.[69] In this regard, the cash from operations distributed to shareholders in the form of dividends is supposed to represent an important factor in the determination of a REIT value.

The DDM can be formulated on the basis of different assumptions regarding the future development of dividend payments. In the scientific literature, the so-called zero growth model assuming constant dividends, the constant growth model incorporating dividends with a steady growth rate and the two- or multi-stage DDM reflecting

[67] BLOCK (2006), p. 220; SCHREIER (2002), p. 50.

[68] BLOCK (2006), p. 221.

[69] BLOCK (2006), p. 222; BOYD (2004), p. 1; KIRBY (2001), p. 1. Dividend payments are defined as the sum of distributions of a company to its shareholders. These distributions may comprise the regular annual dividends, anniversary dividends, liquidation shares, buybacks or the repayment of the par value. As the duration of a share investment is usually not limited, the dividend payments can theoretically last forever. [LODERER (2005), p. 737.]

a changing growth rate have been distinguished. Research on REIT valuation has explicitly considered the constant growth model. Accordingly, the theoretical share price determined by means of the DDM equals a constantly growing perpetuity.[70] For this purpose, historical dividend yields of the respective REIT will be analysed to arrive at a forecast of both dividend payments and long-term growth rates. Both items have to be considered in the following calculation:

$$P_0 = \frac{DIV_0 \times (1+g)}{(c_{el} - g)} = \frac{DIV_1}{(c_{el} - g)} \qquad \textbf{(4.7)}^{71}$$

where

$P_0 =$ theoretical share price
$DIV_0 =$ preceding dividend payment
$g =$ growth rate of dividends
$DIV_1 =$ expected dividend payment

### 4.3.3 Critical assessment

The discounted cash flow model has been classified as a payoff-oriented valuation approach and has earned broad recognition.
Generally, the benefits and shortcomings of the WACC approach that have been previously discussed remain valid in the application of the approach to REITs as well.

In addition, it has been argued that the DCF approach is superior to other approaches used for the valuation of REITs. Although the proponents of the DCF approach ad-

[70] BLOCK (2006), p. 222; LODERER (2005), p. 739.
[71] BLOCK (2006), p. 222. In some cases, dividends are paid not on an annual basis but in other time intervals. For example, REITs domiciled in the United States often pay dividends on a quarterly basis. In these cases, Formula 4.7 can be modified in the following form:

$$P_0 = \frac{DIV_1}{(c_{el} - g)} \times (1 + c_{el})^{(1-NDP)}$$

with *NDP* representing the time period until the next dividend payment (expressed as a share of one year). [LODERER (2005), p. 742; REIT annual reports.]

mit that a large fraction of a REIT's intrinsic value accrues from the value of the real estate assets, they believe that the stock market primarily emphasises cash flows generated by the company.[72]
In spite of this, several issues arise when applying a conventional DCF model to the valuation of REITs.
Specifically, the use of the previously introduced FCF measure may not adequately capture the specific features of a REIT. For example, similar to the FFO-based valuation approach, the DCF model possibly underestimates the earnings from property sales, as these might not be included in the free cash flow calculation. Furthermore, the incorporation of longer-term growth prospects and future risks in the DCF model is associated with difficulties. For example, REITs possessing a high near-term growth or relatively high initial yields might be rewarded with a comparatively high company value.[73]

In comparison to other REIT valuation models, the DCF approach requires more inputs and assumptions, which exacerbate the valuation task. This disadvantage is reinforced when applying the DCF approach to REITs, which still exhibit a shortage of information available about the firm. In particular, the calculation of the cost of equity by means of the CAPM used in a DCF approach to value REITs might be problematic. The limited availability of historical data on REITs, especially on REITs domiciled outside the United States, confines the availability of both beta values and market returns. As previously observed, the number of REITs is still limited in several REIT regimes.

A strength associated with the DDM is based on its focus on dividends. Especially, REITs required to distribute large shares of their earnings should exhibit a strong relationship between cash flows and dividends.[74]
However, the limitations mentioned in the case of the DCF model also demarcate the weaknesses of the DDM. The need to forecast dividend payments in connection with a growth rate might not lead to accurate forecasts. For example, it is difficult to

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[72] CLAYTON/MacKINNON (2002), p. 1; KIRBY (2001), p. 1; WOKER (2005), p. 1.
[73] KIRBY (2001), p. 1.
[74] BLOCK (2006), p. 222f; HEDANDER (2005), p. 7; KIRBY (2001), p. 1; LIU/NISSIM/THOMAS (2005), p. 2; PENMAN/SOUGIANNIS (1998), p. 348.

conduct reliable estimates regarding dividends over the long term. Unlike earnings, future dividends are not measured relatively close to the time that they are generated in the company but rather when they are distributed to shareholders. This time lag potentially aggravates the forecasting task. Fortunately, as a REIT has to approach a high earnings distribution ratio, the period of value generation is close to the period of value distribution.[75] In addition, the uncertainty associated with the forecasting of dividends might be reduced with REITs, as these firms have to distribute a large fraction of their earnings to shareholders.

Aside from these issues, the possibility to conduct scenario or sensitivity analyses in the context of the application of the DDM is reduced, as the model concentrates on the processing of dividends without considering influencing factors. In contrast, as the DDM relies on the calculation of perpetuity with a constant growth rate of dividends, the approach should be beset with less calculation cost in comparison to a DCF model.[76] Similarly, less data have to be collected for the DDM compared to a DCF model.

[75] BLOCK (2006), p. 222f; HÜFNER (2000), p. 27f; KIRBY (2001), p. 1; LIU/NISSIM/THOMAS (2005), p. 2; LODERER (2005), p. 744; PENMAN/SOUGIANNIS (1998), p. 348. For example, the company value can be underestimated when companies finance their growth through retention of earnings and thus do not distribute dividends. [HÜFNER (2000), p. 27.]

[76] LODERER (2005), p. 752f.

# 5 Desirable features of an advanced REIT valuation tool

Before the development of a valuation tool that should accommodate the features associated with REITs, the research sub-question, i.e., asking for the desirable features of a new approach to REIT valuation, is addressed in the following. Specifically, this chapter includes the formulation of requirements against the new REIT valuation tool (5.1) as well as a taxonomy for an advanced REIT valuation tool (5.2).

## 5.1 Requirements

Considering the recent considerations regarding corporate valuation methodologies and REITs, a choice of requirements can be formulated concerning a new REIT valuation tool.
On the one hand, these requirements are extracted on the basis of the characteristics associated with conventional corporate valuation methodologies (5.1.1). On the other hand, requirements are formulated through considering both REIT features and conventional approaches to REIT valuation (5.1.2).

### 5.1.1 Requirements based on conventional corporate valuation models

In a first instance, the new tool suggested in the following should fulfil the general requirements, which are partly retrieved from the principles of corporate valuation as well as from the explanations regarding conventional corporate valuation methodologies made above.

At the beginning, a valuation task shall be formulated. A major task of the approach is to determine a potential price of a REIT. Likewise, both the extent to which the respective stock is mispriced and the question of whether the stock price is fundamentally justified or not are addressed. Further, the value derived by this method

should not be exposed to large random deviations and systematic over- or under-valuations in comparison to the stock price.[1]
Instead of relying on past or present information only, the value of the REIT should be a function of the contingent long-term profitability. The value of the REIT should depend on the cash flows the investor receives in the future. Since real estate is inherently a long-term asset, even the short-term investor has to be aware that his successor will take account of long-term prospects.[2]

As the future profitability of the company cannot be forecast with certainty, the resulting risks of the potential REIT investment need to be reflected as well. Hence, a rule is required that puts the required return in function of the risks that are relevant to the valuation of the company.[3] In this regard, a balanced consideration of both opportunities and risks should be maintained without being distorted by accounting or valuation regulations.
If the required return is derived from an alternative investment, comparability should be warranted. This comparability principally relates to the initial investment, the monetary value, the availability, the duration, the currency and the risk. Particularly, the systematic risk that has to be borne by the investor needs to be rewarded. In addition, the discount rate employed in the model should be expressed in nominal terms in order to be consistent with the calculation of the FCFs.[4]

Besides this, the solution method to derive a REIT value should be intelligible for a third person. This requirement entails that the assumptions made regarding the valuation of the REIT are outlined. Equally, a key date of the valuation has to be defined which serves as a reference point in order to ascertain the magnitude of cash flows assigned to the investors.

Likewise, the time and expertise needed as well as the cost incurred in the course of the application of the new valuation tool should not considerably exceed those occurring during the use of one of the existing REIT valuation methodologies intro-

[1] Adapted from REHKUGLER (2003b, p. 4).
[2] Adapted from OLFERT/REICHEL (2006, p. 246) and STEINER/BRUNS (2002, p. 240).
[3] Adapted from DRUKARCZYK (2003, p. 142) and OLFERT/REICHEL (2006), p. 26).
[4] COPELAND/KOLLER/MURRIN (2000), p. 201; KUP (2007), p. 158.

duced earlier. This requirement can be partly fulfilled through using data that can be collected from sources publicly accessible.[5] Particularly, the cash flow calculation should be based on the balance sheet and the profit and loss statement.

### 5.1.2 REIT-specific requirements

The preceding analyses of REITs have revealed numerous features that may show an impact on the valuation result. In addition, the critical assessment of existing REIT valuation approaches uncovers certain advantages as well as disadvantages associated with these methods. These findings serve as a basis to formulate requirements against the new REIT valuation tool.

In order to forecast cash flows from the REIT business activities, the valuation procedure should include a detailed examination of the value of the REIT operating performance. The value of REIT operating performance consists of present values of cash flows that are generated through the firms' business activities. Therefore, the REITs' potential for realising both internal and external growth should be considered within the model. Particular attention has to be paid to the influence of the real estate portfolio on the valuation result as it has been observed that the holding, management and operating of real estate assets typically represents a crucial business activity of REITs.[6]

In spite of that, complementary activities associated with real estate such as real estate trading, development or the provision of real estate services should be reflected to the extent that they have a notable impact on the valuation result.

The range of financing comprises all cash flows between the company and its debtholders. Given the previous examinations, REITs employ debt to a considerable extent. In this context, the major components associated with the use of leverage that potentially show a considerable impact on the valuation result should be included in the valuation model. To assess the impact of financing activities individually, a separation of the tool between operating and financing activities seems to be advan-

[5] Adapted from REHKUGLER (2006, p. 1) and STARKMAN (2005, p. 1).
[6] Adapted from OLFERT/REICHEL (2006, p. 26) and SEPPELFRICKE (2005, p. 11).

tageous. Especially, in the case of REITs being largely income tax-exempt, it should be identified, whether a REIT can add value through the use of debt although an insignificant impact from the tax shield effect is likely.[7]

Apart from that, the valuation tool should disregard the taxation at the shareholder level. This recommendation results from the observation that taxes at a shareholder level depend on the type of shareholder and are thus not reflected in the tool.

## 5.2 A taxonomy for an advanced REIT valuation tool

The new methodology to derive a value of a Real Estate Investment Trust can be classified according to a choice of criteria. Following the identification of the valuation object (5.2.1), the stakeholders of the REIT valuation tool are characterised as their objectives may affect the valuation task (5.2.2). Additionally, the motive and the purpose (5.2.3) and the methodology (5.2.4) associated with the tool are explained.

### 5.2.1 Identification of the valuation object

The valuation objects include stock exchange-listed Equity-Real Estate Investment Trusts introduced before. In contrast, Mortgage- and Hybrid-REITs are not considered in the following as these entities are carrying out business activities that differ notably from those pursued by Equity-REITs. In the context of the valuation tool suggested in this work, the REITs domiciled in one of the 27 countries exhibiting a REIT regime are identified as valuation objects. As the previous analysis reveals, some REITs hire external advisors or external managers or both. The value attached to the third parties may not be explicitly captured in the model. Additionally, the method presented in this work is applied to REITs without conscious limitations regarding their lifetime.

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[7] Adapted from SEPPELFRICKE (2005, p. 57).

### 5.2.2 Identification of the stakeholders

Taking the recent considerations into account, a potential buyer or a possible seller of REIT shares or the management of the REIT may represent the valuing entity. If a purchase or a sale of REIT shares is considered, the valuing entity should be primarily concerned about the future profitability of the company from a stock market perspective. Similarly, the REIT management might be interested in the results of the valuation as the outcomes potentially reveal the strengths and weaknesses associated with the firm. As the valuation of a REIT may represent a complex task, the valuing entity should become acquainted with the specific REIT entity. Alternatively, the valuing entity might ask third parties such as analysts to carry out the valuation task.

### 5.2.3 Motive and purpose

The determination of the motives of a new valuation tool probably constitutes a controversial issue. On the one hand, the applicability to several motives increases the flexibility attached to the valuation tool. On the other hand, an enhanced applicability potentially heightens the complexity of the tool.

With respect to the life cycle, the valuation tool considered in this work entails the analysis of historical information about the REIT. To accomplish the task of forecasting cash flows, the company should have operated for at least five consecutive years prior to the key valuation date. Although the existence of the REIT status over the same time does not represent a prerequisite, it should be considered that the firm under review followed business activities similar to those of a company exhibiting a REIT status. Besides this, the determination of a liquidation value attached to the REIT is not assumed. One reason relates to the assumption that the valuing entity employs the valuation approach as a decision-making tool regarding a potential long-term investment alternative. Another reason is based on the notion that the conceptual idea to forecast the long-term cash flow-generating ability of the REIT relies on a going-concern scenario.[8]

[8] Indeed, a going-concern scenario is typically assumed in the context of a stock valuation. [HÜFNER (2000), p. 68.]

The form of the valuation, as a second classification criterion introduced earlier, relates to the differentiation between statutory obligations, agreements under private law and other motives. Generally, the valuation task could be accomplished for any of the three classes of motives. However, a stock valuation, which belongs to the category called other motives, is deemed to be the most likely occasion with the following model. This attribution conforms with the main intention of potential investors representing valuing entities, who view the REIT stock as an investment possibility. Similarly, the tool can deliver a supportive valuation for the REIT management with statutory obligations such as mergers or acquisitions. Summarising studies regarding firm acquisitions, BOROWICZ (2006, p. 36) claims that the buying party does not retrieve a value enhancement whereas the transactions are rather valuable to the acquired entity. This finding raises caution especially when a firm seeks to acquire a REIT.
In addition, the decision-making situation as well as the transfer of ownership have been identified as further classes of motives. Rather, the applicability of the valuation tool is not restricted to specific motives belonging to any of these classes.

The previous classification of the motive pertaining to the valuation model confines the purpose associated with the valuation task. In this study, the concept of the market value relates to the value of a REIT on the capital markets. The concept is employed, as the REIT valuation tool should be applicable from the perspective of all capital market participants.[9]

### 5.2.4 Methodology

Having identified both the motive and the purpose of the valuation tool, the choice of an appropriate methodology to derive a REIT value is based on the course of action (5.2.4.1) and the form (5.2.4.2).

[9] MANDL/RABEL (1997), p. 18-21; MATSCHKE/BRÖSEL (2007), p. 25&32; HERING (2004), p. 109-111; SEPPELFRICKE (2005), p. 7.

#### 5.2.4.1 Course of action

With regard to the course of action, the valuation tool discussed in the following can be categorised as a comprehensive valuation method. Correspondingly, expected benefits should accrue from the use of a pooling of all company sources under consideration of positive or negative effects from the combination of the individual sources.[10] In this regard, the concept of comprehensive valuation methods conforms with the principle of future orientation and relies on a going-concern scenario.

#### 5.2.4.2 Form

The form of the valuation tool described in the following can be classified as a pay-off-oriented approach. This approach squares with the requirement regarding the new valuation tool to assess the potential future profitability of the REIT.
At the beginning, the value additivity principle (VAP), that becomes valid in the context of the valuation tool, is introduced (5.2.4.2.1). Subsequently, the approach associated with the application of the valuation tool is explained (5.2.4.2.2).

##### 5.2.4.2.1 Implications of the value additivity principle

The valuation approach described in the following section relies on the adjusted present value concept. In this regard, the APV concept is based on the VAP. Value additivity is given, if the valuation function *V(E)*, comprising cash flows with the vectors $E_1, E_2, \ldots, E_n$, shares the following structure:

$$V(E_1 + \ldots + E_n) = V(E_1) + \ldots + V(E_n) \qquad \textbf{(5.1)}$$

This structure assumes that the market value comprising the sum of the cash flows is equal to the sum of the market values attached to the individual cash flows. The result is not dependent on a possible correlation between the cash flows $E_1, E_2, \ldots, E_n$,

[10] Adapted from BALLWIESER (1993, p. 153).

which insinuates that the assumption of value additivity also holds when the spreading of risks results in risk diversification.[11]
Accepting the VAP, the value of the REIT $V_{REIT}$ equals the sum of the value components $VC_j$:

$$V_{REIT} = \sum_{j=1}^{n} VC_j \qquad \textbf{(5.2)}$$

The requirement that the calculation of the value components derived from the operating and investing activities is separated from the calculation of the value components of financing activities is fulfilled.[12] In accordance with the VAP, the cash flows associated with the operating and the investing activities are subject to a separate analysis when compared to the value of financing activities.
Both the impact of regular income from rents as well as the irregular income generated from property sales will be captured. This approach is motivated through the finding that gains and losses regarding the sale of real estate assets potentially affect the cash flows to equityholders.

#### 5.2.4.2.2 Approach

In the following, the approach associated with the REIT valuation tool is explained in more detail. Principally, the tool, which is relying on the APV concept, comprises the determination of an all-equity financed value at the beginning, the estimation of the value component of debt financing thereafter and the subtraction of negative from positive value components at the end.

In a first step, the market value of the REIT is determined based on the assumption of a company, being completely financed by equity.

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[11] The VAP assumes the existence of a planning period including payments at several points in time. Over all points in time there exist $S$ conditions. The cash flow in the condition $s$ can be written as $e_s$. The total uncertain cash flows represent the vector of payments at all conditions: $E = (e_1, e_2, \ldots, e_s, \ldots, e_S)$. [FRANKE/HAX (2004), p. 334.]
[12] The assumption that investment decisions increasing the market value of a company are independent from the financing decisions is called separation theorem. This theorem assumes complete capital markets. [MATSCHKE/BRÖSEL (2007), p. 27.]

The time period considered in the valuation approach is basically separated into an explicit and an implicit planning period. During the explicit planning period, cash flows are anticipated on the basis of a multifaceted analysis of the REIT. This period is likely to be less than fifteen years. The exact number of years recommended within this valuation framework is derived in the course of subsequent analyses.
The cash flows pertaining to the implicit planning period are not projected in detail but summarised in a terminal value which involves discounting a normalised cash flow that grows at a perpetual rate. Objectively, the underlying assumption of an infinite life of the REIT is conceptually wrong.[13] On the contrary, the exact lifetime of a company is unknown and difficult to forecast. However, as the influence of cash flows on the valuation result diminishes with an increase in the forecasting horizon, the impact of inaccurate results from the projection of the value of the implicit planning period is reduced.
The model presented in this work focuses on the assessment of real estate-related activities carried out by REITs. In contrast, operations that cannot be assigned to the real estate-specific business activities introduced before are largely neglected. Indeed, the recent analysis has shown that REITs typically do not consider business activities that are not associated with real estate assets.
In case a taxpaying company represents the valuation object, cash flows should be calculated on an after-tax basis.[14] However, if it is observed that REITs largely prevent the payment of taxes on a corporate level, cash flows are calculated on a before-tax basis in this work to reduce the complexity of the valuation tool.
Having forecast the cash flows, these are discounted to the present at a rate that reflects the return to equityholders excluding debt financing effects. The cost of capital used to discount the respective cash flows to the present constitutes a critical component in the valuation of a REIT. In this case, the valuation approach assumes a steady discount rate during the forecasting period. As a consequence, the investment risk is supposed to be constant.[15]
Both, the cash flow items and the components of the discount rate are expressed in nominal terms. Potential differences regarding the change in consumer price indices

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[13] See FRANKE/HAX (2004, p. 10).
[14] COPELAND/KOLLER/MURRIN (2000), p. 153.
[15] Adapted from DRUKARCZYK (2003, p. 200f).

are thus neglected. COPELAND/KOLLER/MURRIN (2000, p. 153) argue that apart from high inflation rate environments, the insights from projecting cash flows in real terms and discounting them at a real discount rate are confusing. However, if REITs have their headquarters in a country bearing a relatively high inflation rate, a calculation with real values might be necessary as otherwise the valuation result will be biased.[16]
The summation of the value components results in the market value of the unleveraged company.

A second step involves the calculation of the value impact attached to the debt financing. Based on the recent explanations that point to a tax reduction effect of debt financing, it is not apparent why REITs actually use leverage. Despite the assumption of a missing tax-shield effect with REITs, the recent analysis revealed that many REITs employ debt financing as well.
The separate investigation of value-relevant components of debt financing in the valuation tool described in the following should reveal the motivation of REITs to obtain leverage. In this regard, positive as well as negative components associated with the use of debt financing might be detected.

The total value of the REIT is calculated through adding the value of the unlevered company to the value of the impact of debt financing in a third step. Subtracting the value of debt from the total REIT value results in the equity value, which is divided by the sum of the number of shares and convertible partnership units.[17] Thus, an absolute value of the REIT is obtained that can be compared against the share price in order to detect possible under- or overvaluations.

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[16] PEEMÖLLER (2005c), p. 38f.
[17] Considering the recent argumentation in the context of the NAV per share, the number of shares as well as the convertible partnership units should be obtained on a diluted basis.

# 6 Statistical approaches for investigating potential determinants of REIT stock returns

One research sub-question asks for the factors that probably possess a high influence on the intrinsic value of a REIT. Although an examination of relationships between the intrinsic values of REITs and selected variables would be desirable, the availability of time series of intrinsic values is restricted. Given the expectation that the actual stock price and the value estimated through a REIT valuation tool should revert to equilibrium over the long-term, it seems helpful to study the determinants of REIT stock prices in more detail. As proposed in the following, REIT stock prices are converted into returns, to ensure comparability between variables.

Accordingly, the subsequent statistical approaches are used to investigate the determinants of REIT stock returns in more detail. The findings obtained from previous analyses of company-specific features regarding leverage ratios, business activities or real estate portfolio allocations will be integrated into the interpretation of outcomes. Particularly, the results of the following analyses should contribute to the development of the cash flow calculation scheme and the discount rate, both of which are needed to establish the valuation tool.

At the beginning, the time series utilised in the subsequent analyses are explained (6.1). As raw data are collected, these time series have to be converted into returns and probably need to be adjusted for certain statistical properties (6.2). Parts or all of the resulting data are employed within three main analyses. First, a factor analysis is performed in an effort to extract underlying variables of REITs (6.3). Second, an investigation of the main relationships between REIT stock returns and a broad range of explanatory variables is conducted by means of a multiple regression model (6.4). Third, the results of the previous analyses are complemented through the application of vector autoregressive models (6.5). These models help to identify the forecasting ability of a diversity of variables relevant to REIT returns.

## 6.1 Description of the dataset

Apart from REIT stock prices pertaining to the sample described above, an extensive range of variables has been compiled. If available, the collected time series represent raw data. On the one hand, KRÄMER (2000, p. 13-31) argues that the interpretation of prepared data is made more difficult if a third party has carried out the statistical editing. On the other hand, the use of different approaches for the statistical editing of data may reduce the comparability of time series.

The data employed in this study stem from databases maintained by national economic statistics institutions, companies, real estate organisations or global economic institutions. Data providers include Bloomberg, SNL Financial, the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development (OECD), the National Council of Real Estate Investment Fiduciaries (NCREIF), the National Association of Real Estate Investment Trusts, the European Public Real Estate Association, the Investment Property Databank (IPD), Eurostat, country-specific stock exchanges and country-specific statistics agencies.

Apart from stock prices on each of the 218 REITs included in the sample described previously, 27 variables were selected and are listed in Figure 6.1. The selection of variables was based on the findings of statistical examinations that investigated the determinants of REIT stock returns or general stock returns. Given that these studies rather focus on a single or a few time periods being typically confined to the analysis of REITs or stocks domiciled in a single country, the present study should contribute to the existing research through an extensive analysis across time periods and countries. In this sense, the selection of the variables involved the consideration of expectations regarding their connection with REITs.[1]

The 27 variables were collected for each of the eleven countries in which any of the sampled REITs is domiciled. According to Appendix 6.1, not all 27 variables are available for each of the eleven countries. Accordingly, some variables, such as the yield on long-term bonds issued by the government of Singapore or the money supply relating to Belgium, were approximated through comparable variables. All data were collected at both monthly and quarterly time intervals, as certain variables, such as the GDP, are only available at a quarterly frequency. Furthermore, all data were collected in their respective home currencies to exclude currency risk. If avail

[1] See Section 6.4.2 for explanations of expectations regarding the connection between the chosen variables and REITs.

able, total return indices were collected instead of price indices.[2]

***Figure 6.1: List of variables.***

| | |
|---|---|
| 1 | CPI |
| 2 | CPI excl. food and energy |
| 3 | Producer price index (PPI) |
| 4 | Long-term interest rate (10 years) |
| 5 | Short-term interest rate (3 months) |
| 6 | Term structure of interest rates |
| 7 | Level of total retail sales |
| 8 | Level of consumer climate |
| 9 | Level of the leading indicator |
| 10 | Level of GDP |
| 11 | Unemployment rate |
| 12 | Level of industrial production |
| 13 | Level of industrial production: construction |
| 14 | Level of money supply: M1 |
| 15 | Level of money supply: M3 |
| 16 | National stock index |
| 17 | Small cap stock index |
| 18 | Dividend yield corresponding to the national stock index |
| 19 | PER corresponding to the national stock index |
| 20 | Bond performance index |
| 21 | Level of total building permits |
| 22 | Level of total building starts |
| 23 | Appraisal-based real estate index: all properties |
| 24 | Appraisal-based real estate index: apartments |
| 25 | Appraisal-based real estate index: hotel |
| 26 | Appraisal-based real estate index: office |
| 27 | Appraisal-based real estate index: retail |

*Source: Own considerations while taking scientific research on general stock and REITs into account*

As an approximation for the short-term interest rate, interest rates on three-month government bonds were used. If no data on three-month government bonds were available, interbank rates were adopted, thus following the recommendation by PIKE/NEALE (2006, p. 250).

[2] While a price index indicates variations in the stock prices only, a performance index is adjusted for exogenous factors such as dividend payments or increases in share capital as well. [SCHREIER (2002), p. 191.]

The interest rates on ten-year government bonds in nominal values were utilised as a proxy for long-term interest rates.

To enhance comparability between time series, variables number 16 to 19 included in Figure 6.1 were obtained from the same data provider, namely MSCI. Similarly, the corporate bond performance indices were consistently obtained from Citigroup, subject to data availability.

Appraisal-based real estate indices, summarising the state of the real estate markets in the United States, are retrieved from NCREIF.[3] With regard to appraisal-based direct real estate investment indices comprising Australian and Japanese properties, the respective IPD indices were obtained with monthly data intervals.

## 6.2 Statistical editing of the dataset

Raw time series data were retrieved from the sources mentioned in the previous section. However, these data might be afflicted with certain statistical characteristics that result in a lack of comparability between time series and thus a biased interpretation of results.[4]

To ensure comparability between all data, the time series characteristics were identified and adjusted if appropriate. Accordingly, only those time series' characteristics will be adjusted that could otherwise lead to a biased interpretation of results. The decision for or against an adjustment of time series will be discussed in the following and backed by academic findings.

Specifically, the calculation of returns (6.2.1); the identification and, if necessary, the elimination of outliers (6.2.2); the investigation of normality, including a transformation if needed (6.2.3); the treatment of missing values (6.2.4); the examination of stationarity (6.2.5) and the detection of seasonality (6.2.6) of time series were considered. If necessary, data were adjusted by means of an autoregressive inte-

[3] The quarterly index begins in the year 1978 and includes 6,067 properties with a total market value of 233.15 billion USD (as of 03/31/10). The underlying assets are primarily owned by open-end funds, closed-end funds and separate accounts. [www.ncreif.org]

[4] For example, WINKER (2007, p. 33) argues that existing trends and seasonality effects can aggravate the identification of other changes in the time series.

grated moving average (ARIMA) model (6.2.7) which also replaces the use of appraisal-smoothing correction techniques (6.2.8).

### 6.2.1 Calculation of returns

Raw time series data are usually measured at varying scales, which potentially results in a lack of comparability. As a consequence, the comparability between the data under consideration will be improved through the calculation of returns. A further advantage of calculating return figures is seen in better compliance with the assumption of stationarity.[5] DORFLEITNER (2002, p. 216) argues that the choice of the return calculation methodology is of major importance. The author proposes to investigate the statistical and stochastic characteristics of a return measure as these may lead to inconsistent models.[6] Some empirical work documents no differences in outcomes when employing more than one methodology for calculating returns.[7] However, this finding does not imply that the results extracted from the following statistical approaches are uncoupled from the methodology of calculating returns. Instead, the choice of the approach to calculating returns will be based on the following findings.

Apart from discrete returns – also called simple returns[8] –, time series can be modelled through continuous returns $R_t^{con}$ – also called logarithmic returns. Continuous returns possess a range that also covers every interim value in the interval *[a;b]* with $a<b$. The continuous return of a security can be calculated using the following formula:

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[5] KREIß/NEUHAUS (2006), p. 295. Investigating event studies, HENDERSON (1990, p. 287) criticises that the methodology of calculating returns is barely described in empirical research albeit there may occur numerous issues when estimating returns.

[6] DORFLEITNER (2002), p. 216.

[7] COPELAND/MAYERS (1982, p. 293) employed a future benchmark technique with daily return data from more than 1,000 US stocks between 1965 and 1978 but did not find differences in the results between the use of non-logarithmic and logarithmic returns. BROWN/WARNER (1985, p. 10) investigated the properties of daily return data on 50 US stocks between 1962 and 1979. The authors detect negligibly small differences between continuously compounded returns and returns from a value-weighted market portfolio. Using t-tests on a sample of 465 daily stock returns between 1976 and 1980, THOMPSON (1988, p. 80) argues that the results when employing discrete returns are similar to those obtained with continuous returns.

[8] See, for example, WINKER (2007, p. 37) for further information regarding discrete returns.

$$R_t^{con} = LN(P_t + CF_t) - LN(P_{t-1}) = LN\left(\frac{P_t + CF_t}{P_{t-1}}\right) \qquad \textbf{(6.1)}^{9}$$

where

$LN =$ natural logarithm
$P_t =$ price index at the end of period $t$
$CF_t =$ regular cash flow generated during period $t$
$P_{t-1} =$ price index at the beginning of period $t$

DORFLEITNER (2002, p. 218) criticises numerous scientific publications' treatment of discrete and continuous returns as identical. Although both types of return calculations are approximately equal with values near zero, their difference is proportional to the absolute size of the results.[10]

Unlike discrete returns, continuous returns can be added up over large time intervals. Furthermore, the continuous compounding effect of logarithmic returns seems to be more applicable to stocks that are effectively traded every second. The probability density of continuous returns is rather symmetrical while alleviating the impact of high absolute values. Some researchers argue that continuous returns can be assumed to be normally distributed.[11] In this study, continuous returns are preferred over discrete returns due to the former's better compliance with the assumptions of many statistical approaches.[12]
Based on these considerations, the time series analysed in this study were converted into continuous returns. As demonstrated before, the use of continuously compounded data is recommended for stock exchange data. Time series that are not based on the pricing mechanism of a stock exchange will also be calculated as con-

[9] DORFLEITNER (2002), p. 237; FAHRMEIR et al. (2006), p. 269; HENDERSON (1990), p. 287; STEINER/BRUNS (2002), p. 49-51.
[10] DORFLEITNER (2002), p. 220. According to DORFLEITNER (2002, p. 220), the respective discrete return should lie in the interval *[-0.10; 0.10]* in order to receive a maximum deviation from the continuous return of five percent.
[11] See, for example, FAMA (1976, p. 17-20.) Normal distributions are bell-shaped symmetrical and unimodal. [KOHN (2005), p. 90-93.]
[12] JANDURA (2003), p. 41; JANDURA/REHKUGLER (2001), p. 131; MOSLER/SCHMID (2006), p. 123; PODDIG/DICHTL/PETERSMEIER (2003), p. 105; RICHTER (2005), p. 187; STEINER/BRUNS (2002), p. 49-51; WINKER (2007), p. 37; ZIMMERMANN (1997), p. 54.

tinuous returns to ensure comparability. This approach is consistent with the claim by PODDIG/DICHTL/PETERSMEIER (2006, p. 104) for uniformity in terms of using a methodology of calculating returns. After the calculation of monthly returns, the data can be added up to yield the corresponding quarterly and annual returns.

An examination of the dataset reveals that some time series, such as individual REIT stock returns, show extreme values over certain periods. This observation points to the existence of outliers, which are discussed in Section 6.2.2. The presence of high absolute values indicates a higher probability of differences between continuous and discrete returns. Nevertheless, the impact of high values on the final results of the study can be reduced if they are classified as outliers and thus eliminated. A specific problem is associated with the calculation of variables that may experience a change of sign. For example, the spread of long-term interest rates over short-term interest rates may have a negative value with one data point $P_t$, implying that the short-term interest rate exceeds the long-term interest rate at that time. If the term structure variable exhibits a positive adjacent data point $P_{t-1}$, i.e., the respective long-term interest rate exceeds the short-term interest rate in $t-1$, the ratio $P_t/P_{t-1}$ of the term structure becomes negative. The negative ratio leads to a missing value as the natural logarithm cannot be calculated from negative values. The issue of missing values is discussed in Section 6.2.4.[13]

### 6.2.2 Outliers

The preceding explanations raise the issue of a potential presence of outliers in the data, especially for REIT returns. Outliers represent "[…] aberrant observations that are away from the rest of the data." [MADDALA/KIM (1999), p. 425.] Such observations are likely to occur with financial time series. Several studies indicate that outliers can lead to biased results when using statistical approaches: outliers may negatively affect parameter estimation, lead to model misspecification, distort auto-

[13] Although discrete returns could be calculated in case there is a change of sign in the time series data, this violates the assumption of using one approach of return calculation.

correlation estimates in stationary time series, or result in size distortions in unit root tests.[14]

To cope with these issues, three approaches for handling outliers can be distinguished.

First, outliers can be retained in the analysis if statistical approaches robust to the existence of aberrant observations are employed. However, the statistical analyses applied in this work do not necessarily show robustness against outliers.[15] Second, the specifications of the analysis can be altered. Nevertheless, a change in the specifications could potentially limit the scope and ultimately the explanatory power of the examinations. Third, outliers can be excluded from the analysis. To maintain as many time series as possible while increasing the representativeness of the sample, single values that are classified as outliers are excluded from the data. Given that the previous calculation of returns already indicated the presence of outliers, the exclusion of aberrant observations is performed in the present study due to two reasons: First, many different statistical approaches are carried out in the following with scientific evidence[16] indicating that some methods can deliver biased results when time series contain outliers. Second, a major requirement, which has been formulated concerning a new REIT valuation tool refers to the determination of the REIT value as a function of the contingent long-term profitability. As the results of the subsequent analyses should contribute to the development of a REIT valuation tool, a focus on long-term relationships including the predictive ability of variables concerning REIT returns is pursued. In this regard, the inclusion of irregular events occurring on a single day that are not or almost not predictable, such as the September 11, 2001 terrorist attacks, is supposed to deliver no significant information for the purpose of the following analyses. Accordingly, the data were tested for the presence of outliers in a first step, with aberrant observations being eliminated in a second step.[17]

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[14] CHERNICK/DOWNING/PIKE (1982), p. 745; MADDALA/KIM (1999), p. 425-428; TSAY (1988), p. 1-20.

[15] For example, the test of normality and the ARIMA model proposed in the following are supposed to deliver biased results when time series are beset with outliers.

[16] For example, FREUND/WILSON/SA (2006, p. 108) argue that outliers in time series can lead to serious bias in regression model estimates. [See CHERNICK/DOWNING/PIKE (1982, p. 745), MADDALA/KIM (1999, p. 425-428) and TSAY (1988, p. 1-20) for further information.]

[17] DONALD/MADDALA (1993), p. 680.

Although a variety of graphical approaches exist[18], these typically do not lead to an unambiguous identification of outliers. Hence, the detection of outliers was based on a numerical approach.

Past research has proposed a variety of tests to detect outliers. Subsequent to the introduction of tests to identify single[19] or multiple outliers,[20] procedures for the determination of several types of outliers have been developed.

FOX (1972, p. 350) recommends testing time series for both additive[21] and innovative[22] outliers. This approach was extended by an iterative procedure proposed by CHANG/TIAO (1983), CHANG/TIAO/CHEN (1988) and TSAY (1988) to detect several types of outliers through an ARIMA model. Additional forms of outliers suggested in the literature are permanent level changes[23], transient level changes[24] and variance changes[25].

These models were modified in the sense that some of the shortcomings were avoided through a procedure presented by CHEN/LIU (1993). The approach based on CHEN/LIU (1993) was chosen for multiple reasons: both the time point and the size of the outlying observation are identified, potentially with a reduced hazard of

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[18] For example, the Boxplot, first introduced by TUKEY (1977), provides a well-known device for the visual inspection of outliers. [See HARTUNG/ELPELT (2007, p. 597-601) for an introduction.]

[19] The test suggested by DIXON (1950) constitutes a single-dimensional method to detect outliers. However, it is criticised that tests that are able to detect single outliers show a lack of reliability when multiple outliers are existent. This is also called masking effect and can occur if a single outlier might not be detected as one or more other outliers cause an inflated variance. [BENDRE/KALE (1987), p. 891; PRESCOTT (1978), p. 15; THODE (2002), p. 126; TIETJEN/MOORE (1972), p. 594.]

[20] The two-tailed test introduced by ROSNER (1975, 1983) can be used for the detection of multiple outliers.

[21] An additive outlier is a single observation, which has an impact on the time series but does not affect subsequent observations. Some authors suggest that excess kurtosis observed with financial time series could be caused by additive outliers. An additive outlier can be a result of extreme stock market returns or natural disasters for example. [FOX (1972), p. 350; MADDALA/KIM (1999), p. 428.]

[22] An innovative outlier is present in a single observation, which has an impact on the time series and affects subsequent observations as well. This type of outlier is usually caused by an external factor. [FOX (1972), p. 350; MADDALA/KIM (1999), p. 428.]

[23] A permanent level change – also called level shift – implies that an event has affected a time series at a time point but results in a permanent effect. Level shifts show a changing mean that may result in a structural change. [LO/CHAN (2000), p. 272; MADDALA/KIM (1999), p. 428.]

[24] A transient level change, or temporary change, is represented by an event at a certain point in time that has an impact on subsequent values but decreases exponentially by a deflating parameter. [LO/CHAN (2000), p. 272.] According to LIU/HUDAK (1994, p. 76), this parameter often has a value between 0.6 and 0.8.

[25] Variance changes represent another type of structural change induced by an altering variance of innovations. [MADDALA/KIM (1999), p. 428.]

data mining. Furthermore, there is consistency with the ex ante conception of shifting and segmenting trends. The disadvantages of the model are a potential sensitivity of the results towards the original specification of the ARIMA model. In contrast, a misspecification of the ARIMA model employed in the following can result from the existence of outliers or level shifts. Furthermore, the model may also entail masking effects. Time series considered in this study were analysed for the existence of additive outliers (AO), permanent level changes (PLC) and transient level changes (TLC).[26]

With regard to the time series obtained on both a quarterly and monthly basis (Figure 6.2), a relatively large number of additive outliers and partly transient level changes were identified with both monthly and quarterly data regarding the time period beginning in the year 2000 and ending in the year 2009. Investigating the underlying time series in more detail, the bulk of outliers, irrespective of type, were identified in the fourth quarter of 2008 and the first quarter of 2009 or, if monthly data are examined, between October 2008 and April 2009. A bottoming of stock prices together with high volatility was observed for several REITs during the years 2008 and 2009. During this period, REITs experienced a change from strong declines to strong increases in prices.

In addition, additive outliers, which are supposed to occur as single observations, were observed for REITs focusing on lodging and resort properties in the third quarter of 2001 as a consequence of the September 11, 2001, terrorist attacks in New York.

Outliers identified on the basis of the tests discussed here were removed from the sample. Subsequent to the exclusion of aberrant observations, the distribution properties of the time series were analysed.

[26] ABRAHAM/BOX (1979), p. 232-236; BALKE (1993), p. 81; BALKE/FOMBY (1991), p. 72f; CHEN/LIU (1993), p. 284; SÁNCHEZ/PEÑA (1997), p. 2. Particularly, the procedure suggested by CHEN/LIU (1993) addresses the problem of a biased parameter estimation of models including outliers, which can ultimately affect the efficiency of outlier detection. THURY/WÜGER (1992, p. 91) find that the procedure suggested by CHEN/LIU (1993) provides a favourable method for detecting and removing outliers. The hazard of data mining is reduced due to the mechanical way of detecting outliers. The consistency with the conception of shifting and segmenting trends is achieved through the endogenous identification of shifts. [BALKE/FOMBY (1991), p. 72.]

***Figure 6.2: Summary of the results of the outlier detection.***

| | Time horizon and time interval | Number of observations per time series | Number of sampled firms | Additive outliers (AO) | | Permanent level changes (PLC) | | Transient level changes (TC) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Number | % of total observations | Number | % of total observations | Number | % of total observations |
| Monthly | 1985-2009 | 300 | 15 | 57 | 1.27% | 0 | 0.00% | 22 | 0.49% |
| | 1990-2009 | 240 | 37 | 122 | 1.37% | 3 | 0.03% | 46 | 0.52% |
| | 1995-2009 | 180 | 89 | 312 | 1.95% | 10 | 0.06% | 111 | 0.69% |
| | **2000-2009** | 120 | 142 | **408** | **2.39%** | 19 | 0.11% | **154** | **0.90%** |
| | 1985-1989 | 60 | 15 | 15 | 1.67% | 0 | 0.00% | 1 | 0.11% |
| | 1990-1994 | 60 | 37 | 16 | 0.72% | 3 | 0.14% | 3 | 0.14% |
| | 1995-1999 | 60 | 89 | 48 | 0.90% | 2 | 0.04% | 8 | 0.15% |
| | 2000-2004 | 60 | 142 | 97 | 1.14% | 2 | 0.02% | 10 | 0.12% |
| | **2005-2009** | 60 | 219 | 247 | 1.88% | **31** | **0.24%** | 106 | 0.81% |
| | | | | | | | | | |
| Quarterly | 1985-2009 | 100 | 15 | 30 | 2.00% | 0 | 0.00% | 16 | 1.07% |
| | 1990-2009 | 80 | 37 | 72 | 2.43% | 1 | 0.03% | 30 | 1.01% |
| | 1995-2009 | 60 | 89 | 132 | 2.47% | 11 | 0.21% | 63 | 1.18% |
| | **2000-2009** | 40 | 142 | **145** | **2.55%** | **23** | **0.40%** | **67** | **1.18%** |

*Source: Own calculations based on the total sample (218 REITs)*

### 6.2.3 Distribution properties

As explained previously, logarithmic returns can potentially be assumed to be normally distributed. Several researchers have called this assumption into question.[27] Nevertheless, the normal distribution of data often represents a central assumption of statistical approaches. In contrast, the use of non-normally distributed data may lead to biased results.[28]

Accordingly, the distribution characteristics of the time series were investigated at the beginning of the analysis (6.2.3.1). The findings from this analysis were used to identify appropriate tests of normality (6.2.3.2). To convert time series exhibiting a non-normal into a normal distribution, the use of data transformation techniques was considered thereafter (6.2.3.3). Finally, the results of the detection and, if necessary, the outcomes concerning the transformation of data are presented (6.2.3.4).

#### 6.2.3.1 Assumptions and findings regarding the distribution of variables

Empirical evidence indicates that the validity of the assumption of normality cannot be ascertained. For this purpose, the time series employed in this study were reviewed in terms of the slopes of their distributions. PRAETZ (1972, p. 50) argues that the assumption of a normal distribution has been discarded by most of the empirical studies investigating daily or weekly stock returns.[29] This rejection is mainly based on the following distributional characteristics often observed with stock returns: first, the distribution shows heavy tails, i.e., a higher probability density at the borders. Second, the distribution of stock returns possesses a high peak; i.e., higher returns around the mean.[30] In contrast, CONT (2001, p. 224) argues that stock re-

[27] See, for example, DORFLEITNER (2002, p. 232) or RUNDE/SCHEFFNER (1998, p. 2-6).

[28] KING/YOUNG (1994), p. 9.

[29] See, for example, FAMA (1965). As a consequence, researchers have suggested other types of distribution that characterise equity returns. Recommended distributions are stable Paretian [see LÉVY (1925) and, for an examination, FAMA (1965) and OFFICER (1972)], Box-Tiao, also called power exponential [see BOX/TIAO (1973) and, for an investigation, PEIRÓ (1994)], logistic [see SMITH (1981) and for further investigation APARICIO/ESTRADA (2001) and PEIRÓ (1994)], the student-t [see BLATTBERG/GONEDES (1974) as well as PRAETZ (1972) and, for further investigation, APARICIO/ ESTRADA (2001), KIM/KON (1994) and PEIRÓ (1994)], a Poisson mixture of normals [see PRESS (1967) and, for an evaluation, AKGIRAY/BOOTH (1987) and KIM/KON (1994)] and a discrete mixture of normals [see KON (1984)].

[30] APARICIO/ESTRADA (2001), p. 15; CONT (2001), p. 224; KIM/KON (1994), p. 563; OFFICER (1972), p. 807. Heavy tails together with high peaks are summarised as the phenomenon of leptokurtosis.

turns show an aggregational Gaussianity; i.e., a distribution of stock returns better approximates a normal distribution when returns are calculated over a longer time scale. Several researchers who find that continuous returns of monthly or longer time intervals better approximate a normal distribution when compared to daily or weekly returns conform with this assumption. As data possessing monthly, quarterly and annual intervals are employed in this study, the threat of rejecting the assumption of normally distributed time series is narrowed.[31]

In the context of listed real estate securities, the assumption of a normal distribution of returns is also called into question.[32] Some researchers argue that listed real estate stocks exhibit leptokurtosis,[33] although a normal distribution of data might be assumed for longer time intervals such as quarterly data.[34] LIZIERI/WARD (2000, p. 17) provide evidence for the logistic distribution being appropriate for modelling real estate securities returns.[35]

Empirical research on appraisal-based direct real estate investment indices has argued that the shape of their distribution resembles normality.[36] Concerning monthly, quarterly and annual time series, several researchers find a leptokurtic shape of the return distribution. Furthermore, no fundamental differences in the shapes of distributions were observed when analysing returns of different property types.[37] Investigating appraisal-based direct real estate investment returns together with stocks and corporate and government bonds, MYER/WEBB (1994, p. 269f) find that real estate

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The possibility of the occurrence of extreme values is expressed by means of the so-called kurtosis. Random variables showing a normal distribution have a kurtosis of three, while distributions with a kurtosis higher than three are labelled leptokurtic distributions. In this case, there is a higher probability of extreme values in comparison to a normal distribution. Additional stylised facts of stock returns are a skewed probability distribution and volatility clustering. [CHÓN/VÉLIZ (2008), p. 93; CONT (2001), p. 224; KIM/KON (1994), p. 563; SPREMANN (2006), p. 143.]

[31] AKGIRAY/BOOTH (1987), p. 279; APARICIO/ESTRADA (2001), p. 16; BLATTBERG/GONEDES (1974), p. 249.

[32] See, for example, LIZIERI/SATCHELL/ZHANG (2007) and MYER/WEBB (1993).

[33] BELOW/STANSELL (2003), p. 84; LI/YUNG (2007), p. 357.

[34] MYER/WEBB (1993), p. 88-94.

[35] However, instead of using a REIT index, the authors consider a sub-index of the FTSE All Share Index comprising construction and property companies.

[36] See, for example, BYRNE/LEE (1997), GRAFF/HARRINGTON/YOUNG (1997), MAITLAND-SMITH/BROOKS (1999), or YOUNG/GRAFF (1995).

[37] KING/YOUNG (1994), p. 7-12; MYER/WEBB (1993), p. 91-94; YOUNG/GRAFF (1995), p. 237-252.

returns exhibit the highest kurtosis.[38] Researchers suggest the use of a stable Paretian[39] or a logistic[40] distribution instead of a normal distribution.

The distributional characteristics regarding the remaining explanatory variables employed in this study have been subject to a limited amount of research.[41] A study by BAI/NG (2005) documents that the returns of a variety of macroeconomic variables approximate a normal distribution.[42] Accordingly, it is assumed that the bulk of the remaining variables resemble a normal distribution.

#### 6.2.3.2 Selection of normality tests

The distribution characteristics of returns can affect the choice of an appropriate test for normality. Accordingly, particular attention is paid to the selection of normality tests. The normality tests employed in this study are of both graphical and numerical forms.

First, a histogram[43] was used to visualise the distribution.

Subsequently, numerical tests were employed to serve as a verification or as grounds for the modification of the findings obtained on the basis of the graphical inspection

[38] The authors consider a sample of quarterly real estate returns based on the NCREIF index over a time period between 1977 and 1992. The non-normality is also observed when autocorrelation is removed. [LIZIERI/WARD (2000), p. 20; MYER/WEBB (1991), p. 11.]
[39] MYER/WEBB (1991), p. 12; YOUNG/GRAFF (1995), p. 254.
[40] LIZIERI/WARD (2000), p. 17-19.
[41] In comparison to stock returns, some authors claim that dividend payments exhibit a higher kurtosis. This issue could be exacerbated if the company management smoothes dividend payments. [MARSH/MERTON (1987), p. 34; WU/WANG (2000), p. 107.] The assumption of a lognormal distribution of firm size is made by several researchers, [IJIRI/SIMON (1964) or MANSFIELD (1962)] but was subsequently called into question suggesting that the distribution is rather right skewed. [CABRAL/MATA (2003), p. 1075.]
[42] The authors investigated 21 variables related to the United States, i.e., the Canada-US exchange rate, the Germany-US exchange rate, the Japan-US exchange rate, the unemployment rate, the industrial production, the inflation of the GDP, the GDP, the change in the CPI, the 30-day interest rate, the money supply M2, the consumption of durables, the consumption of non-durables, the employment, the investment, the manufacturing employment, the non-manufacturing employment, the final sales, the non-residential investment, the residential investment and daily value- and equally-weighted stock return indices. Their findings indicate that only the two stock return indices exhibit kurtosis and that the Japan-US exchange rate, the change in the CPI and both stock indices were the only time series that did not fulfil the normality assumption.
[43] The histogram illustrates distribution characteristics such as the centre, the range and skewness of data, the presence of outliers or of multiple modes. [FAHRMEIR et al. (2006), p. 40-49; HENDERSON (2006), p. 114; ÖZTUNA/ELHAN/TÜCCAR (2006), p. 172.]

of the distribution. Numerous relevant normality tests have been developed in the statistical literature.[44] The bulk of tests can be classified as moment tests[45], correlation and regression tests,[46] empirical distribution function (EDF) tests[47] and most powerful location and scale invariant tests[48].[49]

FARRELL/ROGERS-STEWART (2006, p. 815) argue that no omnibus tool exists for testing normality. Findings of empirical research indicate that the power of the bulk of tests is high, with large data samples making differences between test results rather negligible.[50] However, as several REIT regimes lack long-term historical time series, the explanatory power of the tests might be affected. Therefore, the academic research on normality tests is considered in the selection of an appropriate test.

The numerical tests for normality employed in this study have been suggested by JARQUE/BERA (1980, 1987) and LILLIEFORS (1967).

The tool developed by JARQUE/BERA (1980, 1987) has been recommended as a powerful moment test. YAZICI/YOLACAN (2007, p. 183) suggest the use of the JARQUE/BERA (1980, 1987) test for non-symmetric distributions or if the shape of the distribution is unknown.[51] This test is supposed to be notably powerful with distributions showing long tails,[52] which are observed with some of the data em-

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[44] ÖZTUNA/ELHAN/TÜCCAR (2006), p. 172.

[45] Moment tests assess potential deviations from a normal distribution through the coefficients of kurtosis and skewness. [DUFOUR et al. (1998), p. 158; see, for example, D'AGOSTINO/STEPHENS (1986, p. 279-330) for further information.]

[46] Correlation and regression tests rely on a variable $y \sim N(\mu, \sigma^2)$ that can be naturally associated to probability plots and can be expressed as $y=\mu+\sigma x$ with $x \sim N(0,1)$. Correlation tests investigate the strength of the relationship whereas regression tests examine the slope of the line through comparing the order statistics of a sample with their expected values when a normal distribution is present. [SEIER (2002), p. 3; for more information, see D'AGOSTINO/STEPHENS (1986, p. 195-234).]

[47] A specific measure of discrepancy between the hypothesised and the empirical distribution is employed in an empirical distribution function. [DUFOUR et al. (1998), p. 157; for more information, see D'AGOSTINO/STEPHENS (1986), p. 97-194.]

[48] The test-statistics of this class of tests are not affected by changes in the location or scale of the observations. The tests are based on the joint probabilities of the null and of alternative distributions. [THODE (2002), p. 7f.]

[49] DUFOUR et al. (1998), p. 157; FARRELL/ROGERS-STEWART (2006), p. 805.

[50] See, for example, COIN/CORRADETTI (2006, p. 179).

[51] YAZICI/YOLACAN (2007) investigated normality tests suggested by AJNE (1968), ANDERSON/DARLING (1952), D'AGOSTINO (1972), KOLMOGOROV/SMIRNOV [see MASSEY (1951)], KUIPER (1960), PEARSON CHI-SQUARE [see PLACKETT (1983)], SHAPIRO-WILK (1965), VASICEK (1975) as well as modifications pertaining to some of these tests.

[52] Comparing the tests of CRAMER-von MISES [see ANDERSON (1963)], JARQUE/BERA (1980, 1987), KUIPER (1960) and SHAPIRO/WILK (1965), THADEWALD/BÜNING (2007, p. 104) suggest

ployed in the study.[53] Although the test results would be biased when outliers exist, the tool is used after adjusting the data for outliers. Additionally, it should be considered that the test is particularly powerful for normal and standard normal distributions of small samples of fewer than 30 observations.[54]
The LILLIEFORS (1967) test is preferred over the KOLMOGOROV/SMIRNOV [see MASSEY (1951)] test, as the mean and the variance of the distribution are specified ex ante. This test is recommended as one of the most representative EDF tests. The evidence shows that the test seems to be less powerful for small sample sizes below 35, with the results probably being distorted for symmetric distributions with short tails.[55] In this study, no samples with less than 40 observations are used to test normality.

Both tests were applied to the time series of REITs and macroeconomic time series described previously.

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that the JARQUE/BERA (1980, 1987) test works well and is often even the most appropriate when distributions are symmetric, show medium or long tails or are slightly skewed possessing long tails. However, THADEWALD/BÜNING (2007, p. 87) find a reduced power of the JARQUE/BERA (1980, 1987) test when the distribution shows short tails especially with a bimodal shape. Testing skewness, kurtosis and the normality of time series data, BAI/NG (2005, p. 58) find that the JARQUE/BERA (1980, 1987) test is useful as a normality test to the extent that the limiting variance accounts for a serial correlation in the time series.

[53] Concerning the JARQUE/BERA (1980, 1987) test, a critical value of 4.61 has to be exceeded to certify a normal distribution of the data at a 90% level of significance. [BANKHOFER/VOGEL (2008), p. 138.]

[54] ÖZTUNA/ELHAN/TÜCCAR (2006), p. 174. Investigating the tests suggested by D'AGOSTINO/ BELANGER/D'AGOSTINO Jr. (1990), JARQUE/BERA (1980, 1987), LILLIEFORS (1967) and SHAPIRO/WILK (1965), ÖZTUNA/ELHAN/TÜCCAR (2006, p. 175) argue that the reliability of the JARQUE/BERA (1980, 1987) test rises with the number of observations, whereas this test can be biased if outliers are existent.

[55] With regard to the LILLIEFORS (1967) test, a probability of error below 0.05 leads to the conclusion that the distribution of the time series under considerations shows significant deviations from normal distribution. [BÜHL (2008), p. 240.] As the KOLMOGOROV/SMIRNOV test [see MASSEY (1951)] can be applied to test several forms of distribution, ÖZTUNA/ELHAN/TÜCCAR (2006, p. 175) argue that this test might be less powerful than tests, which are specifically designed for testing a normal distribution.

### 6.2.3.3 Data transformation techniques

The application of statistical approaches to time series that are not normally distributed can lead to biased results.[56] When the tests just described indicate that a certain time series shows a non-normal distribution, any of the following methods to accommodate this issue may be chosen.

First, the statistical analyses can be conducted while ignoring the violation of the normality assumption. However, this approach is not followed in this study as it may lead to biased results. Second, statistical approaches that take into account the actual shape of the distribution can be employed. However, a variety of statistical approaches are applied to the data sample considered in this work. As will be documented in the following, some of these approaches are not able to take into account the actual shape of the distribution. Third, statistical analyses can be chosen that show robust results even when the assumption of normality is not satisfied. Nevertheless, the statistical approaches discussed in the following do not necessarily show robustness to a violation of the normality assumption. Fourth, a data transformation technique could be applied to the time series to satisfy the assumption of normality while adequately describing the original data. In this context, data transformation techniques have been proposed by a vast amount of academic research. The main argument for data transformation is the associated substantial increase in the power of statistical tests. The application of a data transformation technique was feasible in the present study, and its use will be described in the following.[57]

The transformation of a variable leads to a distribution of data that better approximates a normal distribution. Depending on the data distribution, several methods of data transformation exist. In this context, it has to be taken into account that the election of an appropriate transformation method can entail difficulties, especially

[56] Indeed, using a Monte Carlo simulation, RASMUSSEN/DUNLAP (1991) show when data transformation is used for data with distributions that are markedly different from a normal distribution, parametric (F-ratio) and non-parametric (Kruskal-Wallis H) statistical tests are more powerful than applying parametric tests to raw data.

[57] GRAYBILL (1976), p. 213; SAKIA (1992), p. 169. LEVINE/DUNLAP (1982) and RASMUSSEN/ UNLAP (1991) confirm this assumption, although some authors [GAMES (1983); GAMES/LUCAS (1966)] have questioned this benefit of transformations, especially when investigating the F-ratio.

with a small number of observations.[58]

### 6.2.3.4 Results

In this study, both numerical and graphical tests of a normal distribution were used. The results of testing for a normal distribution and transforming data if necessary are summarised in Figure 6.3.[59]

Overall, the results of testing for a normal distribution show an aggregational Gaussianity, i.e., data collected at longer time intervals better approximate a normal distribution. With regard to numerical approaches, the hypothesis of normally distributed data was rejected for 31.21% of all monthly time series and 16.25% of all quarterly time series. Referring to the data transformation technique, most frequently, the Johnson family of distributions was fitted to non-normal time series, with data transformed into a normal distribution thereafter.[60] Similarly, the visualisation of the data by means of the histogram showed negatively skewed distributions occurring more frequently than positively skewed distributions. Skewness was also detected in the course of fitting distributions to the data. Although trading strategies with REIT stocks exhibiting skewness in the past could be executed, research has called the predictability of skewness into question.[61]

The analysis of the general stock market returns points to a relatively low share of data that are not normally distributed.

The distribution of REIT returns resembles that of general stock returns but deviates from the distribution of appraisal-based direct real estate investment returns. This finding raises the issue that REIT returns potentially move more closely with stock returns in comparison to real estate returns.

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[58] See GAMES (1983) for further information. According to HARTUNG/ELPELT/KLÖSENER (2005, p. 349-354) commonly applied transformation methods are the reciprocal transformation, the root transformation, the logarithmic transformation the arcus-sinus transformation, the Fisher Z-transformation and the BOX/COX (1964) transformation.

[59] The data have been fitted to a distribution by means of a statistical software called Distribution Analyzer.

[60] See THOMPSON/TAPIA (1990, p. 30-33) for further information.

[61] See SINGLETON/WINGENDER (1986, p. 335) or VARGA (1998, p. 141) for example.

***Figure 6.3: Summary of the results of the normal distribution tests and data transformation techniques.***

| Time horizon and time interval | | Number of sampled firms | Number of sampled firms exhibiting a normal distribution | Data transformation | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Pearson family | Johnson family | Loglogistic | Smallest extreme value | Largest extreme value | Lognormal |
| Monthly | 1985-2009 | 15 | 3 | 11 | 1 | 0 | 0 | 0 | 0 |
| | 1990-2009 | 37 | 16 | 16 | 5 | 0 | 0 | 0 | 0 |
| | 1995-2009 | 89 | 49 | 22 | 16 | 2 | 0 | 0 | 0 |
| | 2000-2009 | 142 | 81 | 17 | 42 | 2 | 0 | 0 | 0 |
| | 1985-1989 | 15 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1990-1994 | 37 | 28 | 1 | 6 | 1 | 0 | 1 | 0 |
| | 1995-1999 | 89 | 82 | 1 | 6 | 0 | 0 | 0 | 0 |
| | 2000-2004 | 142 | 123 | 3 | 15 | 1 | 0 | 0 | 0 |
| | 2005-2009 | 219 | 143 | 8 | 63 | 1 | 1 | 1 | 2 |
| | **Total number** | **785** | **540** | **79** | **154** | **7** | **1** | **2** | **2** |
| | **Share of sampled firms** | **100%** | **68.79%** | **10.06%** | **19.62%** | **0.89%** | **0.13%** | **0.25%** | **0.25%** |
| | | | | | | | | | |
| Quarterly | 1985-2009 | 15 | 9 | 2 | 3 | 1 | 0 | 0 | 0 |
| | 1990-2009 | 37 | 34 | 1 | 2 | 0 | 0 | 0 | 0 |
| | 1995-2009 | 89 | 75 | 0 | 13 | 1 | 0 | 0 | 0 |
| | 2000-2009 | 142 | 119 | 1 | 21 | 0 | 1 | 0 | 0 |
| | **Total number** | **283** | **237** | **4** | **39** | **2** | **1** | **0** | **0** |
| | **Share of sampled firms** | **100%** | **83.75%** | **1.41%** | **13.78%** | **0.71%** | **0.35%** | **0.00%** | **0.00%** |

*Source: Own calculations based on the total sample (218 REITs)*

The application of both graphical and numerical approaches revealed that the bulk of appraisal-based time series used in this study are not normally distributed. Instead, the data more closely resemble a Johnson, Pearson or smallest extreme value distribution. Consequently, appraisal-based time series may show a non-normal distribution and thus should be tested for normality before using them with statistical approaches assuming normally distributed data. However, it should be noted that time series of only a few appraisal-based direct real estate investment indices relating to Australia, Japan and the United States have been obtained in this work.

In addition, the previous assumption, i.e., that macroeconomic variables typically resemble a normal distribution, was largely confirmed with both the numerical and the graphical approaches to testing data for a normal distribution. Considering these results, no transformation of the time series of macroeconomic variables into normally distributed data has been accomplished in most of the cases.

### 6.2.4 Missing value analysis

A vast amount of research documents that missing observations in data can lead to difficulties in statistical analysis.[62] BARNARD/MENG (1999, p. 17) channel relevant findings into three categories: first and most importantly, systematic differences between missing and existing data can result in biased statistical estimation. Second, unobserved values may involve irregularities in data patterns, increasing the complexity of statistical analysis. Third, missing data can result in a loss of efficiency, information or power.

The issue of missing data can be observed with time series as well. In this study, missing values[63] primarily occur when outliers are eliminated, data were not recorded, shifts in variables such as the term structure led to results outside the range of continuous returns or data were adjusted through an ARIMA model, leading to a

[62] See, for example, DEMPTSTER/LAIRD/RUBIN (1977), HEITJAN/RUBIN (1991) or RUBIN (1976, 1987).

[63] Missing values relate to the concept of coarsened data. The latter include numbers being grouped, rounded, censored, aggregated or truncated, which results in a partial loss of information. [HEITJAN/RUBIN (1991), p. 2244; SCHAFER/GRAHAM (2002), p. 148.]

shift in time series.[64]

Missing values will be considered in the following two sections. First, the type of missing data is investigated through the analysis of the missing data mechanism (6.2.4.1). Second, the method for handling missing data is considered (6.2.4.2).

#### 6.2.4.1 Assumptions about the missing data mechanism

The statistical analysis of missing data depends on the assumption about the missing data mechanism. Consequently, the formation of assumptions concerning this mechanism should precede the missing data analysis. Summarising a broad range of literature on missing data, three mechanisms can be distinguished:[65]

First, missing completely at random (MCAR) data imply that the occurrence of a missing value is independent of all observed and unobserved values in the respective model. Second, data classified as missing at random (MAR) allow the probability of missingness to depend on observed data in the model, but not on missing values of the variable under consideration. Third, with missing not at random (MNAR) data the missingness represents a function of the missing data. This can occur with time series when the missing data are associated with the numerical values.[66]

Time series including single missing observations due to erratic data collection do not indicate a dependency on either observed or unobserved data. Accordingly, missing values should be characterised by an MCAR mechanism.

A change of sign for a variable implies that the calculated returns do not conform to the permissible values of continuous returns, which are confined to minus one at the

[64] In cases where the spread of long-term over short-term interest rates becomes negative, the term structure experiences a change in sign. Accordingly, when continuous returns are calculated, a change in sign concerning the term structure could result in a missing value.

[65] LITTLE/SMITH (1987), p. 65; VELICER/COLBY (2005), p. 600. The classification of the missing data mechanism depends on the pattern of non-response. The time series considered in this work can be classified as general and disjunct patterns. Disjunct patterns are observed with ARIMA models as a row of values might be missing due to a shift in time series. General patterns, implying missing data at different points in time, can occur with all other scenarios when data are missing. [GÖTHLICH (2007), p. 121f.]

[66] LITTLE/SMITH (1987), p. 65; RUBIN (1976), p. 581-592; SCHAFER/GRAHAM (2002), p. 151; SINHARAY/STERN/RUSSELL (2001), p. 318; VELICER/COLBY (2005), p. 601. In addition, some authors introduced the concept of observed at random (OAR). OAR is defined as a random distribution of observed values. If data are classified as both MAR and OAR these are said to be MCAR. [ENGEL/EINECKE (1994), p. 261; GÖTHLICH (2007), p. 121; MARINI/OLSEN/RUBIN (1980), p. 316.]

lower end of the interval. Accordingly, the size of the values leads to the missingness of the data. The mechanism associated with this scenario is of an MNAR type. Depending on its magnitude, a specific observation may be classified as an outlier. As a consequence, the missingness is a function of the missing data, implying that missing values can be classified as MNAR. However, the use of the MNAR mechanism requires additional outlay, as the missing data mechanism has to be modelled.[67] The classification of the missing data mechanism of coarsened data as a consequence of the application of ARIMA models demands further examination: the case in which the missing values, being excluded due to the ARIMA estimation, have been responsible for making the decision to apply an ARIMA model, the missing values are considered to be MNAR. Ideally, whether any observation of the time series considered could replace the missing value without affecting decision-making regarding whether to apply a particular type of ARIMA model to the whole time series should be tested. If the decision regarding an ARIMA model is not affected, the missingness of data does not depend on the missing data, implying that this case is of an MAR type. Based on the use of data with at least 40 observations, it is assumed that a single number may not affect decisions regarding the use of an ARIMA model. As a consequence, the data are classified as MAR.

#### 6.2.4.2 Imputation

Various methods have been suggested to address the issue of missing data, also called coarsened data.[68] In this context, imputation equals the process of filling in missing values. The method of imputation should capture the distributional relationships between observed and unobserved data and, as imputed values do not represent real observations, must account for the uncertainty of the replenished values.[69]

[67] McGEE/BERGASA (2006), p. 303. BÉGUIN/HULLIGER (2004, p. 276f) suggest treating missing values as a consequence of outliers as a MAR mechanism. Although it seems to be very difficult, the authors argue, that missing values should be addressed with the principle of imputation. In contrast, McGEE/BERGASA (2006, p. 303) classified missing values due to outlier elimination as a MNAR mechanism.

[68] See, for example, ROBINS/ROTNITZKY/ZHAO (1994) or RUBIN (1976). See, for example, GÖTHLICH (2007, p. 123-128) for an overview of methods to handle missing data.

[69] BARNARD/MENG (1999), p. 18. VELICER/COLBY (2005) investigated incomplete time series with four different missing data methods (deletion, mean substitution, mean of adjacent observations, maxi-

Research on imputation methods has made a major contribution to model-based approaches, which provide estimates of parameters such as means, variances and covariances. In the following, both maximum likelihood (ML)-based estimation methods and Markov-Chain Monte Carlo (MCMC) methods are introduced as forms of model-based approaches.[70]

One type of maximum likelihood-based estimation approach is the so-called expectation maximisation (EM) algorithm introduced by DEMPSTER/LAIRD/RUBIN (1977). The main purpose of applying the EM algorithm is to tackle a complex estimation problem with the help of iteratively solving a complete data problem of reduced complexity.[71] The EM algorithm iterates between the expectation[72] and the maximisation[73] step to obtain ML estimates. The data have to run through this loop until the algorithm converges, i.e., until the imputed values remain stable. DEMPSTER/LAIRD/RUBIN (1977, p. 11) suggest the application of the EM algorithm for MAR mechanisms. It should be noted that the application of the EM algorithm requires the sample to be normally distributed. To ensure unbiased and normally distributed ML estimates, a sample including missing values should be relatively large. In addition, likelihood methods might not be robust to departures from model assumptions, which could lead to enlarged standard errors or misleading test statistics.[74] Adapted from DEMPSTER/LAIRD/RUBIN (1977, p. 11), in the present study, missing values arising from incomplete data records and from ARIMA modelling were imputed using an EM algorithm.

The EM algorithm, classified as a single imputation method in which a single value is imputed in place of a missing value, was extended by the introduction of multiple imputation (MI) approaches. The uncertainty associated with imputing incorrect

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mum likelihood estimation). The authors document a clear superiority of the maximum likelihood estimation procedure.

[70] GÖTHLICH (2007), p. 123-127.

[71] SCHAFER/GRAHAM (2002), p. 163.

[72] The expectation step involves the replacement of missing sufficient statistics by their expected values on the basis of the observed data. [DEMPSTER/LAIRD/RUBIN (1977), p. 3.]

[73] The maximisation step involves the update of the respective parameters by their ML estimates on the basis of the sufficient statistics generated in the expectation step. [GÖTHLICH (2007), p. 128; DEMPSTER/LAIRD/RUBIN (1977), p. 3.]

[74] DEMPSTER/LAIRD/RUBIN (1977), p. 3-6; GÖTHLICH (2007), p. 128; SCHAFER/GRAHAM (2002), p. 164.

values was addressed by the imputation of *m>1* values for each missing observation.[75] Because they are applicable to both single and multiple imputation methods[76], Bayesian approaches such as the method of data augmentation (DA) have been suggested. Complementary to the EM algorithm, a random term is included in the method of DA. The imputation loops are equipped with a posteriori parameter estimates that are calculated through the EM algorithm. Taking the assumed parameters and the observed data into account, the DA method imputes the missing data by extracting them from their conditional distribution. In a subsequent step, the DA method employs these imputed data together with the observed data to simulate new values for the parameters. The simulation is carried out by drawing the new parameter values from a Bayesian posterior distribution.[77]

After estimation by means of the DA method, *m* datasets are available, capturing the uncertainty in imputed values. However, the use of more than one time series, each with a different imputed value, would make the analysis even larger and more difficult to interpret. Accordingly, the formulas first introduced by RUBIN (1987) for summarising the estimated coefficients and standard errors through a mean are suggested.[78]

The main advantages of multiple imputation are its applicability in multiple situations with existing information being included to a notable extent. When compared to single imputation methods, multiple imputation approaches lead to an increased efficiency of estimation as imputations are randomly drawn. Several researchers suggest the application of data augmentation methods for both MCAR and MNAR mechanisms. Although multiple imputation methods rely on the existence of large samples as well, some evidence shows that MI methods work better than ML estimates for small samples.[79]

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[75] GÖTHLICH (2007), p. 123. The concept of multiple imputation was introduced by RUBIN (1977, 1987). The number of imputed values is usually between two and ten. [RUBIN (1987), p. 544; SCHAFER (1999), p. 3.]

[76] GÖTHLICH (2007), p. 123.

[77] GÖTHLICH (2007), p. 128; TANNER/WONG (1987), p. 530-532. Bayesian approaches represent simulation techniques for data imputation belonging to MCMC methods. [GÖTHLICH (2007), p. 128.]

[78] SCHAFER/OLSEN (1998), p. 556. This methodology is also explained in SCHAFER/OLSEN (1998, p. 556-558).

[79] RUBIN (1987), p. 16; SCHAFER/GRAHAM (2002), p. 170; SCHILKE (2007), p. 181. The application of MI for both MAR type and MNAR type data is suggested by SCHAFER/GRAHAM (2002). GLYNN/LAIRD/RUBIN (1993) employ the MI technique with MNAR type data. LIU/GOULD (2002, p.

Missing values resulting from the elimination of outliers or from a change of sign with data on variables were classified as MNAR mechanisms and handled by means of DA. In this work, missing values mainly arise from the elimination of a large number of outliers, especially during the time period beginning in 2000 and ending in 2009.

***Figure 6.4: Handling of missing data.***

| Reason for missing data | Missing data mechanism | Imputation method |
|---|---|---|
| Incomplete data records | MCAR | EM algorithm |
| ARIMA estimation | MAR | EM algorithm |
| Elimination of outliers | MNAR | Data augmentation |
| Change of sign in variables | MNAR | Data augmentation |

*Source: Own considerations based on the total sample (218 REITs)*

### 6.2.5 Stationarity

The issue of stationarity[80] has been thoroughly discussed in statistical research. Likewise, a variety of statistical approaches require stationarity of time series. The importance of this assumption becomes evident when investigating the consequences of non-stationary time series: data that are not stationary potentially question the validity of statistical approaches. For example, when one or more non-stationary variables are applied in regression models, this can result in biased coefficients, distorted results or spurious regressions[81]. Time series that are not stationary can also lead to autocorrelation[82] of data.[83]

222) compare a variety of data replacement techniques and suggest the use of MI techniques for MNAR mechanisms.

[80] A time series is stationary if its mean and variance fluctuate in a constant area; here, the autocovariances might only depend on the distance between the two periods considered but not on the date itself. [WINKER (2007), p. 264.]

[81] The phenomenon of spurious regression occurs if a high coefficient of determination with a significant t-statistic has been calculated although no economic meaning between the variables under consideration does exist. [See GRANGER/NEWBOLD (1974), who investigate this issue in more detail.]

[82] A time series shows autocorrelation, if its values are correlated with each other. The autocorrelation of data can lead to an overestimation of the statistical significance of a regression analysis for example. [BACKHAUS et al. (2003), p. 34; FREITAG (2003), p. 229; HESSELMANN (2006), p. 89.]

[83] ELLIOTT/ROTHENBERG/STOCK (1996), p. 830; GUJARATI (2003), p. 792; MENTZ/NORMANN (2005), p. 484f; WINKER (2007), p. 263.

Taking these effects into consideration, the test used to detect stationarity in the present work will be explained in the following.
A great number of tests have been developed to investigate the stationarity of time series. Many approaches recommend testing the null hypothesis of
the existence of a unit root, i.e., that time series are non-stationary.[84]
However, the determination of the power associated with these tests has not yielded any one test that is uniformly superior to others. Rather, the selection of a specific test is dependent on the sample under consideration.[85] Accordingly, a test is suggested here that seems to fit the purpose of the REIT analysis.

Both the Augmented Dickey Fuller (ADF) test[86] and the Phillips Perron (PP) test[87] have received widespread recognition in research. However, numerous researchers have documented a comparatively low power of both the ADF and the PP test when trying to detect stationarity. In particular, the power is dependent on the time span of the sample rather than on the sample size. Therefore, a modification of the ADF test will be considered in the following.[88]

ELLIOTT/ROTHENBERG/STOCK (1996) suggested a so-called point-optimal unit root test. It is argued that the point-optimal unit root test shows superior power in comparison to other unit root tests, especially when the time series has a unknown mean or displays a linear trend. ELLIOTT/ROTHENBERG/STOCK (1996) show that these tests are more powerful than the Dickey Fuller test in terms of both a constant mean and a linear trend. Additionally, the point-optimal test appears to be more

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[84] MÜLLER/ELLIOTT (2003), p. 1269. The testing of stationarity can be handled through investigating the degree of integration of a time series. If a time series follows a stable and invertible process, after differencing it *n* times, the data are assumed to be integrated of the order *n*. [KUGLER (2002), p. 265; RUMMER (2006), p. 280.] Some researchers [i.e. KWIATKOWSKI/PHILLIPS/SCHMIDT/SHIN (1992) or PARK (1990)] have suggested tests with the null hypothesis that a time series is stationary. However, the major advantage associated with these tests, i.e., to confirm the conclusions of the unit root tests, can be missing due to conflicting results. [MADDALA/KIM (1999), p. 126-128; MENTZ/NORMANN (2005), p. 486; WINKER (2007), p. 271.] Following the recommendation by MADDALA/KIM (1999, p. 145) to skip the use of confirmatory tests, the approaches are not employed in this study.
[85] MÜLLER/ELLIOTT (2003), p. 1269.
[86] DICKEY/FULLER (1979, 1981). See MENTZ/NORMANN (2005, p. 486) and WINKER (2007, p. 271) for further information.
[87] PHILLIPS/PERRON (1988). See MENTZ/NORMANN (2005, p. 486) for further information.
[88] DE JONG et al. (1992), p. 341f; GUJARATI (2003), p. 819; MADDALA/KIM (1999), p. 145; RUDEBUSCH (1993), p. 271.

powerful than the GLS-detrended ADF test[89] when a linear trend exists. Nevertheless, it should be taken into account that the choice of the lag length entails a noticeable effect on the result of the point-optimal test.[90]

Given the evidence presented here, the point-optimal unit root test proposed by ELLIOTT/ROTHENBERG/STOCK (1996) is employed in the present study. Following the recommendation by NG/PERRON (2001, p. 1545), GLS-detrended data are applied for an autoregressive spectral density estimate[91].

The point-optimal unit root test requires the selection of the autoregressive truncation lag $k$. The choice of the appropriate lag length is of particular importance as it may influence study results. Empirical research indicates that the performance of lag length selection criteria improves with increasing sample size.[92]
PHILLIPS/XIAO (1998, p. 440) find that the power of the ADF test can be improved by means of the application of model selection procedures. Several authors have recommended the use of Akaike's information criterion (AIC) for the selection of lag length for smaller samples.[93] In contrast, for relatively large samples, the use of the Hannan Quinn criterion (HCQ)[94] or the Schwarz information criterion (SIC)[95] is suggested.

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[89] See ELLIOTT/ROTHENBERG/STOCK (1996) for further information.
[90] ELLIOTT/ROTHENBERG/STOCK (1996), p. 813-827.
[91] The spectral density function constitutes a tool for analysing the frequency content of a time series. This function usually needs to be estimated from statistical data. [MANOLE (2007), p. 3-5; see MANOLE (2007) and NG/PERRON (2001) for further information regarding the spectral density estimator.]
[92] ASGHAR/ABID (2007), p. 7; LIEW (2004), p. 6; NG/PERRON (2001), p. 1520. ASGHAR/ABID (2007) consider the Akaike Information Criterion [see AKAIKE (1973), the Schwarz Information Criterion [see SCHWARZ (1978)], the Hannan Quinn Criterion [see HANNAN/QUINN (1979)], the Final Prediction Error [see AKAIKE (1969)], and a corrected version of the AIC.
[93] See, for example, ASGHAR/ABID (2007, p. 7) or LIEW (2004, p. 7). ASGHAR/ABID (2007, p. 7f) and LIEW (2000, p. 5) use 60 and 30 observations respectively as being representative for small samples.
[94] LIEW (2004, p. 1) employs a large sample when including 120 observations in the dataset.
[95] ASGHAR/ABID (2007, p. 7f) utilise samples consisting of 120 observations as representatives for a large sample. Testing the lag length selection ability of the SIC and the AIC with ARIMA and GARCH models, JACOBI (2005, p. 1) shows that the SIC leads to a consistent choice of lags, being especially powerful with a high number of observations while the AIC is usually biased towards a number of lags that is too high. JACOBI (2005, p. 14) classifies a small sample as one consisting of 100 observations and a large sample as a collection of 1,000 observations.

Given these findings, the AIC is employed as a lag length selection criterion with samples including fewer than 60 observations, whereas the SIC is utilised with samples including 60 or more observations. This approach is justified as a relatively large amount of scientific research confirms the ability of the SIC and the AIC to choose an appropriate lag length compared to the HCQ criterion.

Summarising the results regarding the investigation of stationarity of REIT returns, the quarterly time series show a higher likelihood of being stationary in comparison to data measured in monthly time intervals.

A relatively large share of non-stationary time series has been observed for the time periods between 1995 and 1999 and from 2000 until 2004 when using monthly data and between 1995 and 2009 when considering quarterly data.[96]

In case of non-stationary time series, these were converted into stationary data by means of an ARIMA model which will be explained in Section 6.2.7.

[96] In this regard, the respective test statistics have been compared against the critical values at a ten percent level of significance.

***Figure 6.5: Summary of the results of the stationarity test.***

| Time horizon and time interval | | Number of observations | Number of sampled firms | Stationary time series | | Non-stationary time series | |
|---|---|---|---|---|---|---|---|
| | | | | Number | % of the total number of sampled firms | Number | % of the total number of sampled firms |
| Monthly | 1985-2009 | 300 | 15 | 8 | 53.33% | 7 | 46.67% |
| | 1990-2009 | 240 | 37 | 30 | 81.08% | 7 | 18.92% |
| | 1995-2009 | 180 | 89 | 75 | 84.27% | 14 | 15.73% |
| | 2000-2009 | 120 | 142 | 98 | 69.01% | 44 | 30.99% |
| | 1985-1989 | 60 | 15 | 9 | 60.00% | 6 | 40.00% |
| | 1990-1994 | 60 | 37 | 25 | 67.57% | 12 | 32.43% |
| | 1995-1999 | 60 | 89 | 44 | 49.44% | 45 | 50.56% |
| | 2000-2004 | 60 | 142 | 63 | 44.37% | 79 | 55.63% |
| | 2005-2009 | 60 | 218 | 131 | 60.09% | 88 | 40.37% |
| Quarterly | 1985-2009 | 100 | 15 | 13 | 86.67% | 2 | 13.33% |
| | 1990-2009 | 80 | 37 | 34 | 91.89% | 3 | 8.11% |
| | 1995-2009 | 60 | 89 | 61 | 68.54% | 28 | 31.46% |
| | 2000-2009 | 40 | 142 | 99 | 69.72% | 43 | 30.28% |

*Source: Own calculations based on the total sample (218 REITs)*

### 6.2.6 Seasonality

Time series possessing monthly or quarterly frequencies can be subject to seasonal movements[97]. Seasonal components included in time series data may interfere with other changes. Accordingly, seasonality of time series should be eliminated.[98]

Apart from graphical tests to detect seasonality[99], the present study included a numerical test to identify seasonality of particular time series.

Several statistical approaches have been suggested to identify the existence and the type[100] of seasonality, including the subsequent removal of seasonal effects.[101] In addition, several adjustment procedures have been developed to remove seasonality from time series.[102]

Particular attention has been paid to the TRAMO/SEATS program[103] and the Census X12 method[104]. FOK/FRANSES/PAAP (2005, p. 6) find that both approaches show robustness against variations in the data-generating process. Nevertheless, much corroboration has been given to the TRAMO/SEATS program. For example,

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97 Seasonal movements represent fluctuations that are recurring on an annual basis due to institutional effects (such as the occurrence of holidays or the length of months) or because of climatic effects. [SCHÄFFER (1997), p. 25.]

98 BUSETTI/HARVEY (2003), p. 420; GRANGER (1979), p. 38; WINKER (2007), p. 216.
In recent years, academic research has begun to consider the seasonal component of time series in more detail. [See, for example, ASHWORTH/THOMAS (1999) or COŞAR (2006).] Some researchers treated seasonality as an effect, which needs to be removed in order to consider the time series net of seasonality only. [BANIK/SILVAPULLE (1999), p. 124.]

99 Graphical techniques to investigate seasonality are discussed in COŞAR (2006, p. 451f) and WAGATHA (2005, p. 139f) for example.

100 Time series can exhibit seasonality as being deterministic, stochastic or both. With academic literature previously being focused on seasonality as being deterministic, time series can have seasonal unit roots and thus not be stationary. Accordingly, fluctuations can be deterministic due to weather or calendar effects, for example, while there potentially exist seasonal fluctuations that are not constant but influenced through the behaviour of economic agents. [BANIK/SILVAPULLE (1999), p. 124; FRANSES (1996), p. 299f; HYLLEBERG (1992, p. 4).]

101 Several studies have followed the proposal by HYLLEBERG (1995), to apply both the HYLLEBERG et al. (1990) test and the test suggested by CANOVA/HANSEN (1995). [See, for example, ASHWORTH/THOMAS (1999), BANIK/SILVAPULLE (1999) or COŞAR (2006).] The quarterly model by HYLLEBERG et al. (1990) was extended by models suitable for monthly data that have been introduced by BEAULIEU/MIRON (1993) and FRANSES (1991).

102 See MOOSMÜLLER (2008, p. 47-80) for an overview regarding seasonal adjustment and the available programs.

103 See GÓMEZ/MARAVALL (1994a, b).

104 The X12-ARIMA program is a seasonal adjustment program suggested by the Census Bureau of the United States. This program represents an enhanced version of the X-11 program. [See DAGUM (1988) and FINDLEY et al. (1998).]

ATUK/URAL (2002, p. 32f) find that the TRAMO/SEATS program is capable of completely removing seasonality effects from time series and does not adjust series without significant seasonality. In contrast, the application of the so-called Census X12 method does not lead to the elimination of all seasonality effects and is likely to produce spurious seasonality.[105]

Based on these considerations, it is assumed that the TRAMO/SEATS program may perform better in adjusting seasonal time series than the Census X12-ARIMA program. Accordingly, the TRAMO/SEATS program, which was employed in this study to detect outliers, was also used for the identification of possible inherent seasonality in time series.

### 6.2.7 Application of a seasonal autoregressive integrated moving average (ARIMA) model

Within time series analysis, several scientific researchers recommend to eliminate all systematic components from the underlying data. Particularly, data might be exposed to non-stationarity or exhibit autocorrelation.[106] A tool that helps to remove these effects is the ARIMA model, first introduced by BOX and JENKINS (1970). The AR($p$) process documents the existence of an autoregressive process of $p$-th order. For example, an autoregressive process with order $p=1$ implies that an observed value is specified through its preceding value. The expression I($d$) indicates whether or not a time series exhibits stationarity. The results of the test of stationarity documented previously indicate the need for differentiating the various time series based on the parameter $d$. The MA($q$) process indicates whether an observed value entails distortions from the $q$ previous values. Accordingly, a $q$ equal to one documents distortions of the observed value from the previous value.[107]

The approach to adjusting the time series through a seasonal ARIMA model entails the following steps: First, the orders of the seasonal ARIMA model expressed

[105] FOK/FRANSES/PAAP (2005), p. 29.

[106] BACKHAUS et al. (2003), p. 34; FREITAG (2003), p. 229; HESSELMANN (2006), p. 89, SCHEUFELE/HAAS (2008), p. 167.

[107] BÜHL/ZÖFEL (1996), p. 228; FRANKE/HÄRDLE/HAFNER (2003), p. 180; SCHEUFELE/HAAS (2008), p. 167.

through *p*, *q* and *d* as well as the seasonal parameters *sp*, *sd* and *sq* are estimated. Second, the ARIMA model is estimated, yielding an adjusted time series.[108]

With regard to the first step, the issue of time series stationarity has been addressed by means of the point-optimal unit root test discussed previously. In addition, the seasonal parameters are detected through the use of the TRAMO/SEATS program. Accordingly, the *p* and *q* parameters have to be specified. Although the actual order of a process is rarely known, various methods have been proposed to determine the order of an ARMA process.[109]

Two approaches are applied for the identification of the parameters *p* and *q*.

First, autocorrelation and partial autocorrelation values are analysed. This begins with inspection of the autocorrelation and partial autocorrelation diagrams associated with a particular time series. Subsequently, the results obtained from the graphical examination of the diagrams are verified or called into question by investigating calculated Box-Ljung values.[110]

The results show that the REIT time series are more often specified (implying a non-zero *p*) than distorted (implying a non-zero *q*) through previous values. Autocorrelations between values have been observed to a considerable extent, particularly in recent years. Specifically, the returns of a relatively large share of the sampled REITs have been specified through previous returns when considering the time period between 2005 and 2009 which could be a result of time intervals of excessive positive and negative returns.

Second, the time series are investigated in terms of the ARMA parameters using the TRAMO/SEATS procedure. The parameters *p* and *q* are obtained from this analysis. As a decision rule, non-zero values are assigned to the parameters *p* and *q* if all approaches explained thus far indicate an AR(*p*), an MA(*q*) or an ARMA (*p*,*q*) process.

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[108] Furthermore, it has been suggested to evaluate the ARIMA model in terms of its adequacy. However, as this evaluation would be subject to a disproportionate cost, no iterative process is carried out in this study. [See, for example, NEUSSER (2006, p. 79) for further information.]

[109] DE GOOIJER et al. (1985), p. 301f; PUKKILA/KOREISHA/KALLINEN (1990), p. 537.

[110] BÜHL/ZÖFEL (1996), S. 229. See LJUNG/BOX (1978) and PATTERSON (2000, p. 174) for an explanation of the BOX-LJUNG test.

***Figure 6.6: Summary of the results of the ARMA parameter estimation with REIT returns.***

| Time horizon and time interval | | Number of observations | Number of sampled firms | Autoregressive (AR) parameter | | Moving average (MA) parameter | |
|---|---|---|---|---|---|---|---|
| | | | | Number | % of the total number of sampled firms | Number | % of the total number of sampled firms |
| Monthly | 1985-2009 | 300 | 15 | 1 | 6.67% | 1 | 6.67% |
| | 1990-2009 | 240 | 37 | 2 | 5.41% | 3 | 8.11% |
| | 1995-2009 | 180 | 89 | 15 | 16.85% | 15 | 16.85% |
| | 2000-2009 | 120 | 142 | 35 | 24.65% | 17 | 11.97% |
| | 1985-1989 | 60 | 15 | 1 | 6.67% | 0 | 0.00% |
| | 1990-1994 | 60 | 37 | 2 | 5.41% | 3 | 8.11% |
| | 1995-1999 | 60 | 89 | 9 | 10.11% | 3 | 3.37% |
| | 2000-2004 | 60 | 142 | 34 | 23.94% | 2 | 1.41% |
| | 2005-2009 | 60 | 218 | 78 | 35.78% | 12 | 5.50% |
| | | | | | | | |
| Quarterly | 1985-2009 | 100 | 15 | 2 | 13.33% | 0 | 0.00% |
| | 1990-2009 | 80 | 37 | 6 | 16.22% | 4 | 10.81% |
| | 1995-2009 | 60 | 89 | 15 | 16.85% | 1 | 1.12% |
| | 2000-2009 | 40 | 142 | 23 | 16.20% | 0 | 0.00% |

*Source: Own calculations based on the total sample (218 REITs)*

Having identified the ARIMA model in the form ARIMA (*p,d,q*)(*sp,sd,sq*), the model can be estimated in a second step. The estimation is performed through a statistical software package to obtain an adjusted time series.[111]

### 6.2.8 Considerations regarding the application of appraisal smoothing correction techniques

Some of the following statistical approaches consider returns on appraisal-based direct real estate indices of several countries with a REIT regime as independent variables to study their impact on REIT returns. A vast amount of literature documents the existence of appraisal smoothing in appraisal-based direct real estate investment indices.[112] In this regard, several real estate researchers have argued that appraisal-based direct real estate investment returns do not provide a reasonable approximation of actual but unobservable returns. Specifically, it is supposed that appraisers estimate the value of a property by considering both historical appraisals and contemporaneous information. Accordingly, present valuations are correlated with previous appraisals. If appraisal smoothing is observed with time series, the data may exhibit a higher positive autocorrelation. Further criticism has highlighted the observation that the valuation of the underlying properties is typically carried out on an annual basis. In this scenario, the volatility of appraisal-based direct real estate investment time series that are typically calculated at monthly or quarterly intervals might be understated.[113]

Literature that addresses the issue of data smoothing generally distinguishes between two approaches.

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[111] BÜHL/ZÖFEL (1996), p. 235-239. In this study, the SPSS software has been used to estimate the identified ARIMA model.
[112] See, for example, BARKHAM/GELTNER (1994), FISHER/GELTNER (2000) or GYOURKO/KEIM (1992).
[113] GELTNER (1993), p. 326-328; GELTNER/MacGREGOR/SCHWANN (2003), p. 1048. MAURER/REINER/SEBASTIAN (2004), p. 65. Accordingly, a property that is not appraised in a specific quarter is included in the index with the same value that had been assigned to the property in the previous quarter. Furthermore, it should be considered that a large share of the properties included in appraisal-based indices is valued in the fourth quarter, leading to an increased magnitude in fourth quarter returns in the case property prices move in the same direction. [GELTNER (1993), p. 326.]

First, several researchers suggest the use of transaction-based indices instead of appraisal-based direct real estate investment indices. Transaction-based returns calculated from these indices potentially show higher volatility. Additionally, it has to be taken into account that transaction data must be collected in order to construct such an index. This task is further restricted by a lack of sufficient data in less mature markets.[114] Accordingly, the use of transaction-based indices is not considered in this study.

Second, adjustment methods that account for a potential lag bias in appraisal-based data through a formal model have been suggested.[115] The application of corrective measures was first introduced in BLUNDELL/WARD (1987) and subsequently refined by several authors.[116] FISHER/GELTNER/WEBB (1994) developed a procedure for the extraction of market values from a smoothed appraisal-based direct real estate investment index. This method can be applied without assuming that private real estate markets are informationally efficient. However, the model has been criticised as it determines the volatility of the adjusted time series to represent one half of the stock exchange volatility, thus ignoring potential changes in stock volatility. Additionally, the assumption made by FISHER/GELTNER/WEBB (1994), i.e., that property prices follow a random-walk, might be less accurate for time series measured less frequently, i.e., quarterly or annually, thus leading to inconsistent parameter estimates.[117]

Although the drawbacks of the correction techniques have been partly addressed by publications[118], no uniform model has been proposed. Given the criticism together with the demand for high comparability between data, the issue of autocorrelation in

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[114] GELTNER/MacGREGOR/SCHWANN (2003), p. 1056. The repeat-sales regression procedure was employed by FISHER/GELTNER (2000), GATZLAFF/GELTNER (1998) and GELTNER/GOETZMANN (2000). Hedonic price models used to develop transaction-based commercial price indices were employed by FISHER/GELTNER/WEBB (1994), JUDD/WINKLER (1999) and MUNNEKE/SLADE (2001) for example. The NCREIF transaction-based index has been introduced in the United States but includes much fewer observations in comparison to the NCREIF appraisal-based indices. (Source: *www.ncreif.org*)

[115] GELTNER/MacGREGOR/SCHWANN (2003), p. 1056.

[116] See, for example, FISHER/GELTNER/WEBB (1994) and ROSS/ZISLER (1991).

[117] CHO/KAWAGUCHI/SHILING (2003), p. 393f; FISHER/GELTNER/WEBB (1994), p. 138; MÜHLHOFER (2004), p. 10.

[118] For example, inconsistent parameter estimates together with the drawback that the FISHER/GELTNER/WEBB (1994) model does not fulfil the Bayes' rule are addressed through the paper by CHO/KAWAGUCHI/SHILING (2003).

the present study was addressed by means of identifying the parameters of and estimating a seasonal ARIMA model instead of applying a real estate de-smoothing[119] model.

The results of the parameter estimation concerning appraisal-based direct real estate investment returns are reported in Figure 6.7. The results in the present study confirm that appraisal-based direct real estate investment returns show an enhanced degree of autocorrelation. In this regard, the frequency of the existence of non-zero AR parameters clearly exceeds that of MA parameters beyond null. The identification of the AR and MA parameters led to the decision to adjust the appraisal-based direct real estate investment time series. To ensure comparability between time series used in the statistical approaches, the appraisal-based real estate returns have been adjusted for autocorrelation through the application of a seasonal ARIMA model which has been explained in the previous section.

[119] In line with the argumentation by BYRNE/LEE (1995, p. 82), the term de-smoothing is used instead of the term unsmoothing, as data probably cannot be corrected for the whole smoothing effect.

***Figure 6.7: Summary of the results of the ARMA parameter estimation with appraisal-based direct real estate investment returns.***

| Country of origin | Time horizon | Time interval | Real estate sector | Autoregressive (AR) parameter | Moving average (MA) parameter |
|---|---|---|---|---|---|
| **Australia** | 2000-2009 | quarterly | all property types | 1 | 0 |
| | | | | | |
| **Japan** | 2005-2009 | monthly | all property types | 3 | 0 |
| | | | | | |
| **United States** | 1985-2009 | quarterly | all property types | 0 | 3 |
| | 1990-2009 | quarterly | all property types | 0 | 2 |
| | 1995-2009 | quarterly | all property types | 0 | 0 |
| | 2000-2009 | quarterly | all property types | 0 | 0 |
| | 1985-2009 | quarterly | office properties | 2 | 0 |
| | 1990-2009 | quarterly | office properties | 2 | 0 |
| | 1995-2009 | quarterly | office properties | 1 | 0 |
| | 2000-2009 | quarterly | office properties | 2 | 0 |
| | 1985-2009 | quarterly | apartments | 3 | 0 |
| | 1990-2009 | quarterly | apartments | 2 | 0 |
| | 1995-2009 | quarterly | apartments | 2 | 0 |
| | 2000-2009 | quarterly | apartments | 1 | 0 |
| | 1985-2009 | quarterly | retail properties | 0 | 4 |
| | 1990-2009 | quarterly | retail properties | 5 | 0 |
| | 1995-2009 | quarterly | retail properties | 3 | 0 |
| | 2000-2009 | quarterly | retail properties | 2 | 0 |
| | 2000-2009 | quarterly | hotel properties | 2 | 0 |
| | | | | | |
| **Sum of parameter values** | | | | **14** | **3** |

*Source: Own calculations based on the total sample (147 of 218 REITs)*

## 6.3 Factor analysis

Factor analysis represents a heuristic approach employed in the present study. As a data reduction method, the approach attempts to reduce the number of intercorrelated observed variables to a smaller number of underlying variables. Accordingly, factor analysis investigates whether different variables can be classified into groups, which are themselves reducible to synthetic factors. The factors should be able to explain the relationships between the variables as well as possible.[120]

In the context of this work, an exploratory factor analysis[121] will help to provide insights regarding potential underlying variables affecting REIT returns. As the interpretation of the results of a factor analysis should always entail an examination of the underlying variables,[122] the findings of the analyses of the REIT sample conducted previously will be considered. Overall, the factor analysis may contribute to an identification of synthetic factors that are not considered in subsequent statistical approaches but may deliver additional explanations regarding the research subquestion of which factors probably possess a high influence on the intrinsic value of a REIT.

### 6.3.1 Methodological approach

The factor analysis employed in this study is carried out in four steps (Figure 6.8).[123]

First, the data editing includes the selection and standardisation of variables, the determination of a correlation matrix and an evaluation of the data quality for a factor analysis.

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[120] BAUR/FROMM (2004), p. 33; BELLGARDT (2004), p. 205; BORTZ (2005), p. 565; BRO-SIUS (2004), p. 773; BÜHL (2008), p. 555; FROMM (2008), p. 324; JANSSEN/LAATZ (2007), p. 497.

[121] The statistical literature distinguishes between exploratory and confirmative factor analysis. With regard to the explanatory factor analysis, the number of factors is chosen on the basis of a mathematical algorithm with the intention to receive a small number of factors. In terms of a confirmative factor analysis, the number of factors is already known, whereas the degree to which the existing correlation matrix can be reproduced through the factor structure model is tested. [HAFNER/WALDL (1992), p. 284; JANKER (2008), p. 178.]

[122] FROMM (2008), p. 232.

[123] See BROSIUS (2004, p. 777f) under consideration of the explanations provided by BACKHAUS et al. (2003, p. 268) and MARTENS (2003, p. 225).

***Figure 6.8: Steps in a factor analysis.***

| | |
|---|---|
| **1.** | **Data editing** |
| **2.** | **Factor extraction** |
| **3.** | **Factor rotation** |
| **4.** | **Estimation of factor values** |

The selection of variables can affect the quality of the results of a factor analysis. Specifically, the data should show homogeneity, which corresponds to relatively strong correlations between variables that can be consolidated within a group.[124] This assumption is probably fulfilled as the sample consists of firms whose business activities are concentrated in the same sector.

Standardisation of variables contributes to an increase in their comparability and enhances the interpretability of results.[125] The standardised observed value of a variable can be calculated as follows:

$$z_{kj} = \frac{x_{kj} - \bar{x}_j}{\sigma_j} \qquad \textbf{(6.2)}$$ [126]

where

$z_{kj}$ = standardised observed value of the variable $j$ for the object $k$

$x_{kj}$ = observed value of the variable $j$ associated with object $k$

$\bar{x}_j$ = mean of the variable $j$ associated with all objects

$\sigma_j$ = standard deviation of the variable $j$

Addressing the demand that the data used in a factor analysis show homogeneity, the determination of a correlation matrix provides a first indication regarding whether variables can be consolidated in groups. Additionally, the suitability of data for

124 BACKHAUS et al. (2003), p. 269. Likewise, the data need to be of metric scale [ECKSTEIN (2008), p. 125.], which is assumed to be fulfilled with the data employed in this study.

125 BACKHAUS et al. (2003), p. 271.

126 BACKHAUS et al. (2003), p. 271.

factor analysis is assessed using the Kaiser-Meyer-Olkin (KMO) criterion and the Bartlett test of sphericity.[127]

In a second step, factors were retrieved from the data by means of a factor extraction method[128]. The choice of the factor extraction method can affect the results of the analysis. Principal components analysis, as a factor extraction method, assumes that the extraction of components can fully explain the variance of the initial variables. The main purpose of this analysis is to minimise the number of factors while maximising the degree of reproduction of a data structure.[129]

Principal components analysis was chosen in the present study as its assumptions and main purpose contribute to the objectives of this study.[130]

Communalities[131] help to visualise the explanatory power of the factors regarding each variable. Accordingly, the variance of a single variable is fully explained by all factors if it possesses a communality of one.[132]

The number of factors can be limited by the condition that each factor should have an eigenvalue[133] equal to or greater than one.[134] In addition, a screeplot was used for the determination of the appropriate number of factors.[135]

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[127] BAUR/FROMM (2004), p. 36f. The Bartlett test of sphericity examines the hypothesis that all correlation coefficients of the population own a zero value. The KMO criterion contributes to an evaluation of a correlation matrix as well as of single variables. Specifically, the KMO criterion examines whether the variables exhibit correlations that are sufficient to carry out a factor analysis. The results of the calculation of the KMO-criterion may exhibit values between zero and one and can be interpreted as follows. A criterion below 0.5 points to an “unacceptable” sample, a criterion larger than or equal to 0.5 indicates a “miserable” dataset, a criterion being equal to or exceeding 0.6 is denominated “mediocre”, a criterion equal to or above 0.7 relates to a “middling” dataset, a criterion equal to or exceeding 0.8 conforms to a “meritorious” sample whereas a criterion equal to or larger than 0.9 is denominated as being “marvellous”. [BACKHAUS et al. (2003), p. 276f; FROMM (2008), p. 325.]

[128] Factor extraction is defined as the determination of underlying factors based on a choice of variables. [ECKSTEIN (2008), p. 301-311.]

[129] BELLGARDT (2004), p. 209f; ECKSTEIN (2008), p. 126; HAFNER/WALDL (1992), p. 285.

[130] This argumentation is also made by JANKER (2008, p. 196).

[131] The communality represents the share of the variance of a single variable that is explained by all factors. [JANSSEN/LARTZ (2007), p. 502; MARTENS (2003), p. 225.]

[132] BROSIUS (2004), p. 784f; MARTENS (2003), p. 225.

[133] The eigenvalue $\lambda_j$ describes the share of the total variance of all variables explained by a single factor. [BORTZ (2005), p. 520; MARTENS (2003), p. 225.]

[134] BELLGARDT (2004), p. 209f; KIM/MUELLER (1978a), p. 43.

[135] BROSIUS (2004), p. 787; HAFNER/WALDL (1992), p. 297f; JANSSEN/LARTZ (2007), p. 506f. In a screeplot, the chosen number of factors corresponds to the value of the x-axis where the curve establishes a break. [BROSIUS (2004), p. 787.]

A factor matrix was utilised to interpret the relationships between all variables and the extracted factors. Specifically, a factor is supposed to possess sufficient explanatory power regarding a specific variable if the entries in the factor matrix have values, also called factor loadings[136], above 0.5.[137]

In a third step, a rotation method[138] was utilised as an interpretation aid. Rotation methods rely on the principle of revolving axes in a coordinate system, including the extracted factors, to improve the interpretability of the results. The validity of the factor extraction method is not affected by the rotation of the coordinate plane.[139]

In this study, Varimax rotation was chosen because its approach of minimising the number of extracted factors is notably convenient in factor analysis. Additionally, the Varimax rotation method allows the factors to remain uncorrelated with each other. After the application of the Varimax rotation method, a general factor[140], a group factor[141] or a specific factor[142] may be observed.[143]

In a fourth step, the factor values were estimated on the basis of the background variables through the following equation:

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[136] The factor loading of a variable specifies the correlation between the variable and a factor. [MARTENS (2003), p. 225.]

[137] BROSIUS (2004), p. 785; MARTENS (2003), p. 237f.

[138] Rotation methods can be categorised into orthogonal and oblique rotation approaches. With regard to orthogonal rotation methods, the axes are rotated without changing their relative positions. This form of rotation squares with the assumption that the factors are not correlated with each other. This assumption is rejected, thus allowing for correlations between factors in a oblique rotation. Commonly used orthogonal rotation methods are the Varimax method, the Quartimax method or the Equimax method. Examples of oblique rotation approaches are the Promax method or the direct Oblimin method. [BROSIUS (2004), p. 790; HAFNER/WALDL (1992), p. 314-319.]

[139] BACKHAUS et al. (2003), p. 299; BELLGARDT (2004), p. 212f. For example, difficulties in interpretation exist when a factor possesses factor loadings above 0.5 on more than one variable. The rotation of the axes leads to a reduced amount of variables possessing high factor loadings. [BELLGARDT (2004), p. 213; BROSIUS (2004), p. 790-792.]

[140] A general factor possesses high factor loadings on all variables. [COOPER (1983), p. 144.]

[141] A group factor includes high loadings on a group of two or more but not on all variables. [COOPER (1983), p. 144.]

[142] A specific factor owns a high factor loading on a single variable. [COOPER (1983), p. 144.]

[143] COOPER (1983), p. 144. However, it has to be noticed that no method of rotation can alter the size of the explained covariation in the data through a factor analysis. In this sense, KIM/MUELLER (1978b, p. 50) argue that the choice of a particular rotation method should not represent a major concern in a factor analysis.

$$Factor_k = a_1 + a_2 \text{ var}_1 + a_2 \text{ var}_2 + ... + a_n \text{ var}_n \qquad \textbf{(6.3)}$$ [144]

where

$Factor_k$ = extracted factor $k$

$k$ = number of factors

$n$ = number of background variables

$var_1, ..., var_n$ = background variables of factor $k$

$a_1, ..., a_n$ = regression coefficients

### 6.3.2 Results

As previously explained, the interpretation of the results of a factor analysis should be based on an investigation of the underlying variables. Accordingly, the REITs included in the factor analysis were classified and interpreted with regard to the REIT regime, the property type classification, the size in terms of market capitalisation and the leverage ratio, expressed as the book measure of leverage.

On the one hand, the sample was categorised according to the eleven REIT regimes and the fourteen different property sector categories introduced previously. On the other hand, the sample was distinguished into quartiles with regard to both the leverage ratios and the firm sizes.[145] The quartiles associated with the leverage ratios are named as follows: “high leverage”, “upper-middle leverage”, “lower-middle leverage” and “low leverage”. The quartiles corresponding to firm sizes are named “high market capitalisation”, “upper-middle market capitalisation”, lower-middle market capitalisation” and “low market capitalisation”.

The classification of a factor dependent on one of the four characteristics was addressed as follows: With regard to the categorisation of the sample in terms of leverage, a group including more than 50% of firms belonging to the same quartile was classified as a leverage factor. The same procedure was carried out with the size factor. In contrast, the sector classification does not comprise groups with an equal

[144] As the principal component analysis was chosen as a factor extraction method, equation 6.3 can be employed. In contrast, other factor extraction methods might require an estimation method to obtain factor values. [BROSIUS (2004), p. 795f.]

[145] The categorisation of the sample according to the leverage ratio and the market capitalisation have been based on the arithmetic mean values measured over a time period between 2004 and 2008.

number of firms. For example, a large number of REITs focused on office property types but a small number of REITs concentrated on self-storage facilities were identified. To address this issue, first, the number of REITs belonging to each sector was counted for each time horizon considered. Second, the resulting numbers were divided by the total number of REITs included in the sample attached to the same time horizon. The resulting percentage represents the share, denominated as $S_{sample}$, of REITs categorised as holding, managing or operating a certain property type or being diversified as the total number of REITs sampled over a specific time span. Third, $S_{sample}$ was compared to the share of REITs included in a factor, named $S_{factor}$, that exhibit the same property type classification. The factor was denominated as a property type factor if $S_{factor}$ was more than double $S_{sample}$. In addition, the factor should include at least two firms sharing the same property type classification. The procedure described for the calculation of property sector factors was adopted for the calculation of country factors as well. However, as an exception, the large number of REITs domiciled in the United States led to a separate treatment of this group: specifically, a factor was classified as a country factor if the share of REITs domiciled in the United States accounted for more than 90% of all firms included in the respective factor.

The results obtained from the application of the factor analysis are summarised in Figure 6.9.[146] In the following, the results are presented for extracted factors, with the factors sorted in accordance with the number of underlying REITs, i.e., the highest number of REITs loads on the first factor. In this context, not all extracted factors are necessarily considered in the following as some factors only include a single REIT or REITs that do not share any similarities in terms of the categorisation explained above. Given that a factor may contain a single REIT only or REITs that share several similarities, i.e., belonging to the same REIT regime and size quartile, the number of total factors in Figure 6.9 may differ from the respective sum of the country, sector, leverage and size factors.

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[146] The presentation of the factor components and the factor loadings has been omitted due to the extensive amount of data. However, data regarding the results attached to the time period between 1985 and 2009 are included in Appendix 6.2.

***Figure 6.9: Summary of the results of the factor analysis.***

| Time horizon | | Number of observations | Number of sampled firms | Number of factors | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Total factors | Country factor | Sector factor | Leverage factor | Size factor |
| Monthly | 1985-2009 | 300 | 15 | 5 | 2 | --- | --- | 2 |
| | 1990-2009 | 240 | 37 | 11 | 3 | 3 | 2 | 3 |
| | 1995-2009 | 180 | 89 | 23 | 6 | 3 | 2 | 4 |
| | 2000-2009 | 120 | 142 | 36 | 7 | 4 | --- | 3 |
| | 1985-1989 | 60 | 15 | 6 | 1 | --- | --- | --- |
| | 1990-1994 | 60 | 37 | 13 | 3 | 2 | --- | 2 |
| | 1995-1999 | 60 | 89 | 25 | 4 | 4 | 2 | 3 |
| | 2000-2004 | 60 | 142 | 33 | 6 | 5 | --- | 2 |
| | 2005-2009 | 60 | 219 | 45 | 10 | 6 | 5 | 4 |
| | **Total number** | | **785** | **197** | **42** | **27** | **11** | **23** |
| | **Share as of total factors** | | | **100%** | **21.32%** | **13.71%** | **5.58%** | **11.68%** |
| | | | | | | | | |
| Quarterly | 1985-2009 | 100 | 15 | 5 | 3 | 1 | 1 | 1 |
| | 1990-2009 | 80 | 37 | 10 | 4 | 3 | 1 | 2 |
| | 1995-2009 | 60 | 89 | 21 | 5 | 1 | 2 | 3 |
| | 2000-2009 | 40 | 142 | 27 | 5 | 2 | 3 | 2 |
| | **Total number** | | **283** | **63** | **17** | **7** | **7** | **8** |
| | **Share as of total factors** | | | **100%** | **26.98%** | **11.11%** | **11.11%** | **12.70%** |

*Source: Own calculations based on the total sample (218 REITs)*

Concerning monthly data between 1985 and 1989, six REITs that are all domiciled in the United States load on the first factor.

Analysing monthly data between 1985 and 2009, factor one includes three REITs that are located in the high capitalisation group as well as two REITs that are classified as upper-middle capitalised firms. In addition, the second factor includes a group of three REITs, with one firm classified as high capitalised and two REITs belonging to the upper-middle market capitalisation group. Therefore, two size factors do exist, although it should be noted that the classification of the sample according to market capitalisation was carried out with data covering the time period from 2004 to 2008 only.

With regard to quarterly data between 1985 and 2009, a country focus concerning REITs domiciled in the United States was observed with the first factor, with two community centre-focused and two merchandise centre-focused firms included in this factor. Each of the four companies included in the second factor is domiciled in the United States. Further evidence indicates three REITs that are all categorised as high capitalisation entities that load on the third factor. In addition, two of these three REITs are headquartered in Australia and exhibit low leverage ratios.

With regard to the three time periods starting in 1985, comparatively large shares of both country and partly of size factors were observed. Presumably, the reduced number of REITs at that time caused reduced sector specialisation. In addition, the financing instruments employed by REITs did not exhibit the same variety as those used in recent years. Accordingly, few disparities between the financing policies used by REITs may have existed in the eighties.

With respect to monthly data between 1990 and 2009, factor one includes nine REITs that are all headquartered in the United States. Little evidence of a size factor is observed as five REITs are located in the high capitalisation group, with another three firms classified as upper-middle capitalised entities. Furthermore, two of the three sampled REITs focusing on investments in apartments are included in factor one. Factor two includes six firms that are all domiciled in the United States, two of which REITs concentrated their investments on community centres. In addition, the three REITs loading on factor four are all classified as firms exhibiting low leverage ratios, with two companies possessing high market capitalisation. Factor five in-

cludes four REITs that are domiciled in the United States, with the bulk being classified as lower-middle leveraged and highly capitalised firms.
With regard to quarterly data pertaining to the time period between 1990 and 2009, all REITs loading on the first factor are domiciled in the United States. In addition, the two firms focusing on merchandise centres are included in the first factor. The second factor includes four REITs that are all headquartered in the United States. Similarly, the six REITs forming factor three are exclusively domiciled in the United States. Additionally, the factor exhibits four highly capitalised REITs and three firms concentrating on health care properties. The fourth factor includes highly capitalised REITs, with the bulk of firms being low leveraged. In detail, the factor comprises one REIT domiciled in the United States and two REITs from the Netherlands that hold portfolios diversified across property types.
Examining monthly data between 1990 and 1994, the first factor includes six firms that are all governed through the United States REIT regime, including two firms that are concentrated on the holding and management of free standing properties. The three REITs loading on the second factor are all firms with a high market capitalisation. The third factor includes REITs that are headquartered in the United States and are largely high capitalised, with two firms that are concentrated on the holding and management of apartment properties. Although the fourth factor is ambiguous, the fifth factor includes three REITs that are domiciled in the United States.
In summary, the analyses using time spans starting in the year 1990 document an increased occurrence of sector factors in comparison to time periods starting five years earlier. Additionally, the number of country factors has risen presumably because REITs in regimes other than that of the United States have been founded.

In terms of monthly data covering the time period between 1995 and 2009, factor one solely includes REITs domiciled in the United States, with a comparatively large number of REITs that are concentrated on the holding and management of merchandise centres. In factor two, six of the nine REITs that are headquartered in the United States are classified as focusing on apartment properties, with six firms being highly capitalised. Factor three includes a relatively high share of firms either focusing on free standing properties or exhibiting a lower-middle leverage ratio. Albeit comprising three firms only, factor four exclusively includes REITs that are domiciled in the United States, with two firms being classified as entities exhibiting upper-middle market capitalisation. However, factor five includes three REITs that are all domiciled in Australia and exhibit both a high market capitalisation and a low leverage ratio. Factor six includes two Dutch and two American REITs, with two firms having a low and two a lower-middle leverage ratio. In addition, three REITs are focused on retail properties (neighbourhood centres, community centres, free standing), whereas one REIT holds a portfolio diversified across property types. Consequently, a retail element could be attached to the factor despite the fact that the REITs are domiciled in different countries. Factor seven includes three REITs, all of which are domiciled in the United States, with two firms being categorised as highly capitalised entities.

Analysing quarterly data over the time period beginning in 1995 and ending in 2009, factor one includes 33 firms, with 31 of them headquartered in the United States, but does not reveal further similarities between the companies. Similarly, factor two includes 25 firms, with 24 of them headquartered in the United States. Factor two comprises a relatively large share of highly capitalised firms as well as four companies that mainly invest in community centres. Although only three REITs load on factor three, these firms are exclusively headquartered in the United States, with two firms being classified as high leverage entities. Factor four consists of four REITs, with two firms being domiciled in Canada. Factor six includes four REITs, with three entities being classified as highly capitalised REITs. Three REITs, all of which have a low capitalisation and are domiciled in Australia, comprise factor seven.

In terms of monthly data between 1995 and 1999, factor one includes ten firms that are all domiciled in the United States, with six companies being categorised as highly capitalised REITs. Further, factor two includes six firms that are exclusively headquartered in the United States, with two firms being focused on the holding and management of apartment properties. Factor three includes five REITs that are all domiciled in the United States, with three of them focusing their portfolios on apartment properties. An increased proportion of REITs concentrating their operations either on merchandise centres or on apartments is included in the fourth factor. In addition, the factor comprises a comparatively large share of REITs with high leverage ratios and firms classified as having an upper-middle market capitalisation. Factor five comprises three REITs that are all domiciled in the United States,

whereas factor six does not entail definite similarities between its components. In contrast, factor eight includes three REITs that are all highly capitalised, along with two firms that are classified as low leverage firms and domiciled in Australia.
Overall, the examination of the time periods beginning in 1995 reveals the existence of a comparatively large share of sector factors, comprising retail and apartment properties.

With regard to quarterly time series between 2000 and 2009, no distinct similarities were observed with the components shaping factor one. In contrast, an investigation of the REITs loading on factors two and three revealed that both factors include a comparatively large share of Australian firms. Factor four includes seven REITs, all of which are domiciled in the United States, with five firms categorised as highly capitalised entities, four companies assigned to the upper-middle leverage quartile and a comparatively large number of three firms focusing their activities on apartment properties. No explicit analogies between the components of factor five were detected. Factor six includes four REITs, all of which are domiciled in the United States, with three firms invested in merchandise centres. Factor nine comprises three firms classified as low capitalised firms, two of which are headquartered in Turkey.
Concerning monthly data between 2000 and 2009, all 28 REITs included in factor one, as well as 22 of the 23 firms loading on factor two, are headquartered in the United States. Factor three reveals a comparatively high presence of REITs domiciled either in Australia or in Belgium. A considerable share of REITs investing in community centres loaded on factor four. Although factor five includes only three REITs, two of them are located in Australia. Four REITs, all of them domiciled in the United States and three firms categorised as upper-middle capitalised, represent factor six. Factor seven includes three companies that are all domiciled in the Netherlands, with two firms being diversified across properties. In contrast, three REITs, each of which is headquartered in the United States and two of which are concentrated on the holding and management of office properties, make up factor eight. Factor number ten includes three firms, with two diversified across property sectors and two classified as lower-middle capitalisation entities.
When investigating monthly data over the time period between 2000 and 2004, no similarities are observed, with 30 firms loading on factor one. The second factor

includes 18 REITs, all of which are domiciled in the United States, with ten firms exhibiting a high market capitalisation and five firms being focused on the holding and management of apartment properties. The third factor comprises twelve REITs, which exclusively originated in the United States, includes seven firms exhibiting a large market capitalisation and entails five firms being primarily invested in office properties. Factor four includes six REITs, with each firm being headquartered in the United States. In addition, a comparatively large share of companies focusing on health care properties is included. Factor five includes nine REITs, with a relatively large share of these firms being domiciled in New Zealand. REITs loading on factor six are all headquartered in the United States, with a relatively large proportion of firms concentrating their holding and management business on community centres. Factor seven includes four REITs, all of which are domiciled in Canada, with two firms diversifying their portfolios across property types.
Summarising the previous results, the collected data starting in the year 2000 did not show a high degree of homogeneity while aggravating the interpretability of the extracted factors. However it should be noted that the interpretation of the extracted factors has been carried out on the basis of the four characteristics only. Differentiation according to further REIT features may lead to an improved ability to interpret the factors.

For the time period between 2005 and 2009, 42 of the 44 REITs that are consolidated within factor one are domiciled in the United States. Factor two comprises twelve REITs that predominantly originated in the United States, with a relatively large share of these REITs being invested mainly in either industrial or health care properties. Factor three includes twelve firms, with a relatively large share of companies focusing their activities on industrial properties. Factor four includes a relatively large share of firms concentrating their business activities on apartment properties. The group of REITs included in factor five comprises a comparatively large share of companies focused on free standing properties. Although only six REITs are included in factor six, four of them are domiciled in Australia, with another group of four firms being classified as low capitalisation REITs. Factor seven includes five REITs, with three being domiciled in Singapore and four possessing a relatively low leverage ratio. A country focus is observed when reviewing factor eight, which includes exclusively REITs domiciled in Japan. The bulk of the five firms are concentrated on the holding and management of office properties and classified as upper-middle capitalised and upper-middle leveraged entities. Factor nine includes four companies, three of which are domiciled in Turkey and three of which are characterised by low leverage ratios. Factor ten does not reveal definite similarities, whereas all five entities forming factor eleven comprise Australian REITs. Factor twelve includes five entities, with the bulk being grouped as high capitalisation firms. Three REITs, each of them governed by the Australian REIT regime, form factor thirteen. Two of the three firms are both highly capitalised and low leveraged. Factor fourteen includes four companies, with three entities being diversified across property types and subject to South African REIT legislation. A similarity between the three REITs forming factor fifteen concerns their classification as highly leveraged REITs.

The results for the time period between 2005 and 2009 show a large number of country factors. This observation is partly associated with the inclusion of REITs belonging to three regimes that were not included in previous time periods. In addition, a comparatively large share of leverage factors can be observed. Presumably, the increased leverage ratios exhibited by several REITs were a critical issue during the subprime crisis starting in 2007.

Despite the adjustment explained previously, it should be noted that the balance of the sample was distorted by the large fraction of REITs domiciled in the United States. Nevertheless, the results summarised in Figure 6.9 reveal that country factors account for the highest share of all factors identified in the analysis. This finding indicates the necessity of carrying out a REIT valuation under consideration of the country of origin associated with the REIT.

The third and second highest shares of all factors refer to the sector and the size factors, respectively. The size factors seem to occur more consistently than the sector factors over all time periods, whereas the sector factors are rather prevalent in recent periods. From a dynamic perspective, the importance of both the leverage and the sector factors has risen in recent years. The development of sector factors can be partly explained through a tremendous increase in the number of firms, prompting REITs to concentrate on a property sector to enhance competitiveness. The increased occurrence of leverage factors in past years is likely related to the development of an extended variety of financing instruments that are employed by REITs in connection with more intensive management of financing activities. In this sense, a detailed examination of the REIT financing activities is valuable within the development of the valuation tool.

Although the factor values could be used within the subsequent statistical approaches, this is not pursued in this study due to the following reasons: First, the factor analysis has been applied to study the impact of the firm size, the leverage ratio, the property type allocation as well as the REIT regime on REIT returns. The findings presented above are considered in the development of the valuation tool in Chapter Seven. Second, the consideration of factor values in the context of the following statistical approaches would heavily raise the number of variables and could aggravate the interpretability of results while a significant increase in insights remains questionable.[147]

## 6.4 Multiple regression model

A multiple regression model will be employed to investigate the relationship between REIT returns as the dependent variable and a set of independent variables. Thereafter, the relationship between variables is described quantitatively and explained.[148]

In the context of the REIT study, a multiple regression model should allow the detection of relationships between REIT stock returns and independent variables. Hopefully, this approach contributes to answering the research sub-question of which factors probably possess a high influence on the intrinsic value of a REIT. If a considerable impact of specific variables on REIT returns is detected, these variables should be considered for incorporation into the calculations of cash flows and discount rates associated with the valuation tool that will be discussed in the following chapters.

[147] With regard to the multiple regression model, the consideration of factor values with monthly data for the time interval from 2005 until 2009 would result in the inclusion of 45 additional variables, with several factors containing only a single REIT.

[148] BACKHAUS et al. (2003), p. 46.

### 6.4.1 Methodological approach

The multiple regression model will be processed in four steps described in the following.[149]

In a first step, a regression model is chosen that captures the cause-and-effect relationship as exhaustively as possible.[150]

In a second step, the regression function is estimated. In this study, the method of least squares is applied to arrive at a function that possesses the minimum squared deviation.[151] The relationship between a dependent variable $Y$ and a selection of independent variables $X_1, \ldots, X_J$ can be formulated as:

$$Y = b_0 + b_1 \times X_1 + b_2 \times X_2 + \ldots + b_j \times X_j + \ldots + b_J \times X_J + e \qquad \textbf{(6.4)}$$ [152]

where

$b_0$ = constant

$b_1, \ldots, b_J$ = regression coefficients

$e$ = error term

As the regression coefficients may not be comparable to each other due to the measurement of the independent variables in different units, the coefficients are standardised by the following:

$$\hat{b}_j = b_j \times \frac{\sigma_{Xj}}{\sigma_Y} \qquad \textbf{(6.5)}$$ [153]

149 BACKHAUS et al. (2003), p. 52.
150 BACKHAUS et al. (2003), p. 52; MARTENS (2003), p. 195.
151 See ECKSTEIN (2008, p. 33-36) and KOHN (2005, p. 41) for further information regarding the method of least squares.
152 BACKHAUS et al. (2003), p. 53 & 69; BAUR/FROMM (2004), p. 262.
153 BACKHAUS et al. (2003), p. 61f; BELLGARDT (2004), p. 115; BROSIUS (2004), p. 578f.

where

$\hat{b}_j =$ standardised regression coefficient with $j = 1,2,\dots, J$

$\sigma_{Xj} =$ standard deviation of the independent variable $X_j$ with $j = 1,2,\dots, J$

$\sigma_Y =$ standard deviation of the dependent variable

In a third step, the quality of the regression model is tested through both an examination of the regression function and an investigation of single regression coefficients. The tests of the regression function consider the explanatory power of all independent variables for the dependent variable of interest. Specifically, the coefficient of determination[154], the adjusted coefficient of determination[155], the F-statistic[156] and the standard error[157] are used as measures for testing the entire regression function.
If the tests describing the regression function document a significant connection between the dependent and the independent variables, the regression coefficients of the equation will be examined via the t-statistic[158] and the confidence interval of the regression coefficient[159].

A fourth step involves the examination of the assumptions associated with the multiple regression model.
A main assumption concerns a linear relationship between the dependent and the independent variables. If this assumption is not fulfilled, the estimated values might be biased in the sense that $b_j$ does not converge to the unknown but true regression coefficient with an increased sample size.[160]
Aside from this, the model should incorporate all relevant variables. Specifically, the omission of important independent variables may result in biased estimators. In

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[154] See BACKHAUS et al. (2003, p. 66) and HAFNER/WALDL (1992, p. 27) for further information regarding the coefficient of determination.
[155] See BACKHAUS et al. (2003, p. 63-68), BROSIUS (2004, p. 570f), KMENTA (1997, p. 417) and MARTENS (2003, p. 200) for further information concerning the adjusted coefficient of determination.
[156] See BACKHAUS et al. (2003, p. 68) for further information regarding the F-statistic.
[157] See BACKHAUS et al. (2003, p. 63) and MARTENS (2003, p. 200) for further information regarding the standard error.
[158] See BACKHAUS et al. (2003, p. 63-75) for further information regarding the t-statistic.
[159] See BACKHAUS et al. (2003, p. 76) for further information concerning the confidence interval of the regression coefficient.
[160] BACKHAUS et al. (2003), p. 78-92; ECKSTEIN (2008), p. 36f; MARTENS (2003), p. 194.

contrast, the consideration of too many independent variables can result in inefficient estimators.[161]

To calculate the multiple regression model, the dependent variable and the independent variables should be, at least, interval-scaled. The independent variables can also be dichotomous or be transformed into dichotomous variables.[162]

Additionally, the number of observations $K$ should exceed the number of estimated parameters $J+1$.[163]

Furthermore, the expected value of the residual term should equal zero. A violation of this assumption can result in biased regression coefficients.[164]

Another premise demands the absence of significant correlations between the independent variables and the residual term. A violation of this assumption can lead to a distortion of $b_j$.[165]

The assumption of homoscedasticity implies a constant variance of the residual term. Empirical research on time series has identified both large and small residual values in clusters. In time series analysis, heteroscedasticity can be pronounced through volatility clustering. As a consequence of heteroscedasticity, the estimation becomes inefficient, and the standard error of the regression coefficient is falsified, which may lead to an imprecise estimation of the confidence interval.[166] The WHITE (1980) test represents a common test for heteroscedasticity, with squared error terms being isolated and then regressed against the independent variables, their squared values and their products. However, LYON/TSAI (1996, p. 348) find that the WHITE (1980) test can lead to erroneous conclusions about heteroscedasticity,

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[161] BACKHAUS et al. (2003), p. 83f. Biased estimators can be avoided if there exists no correlation between the error term, which includes unconsidered variables, and the independent variables of the model. Inefficient estimators imply that the variance of the estimators is not minimal. [BACKHAUS et al. (2003), p. 83; KMENTA (1997), p. 446.]

[162] BAUR/FROMM (2004), p. 261.

[163] BACKHAUS et al. (2003), p. 78.

[164] BACKHAUS et al. (2003), p. 101; RUDOLF (2004), p. 36f. A violation of this assumption occurs if the independent variables are measured too high or too low with a constant error. The resulting systematic measurement error can affect the constant $b_0$, thus violating the assumption of an unbiased constant. [BACKHAUS et al. (2003), p. 82f.]

[165] BACKHAUS et al. (2003), p. 78-84.

[166] BACKHAUS et al. (2003), p. 78-85; HANSSENS/PARSONS/SCHULTZ, p. 214; PODDIG/DICHTL/PETERSMEIER (2003), p. 325f; RUDOLF (2004), p. 37; SCHLITTGEN (2003), p. 438f. The heteroscedasticity of the residual term could be removed by means of the data transformation technique suggested by URBAN/MAYERL (2008, p. 249-253). Given the scarce evidence regarding the power of this technique, a data transformation is not carried out in the present examination.

especially with regard to the investigation of financial markets data. Additionally, the application of the WHITE (1980) test becomes questionable if the regression model includes numerous exogenous variables, which is the case in the present work.[167] Considering the disadvantages associated with the WHITE (1980) test, the test suggested by KOENKER (1981), which has been recommended in research[168], is employed in the present examination.

Aside from this, consecutive residual values must be uncorrelated with each other. Potential consequences of autocorrelation between residual values are distortions in the estimation of the standard errors of the regression coefficients and, consequently, in the determination of the confidence intervals pertaining to the regression coefficients.[169]

Furthermore, the residual values must be normally distributed. If the shape of the distribution of residual values does not resemble a normal distribution, the F-statistic or the t-statistic(s) may become invalid.

Finally, the independent variables must not possess a linear relationship with each other. If this assumption is violated, an overlapping in the information content of single independent variables may occur, which would be described as multicollinearity. As a consequence, the estimated regression coefficients may show an exceptional sensitivity towards minor changes in the data sample. The test for multicollinearity requires the calculation of a correlation matrix in a first step. If high correlations between the independent variables are found, both a test of variance inflation factor variables and a test of tolerance are conducted in a second step.[170] In case the

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[167] GREENE (2008), p. 222; VON AUER (2007), p. 367. The criticism is extended by WALLENTIN/ÅGREN (2002), who test the power of the GOLDFELD/QUANDT (1965) test, the GLEJSER (1969) test, the PESARAN/TAYLOR (1999) test and the test proposed by WHITE (1980). The authors find that all tests can be applied while obtaining reasonable results but propose to devote particular attention to the application of the WHITE (1980) test as this test might lead to inappropriate results. [WALLENTIN/ÅGREN (2002), p. 209f.]

[168] See, for example, GODFREY (1996).

[169] BACKHAUS et al. (2003), p. 87; BAUR/FROMM (2004), p. 261; RUDOLF (2004), p. 37. This premise is examined through the BOX-LJUNG test in combination with the diagrams for autocorrelation and partial autocorrelation. Autocorrelation of the residual values can be reduced through a data transformation method [see SCHWAGER (1997, p. 369-371) for further information] but is not carried out in the present examination.

[170] BACKHAUS et al. (2003), p. 89f; BAUR/FROMM (2004), p. 263f; BROSIUS (2004), p. 588f; ECKSTEIN (2008), p. 197. As a consequence of multicollinearity, the inclusion or exclusion of a variable may considerably alter the magnitude of the regression coefficients. A further consequence of multicollinearity

results show multicollinearity between the independent variables, the orthogonalisation of the variables is performed as explained by PODDIG/DICHTL/PETERSMEIER (2003, p. 387).
Complementary to the calculation of the multiple regression model, a stepwise multiple regression analysis is conducted. In this model, the choice of an appropriate regression model is based on the statistical significance of the relationship between the dependent and the independent variables. Specifically, each of the independent variables is tested based on the significance of the F-statistic, which indicates whether or not the variable exhibits a significant relationship with the dependent variable.[171]

### 6.4.2 Results

Multiple regression analysis was employed to investigate the connection between REIT stock returns and the explanatory variables, which represent return figures and are listed in Figure 6.10. For this purpose, the nine monthly time intervals as well as the four quarterly time intervals described previously were used. The dependent and all independent variables represent data described both in Section 2.1 and in Section 6.1 that were converted into return figures as documented in Section 6.2.1.
The results of the analyses will be explained in two ways. First, the outcomes of the stepwise regression analysis when using stock market returns of single REIT entities are presented. Second, the significant connections between variables identified through a multiple regression analysis that employs returns on REIT portfolios are explained. To reduce the amount of reported data, only connections that exhibited a five percent level of significance were considered in the multiple regression analysis and in all of the following statistical analyses, unless stated otherwise.
In addition, the assumptions of the underlying regression models have been tested. Specifically, the independent variables had to be orthogonalised in the bulk of cases.

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relates to the observation that the coefficient of determination is significant albeit the individual regression coefficients are insignificant. [BACKHAUS et al. (2003), p. 89.]

[171] BACKHAUS et al. (2003), p. 104; BELLGARDT (2004), p. 145-154; BROSIUS (2004), p. 590-594.

# *Figure 6.10: Summary of the (significant) results of the stepwise regression analysis.*

| *Time interval* | Monthly | | | | Quarterly | | | |
|---|---|---|---|---|---|---|---|---|
| *Type of connection* | + | | - | | + | | - | |
| *Explained variable: REIT stock returns*<br>*Explanatory variables (calculated as returns)* | Share as of total number of significant connections | Number of significant connections | Share as of total number of significant connections | Number of significant connections | Share as of total number of significant connections | Number of significant connections | Share as of total number of significant connections | Number of significant connections |
| 1 CPI | 2.46% | 46 | 5.23% | 70 | 2.86% | 21 | 8.05% | 56 |
| 2 CPI excl. food and energy | 2.57% | 48 | 8.36% | 112 | 4.09% | 30 | 7.61% | 53 |
| 3 PPI | 3.42% | 64 | 3.81% | 51 | 4.37% | 32 | 2.87% | 20 |
| 4 Long-term interest rate (10 years) | 6.37% | 119 | 5.60% | 75 | 3.14% | 23 | 2.73% | 19 |
| 5 Short-term interest rate (3 months) | 4.28% | 80 | 6.80% | 91 | 4.77% | 35 | 1.58% | 11 |
| 6 Term structure of interest rates | 4.12% | 77 | 4.56% | 61 | 1.50% | 11 | 3.30% | 23 |
| 7 Level of total retail sales | 6.85% | 128 | 3.36% | 45 | 4.37% | 32 | 2.01% | 14 |
| 8 Level of consumer climate | 8.08% | 151 | 5.15% | 69 | 12.28% | 90 | 2.16% | 15 |
| 9 Level of the leading indicator | 12.25% | 229 | 3.21% | 43 | 19.37% | 142 | 1.15% | 8 |
| 10 Level of GDP | | | | | 3.27% | 24 | 7.76% | 54 |
| 11 Unemployment rate | 3.32% | 62 | 7.09% | 95 | 3.27% | 24 | 4.60% | 32 |
| 12 Level of ind. prod. | 3.53% | 66 | 3.81% | 51 | 3.82% | 28 | 5.75% | 40 |
| 13 Level of ind. prod.: construction | 0.64% | 12 | 0.75% | 10 | 0.27% | 2 | 0.43% | 3 |
| 14 Level of money supply: M1 | 3.80% | 71 | 3.29% | 44 | 3.00% | 22 | 2.30% | 16 |
| 15 Level of money supply: M3 | 2.68% | 50 | 6.95% | 93 | 1.50% | 11 | 5.03% | 35 |
| 16 National stock index | 11.66% | 218 | 2.91% | 39 | 3.41% | 25 | 5.89% | 41 |
| 17 Small cap stock index | 6.47% | 121 | 3.88% | 52 | 2.86% | 21 | 2.16% | 15 |
| 18 Dividend yield (national stock index) | 2.03% | 38 | 8.36% | 112 | 2.18% | 16 | 9.48% | 66 |
| 19 PER (national stock index) | 5.14% | 96 | 5.23% | 70 | 2.73% | 20 | 3.30% | 23 |
| 20 Bond performance index | 4.55% | 85 | 4.33% | 58 | 1.77% | 13 | 2.16% | 15 |
| 21 Level of total building permits | 2.62% | 49 | 4.11% | 55 | 4.09% | 30 | 2.59% | 18 |
| 22 Level of total building starts | 3.16% | 59 | 3.21% | 43 | 1.50% | 11 | 2.01% | 14 |
| 23 App.-based r. e. ind.: all properties | | | | | 0.82% | 6 | 7.76% | 54 |
| 24 App.-based r. e. ind.: apartments | | | | | 3.82% | 28 | 2.01% | 14 |
| 25 App.-based r. e. ind.: hotel | | | | | 0.41% | 3 | 0.00% | 0 |
| 26 App.-based r. e. ind.: office | | | | | 1.23% | 9 | 3.88% | 27 |
| 27 App.-based r. e. ind.: retail | | | | | 3.27% | 24 | 1.44% | 10 |
| Total number of significant connections | | **1869** | | **1339** | | **733** | | **696** |
| Highest value | **12.25%** | **229** | **8.36%** | **112** | **19.37%** | **142** | **9.48%** | **66** |
| Lowest value | **0.64%** | **12** | **0.75%** | **10** | **0.27%** | **2** | **0.00%** | **0** |
| Mean value | **4.76%** | **89** | **4.76%** | **64** | **3.70%** | **27** | **3.70%** | **26** |

*Source: Own calculations based on the total sample (218 REITs)*

*Note: A significant connection refers to a significant regression coefficient of the corresponding explanatory variable when using REIT stock returns as the explained variable.*

The increased occurrence of multicollinearity can be partly a result of the high number of independent variables included in the models. Moreover, very few models point to an increased autocorrelation of the error term or to heteroscedasticity.[172]
For the stepwise regression analysis, the significant connections between explanatory variables and REIT returns are summarised in Figure 6.10.
The total number of significant connections, implying significant regression coefficients, of monthly data exceeds that of quarterly data, as nine time periods including monthly data have been employed; in comparison, quarterly data are available over four periods. Irrespective of the use of data with monthly or quarterly time intervals, the number of significant positive relationships exceeds the number of significant negative relationships. Depending on the explanatory variable, the results show clear variations in terms of the number of significant connections.

Figure 6.11 ranks the explanatory variables in terms of the number of significant connections expressed as a share of the total number of significant connections.
Notably, returns on variables such as the leading indicator and the consumer climate show significant connections with REIT returns when employing data measured in both monthly and quarterly time intervals. The consumer climate variable shows a significant negative impact on the returns of several REITs. Although the number of positive connections clearly exceeds that of negative connections, there is some scepticism regarding the direction of the relationship between the consumer climate and REIT returns over time.
In addition, a positive connection between REIT returns and stock market returns was observed frequently. Considering that no unambiguous results were obtained regarding the relationship between REIT returns and the returns on appraisal-based direct real estate investment indices, REITs are probably connected with general stocks rather than being susceptible to returns generated in the direct real estate markets. In this regard, the findings of past research have begun to document that returns in direct real estate markets respond to REIT returns with a time lag.[173]

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[172] See Appendix 6.3 for results regarding monthly data of the time period starting in 1985 and ending in 2009.
[173] See, for example, SEILER/WEBB/MYER (1999, p. 180).

Similarly, the rankings in Figure 6.11 do not deliver clear results regarding the direction of the relationship between REIT returns and returns on different types of interest rates. Generally, the following assumptions about the relationship between REIT returns and interest rates can be made. First, an increase in interest rates may raise the costs of debt charged to a REIT. In this regard, a REIT exposed to a relatively high level of debt, and potentially also using variable-rate financing instruments, could suffer from a progression in interest rates. Second, rising interest rates may indicate increased economic growth, with upward-sloping inflation rates ultimately resulting in higher property rents and prices. Specifically, short-term interest rates tend to reflect monetary development and the intention of institutions to control economic activity or demand pressure. In contrast, long-term interest rates are supposed to mirror how the participants in the financial markets perceive the financing activities of the public authorities, inflation rate development, exchange rate stability and economic growth.[174]

### *Figure 6.11: Ranking of significant explanatory variables with REIT stock returns as the explained variable.*

| *Time interval* | | Monthly | | Quarterly | |
|---|---|---|---|---|---|
| *Type of connection* | | + | - | + | - |
| Ranking of explanatory variables (calculated as returns) | 1. | Level of the leading indicator | CPI excl. food and energy | Level of the leading indicator | Dividend yield (national stock index) |
| | 2. | National stock index | Dividend yield (national stock index) | Level of consumer climate | CPI |
| | 3. | Level of consumer climate | Unemployment rate | Short-term interest rate (3 months) | Level of GDP |
| | 4. | Level of total retail sales | Level of money supply: M3 | PPI | App.-based r. e. ind.: all properties |
| | 5. | Small cap stock index | Short-term interest rate (3 months) | Level of total retail sales | CPI excl. food and energy |
| | 6. | Long-term interest rate (10 years) | Long-term interest rate (10 years) | CPI excl. food and energy | National stock index |
| | 7. | PER (national stock index) | CPI | Level of total building permits | Level of industrial production |
| | 8. | Bond performance index | PER (national stock index) | Level of industrial production | Level of money supply: M3 |
| | 9. | Short-term interest rate (3 months) | Level of consumer climate | App.-based r. e. ind.: apartments | Unemployment rate |
| | 10. | Term structure of interest rates | Term structure of interest rates | National stock index | App.-based r. e. ind.: office |

*Source: Own calculations based on the total sample (218 REITs)*
*Notes: The ranking is performed in descending order based on the share of significant coefficients as of the total number of significant coefficients when considering the results of the stepwise regression analysis (see Figure 6.10).*

For data at monthly time intervals, both short- and long-term interest rates share positive as well as negative connections with REIT returns. For long-term interest rates, a preponderance of positive connections can be observed between 1990 and 1994 and from 2005 to 2009, whereas negative connections are primarily identified between 1995 and 2004. For short-term interest rates, remarkable differences between the numbers of observations with positive and with negative connections are

[174] Adapted from BROOKS/TSOCALOS/LEE (2000, p. 543-547).

observed. Specifically, the time period between 1995 and 1999 is characterised by a bulk of negative connections, whereas the time horizon beginning in 2000 and ending in 2004 exhibits a greater number of positive connections.
An increase in the term structure, equal to the difference between the yields on long-term and short-term government bonds, is typically associated with increases in investments, production and consumer spending.[175] In summary, no definite positive relationship was observed between REIT returns and the returns on the term structure of interest rates.

The continuous returns on the dividend yield corresponding to the national stock market exhibit a negative relationship with REIT returns in several cases. This finding may result from stock investors' favouring REIT investment due to its comparatively high dividend yield. A high level of regular dividend payments is ascertained as REITs are required to distribute the bulk of their earnings to shareholders. However, if the average dividend yield of general stocks increases, the advantage of a REIT in delivering a relatively high dividend yield dissolves. A second explanation relates to the assumption that a falling dividend yield represents an indicator of progression in economic activities.[176]

Furthermore, an increase in unemployment rates translates into a fall in REIT prices for a relatively large share of the sampled firms. Indeed, a rise in unemployment rates could negatively affect the demand from corporations for commercial space or from individuals for residential properties, which could ultimately lead to falling REIT prices.

In the past, some researchers argued that low PERs typically result in future increases in stock returns.[177] In this regard, low PERs pertaining to general stocks could relate to a higher attractiveness of a general stock investment in comparison to a REIT investment. However, if strong correlations between general stocks and REITs are observed, this relationship may not hold. Overall, the results illustrated in

[175] Adapted from BROOKS/TSOCALOS (2001, p. 718).
[176] Adapted from BROOKS/TSOCALOS/LEE (2000, p. 543).
[177] See, for example, BASU (1977) or JAFFE/KEIM/WESTERFIELD (1989).

Figure 6.11 do not show a distinct relationship between the PER of general stocks and REIT returns.

With regard to the money supply variables, it has been argued that an unexpected decrease or increase in the growth rate of money can ultimately result in a rebalancing of investor portfolios. In this sense, a positive connection between money supply and the level of stock prices has been hypothesised. Considering that the stock price is determined through the growth rate of dividends, the risk-free rate and the risk premium, the money supply should be positively related to the level and growth rate of dividends and negatively related to the remaining two variables. In this context, some evidence points to a negative relationship between REIT returns and the returns on money supply variables. In terms of general stocks, it has been argued that a decrease in the money supply leads to a rise in interest rates, a decrease in capital investments, a decline in the firm's sales and earnings and a reduction in dividends. However, considering that the main income source attached to a REIT comprises rents that are typically fixed through lease contracts, the effect of changes in money supply might occur with a time lag. Indeed, it has been hypothesised that the response of investors to changes in the monetary supply may occur with a time lag. Some evidence regarding the connection between the money supply and stock returns shows that the stock market is efficient in the sense that money supply information is incorporated not with the causality moving from money supply to stock returns but rather in a bi-directional relationship.[178]

With regard to the continuous returns on the consumer price index, the rental income generated by a REIT is often linked to the CPI. In this sense, it is supposed that an increase in the return on the consumer price index leads to a progression in rents and thus possibly possesses a positive connection with REIT returns. Indeed, a positive association between the returns on the CPI and stock returns has been observed in research on unsecuritised real estate assets.[179] However, significant negative relationships between REIT returns and the CPI returns, either comprising all items or

[178] ROGALSKI/VINSO (1977), p. 1017-1029. See HOMA/JAFFEE (1971, p. 1046f) for further information.

[179] See, for example, FAMA/SCHWERT (1977).

## *Figure 6.12: Ranking of the (significant) results of the regression analysis by country of origin (monthly time series).*

| *Explained variable: REIT stock returns* | *Country of origin* | Australia | | Belgium | | Canada | | France | | Nether-lands | | New Zealand | | South Africa | | Turkey | | United States | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Explanatory variables (calculated as returns)* | *Type of connection* | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - |
| 1 CPI | | 10 | 5 | 1 | 7 | 10 | 4 | 5 | | 4 | 4 | 6 | 5 | 10 | 6 | 1 | 2 | 14 | 1 |
| 2 CPI excl. food and energy | | 10 | 5 | 3 | 1 | 10 | 4 | 5 | | 11 | 1 | 6 | 5 | 10 | 12 | 4 | 1 | 14 | 2 |
| 3 PPI | | 10 | 5 | 1 | 7 | 4 | 4 | 5 | | 4 | 4 | 6 | 5 | 10 | 3 | 4 | 6 | 5 | 6 |
| 4 Long-term interest rate (10 years) | | 10 | 5 | 10 | 1 | 10 | 1 | 5 | | 4 | 4 | 6 | 5 | 10 | 1 | 4 | 6 | 3 | 7 |
| 5 Short-term interest rate (3 months) | | 6 | 1 | 10 | 1 | 10 | 1 | 1 | | 4 | 4 | 6 | 1 | 3 | 12 | 4 | 2 | 14 | 7 |
| 6 Term structure of interest rates | | 10 | 1 | 10 | 7 | 4 | 4 | 5 | | 11 | 11 | 6 | 5 | 10 | 6 | 4 | 6 | 5 | 7 |
| 7 Level of total retail sales | | 10 | 3 | 3 | 7 | 4 | 4 | 5 | | 2 | 4 | 1 | 5 | 3 | 12 | 4 | 6 | 5 | 17 |
| 8 Level of consumer climate | | 10 | 3 | 10 | 7 | 2 | 4 | 1 | | 4 | 11 | 2 | 5 | 3 | 12 | 4 | 6 | 4 | 7 |
| 9 Level of the leading indicator | | 6 | 5 | 3 | 1 | 4 | 4 | 1 | | 1 | 4 | 2 | 5 | 1 | 12 | 4 | 6 | 1 | 19 |
| 10 Unemployment rate | | 6 | 5 | 10 | 7 | 10 | 4 | 5 | | 11 | 11 | 6 | 5 | 10 | 12 | 4 | 6 | 10 | 7 |
| 11 Level of industrial production | | 10 | 5 | 3 | 1 | 10 | 4 | 5 | | 4 | 11 | 6 | 5 | 10 | 6 | 4 | 6 | 18 | 7 |
| 12 Level of industrial production: construction | | 10 | 5 | 3 | 7 | 10 | 4 | 5 | | 4 | 11 | 6 | 5 | 3 | 6 | 4 | 6 | 18 | 19 |
| 13 Level of money supply: M1 | | 6 | 5 | 10 | 7 | 10 | 4 | 5 | | 11 | 11 | 6 | 1 | 10 | 3 | 4 | 6 | 14 | 7 |
| 14 Level of money supply: M3 | | 2 | 5 | 10 | 7 | 4 | 4 | 5 | | 11 | 11 | 6 | 1 | 3 | 12 | 4 | 6 | 18 | 2 |
| 15 National stock index | | 1 | 5 | 3 | 7 | 1 | 4 | 1 | | 11 | 4 | 2 | 5 | 3 | 6 | 1 | 2 | 1 | 19 |
| 16 Small cap stock index | | 10 | 5 | 10 | 7 | 4 | 4 | 5 | | 11 | 11 | 6 | 5 | 10 | 12 | 4 | 6 | 5 | 17 |
| 17 Dividend yield (national stock index) | | 2 | 5 | 3 | 7 | 10 | 1 | 5 | | 11 | 3 | 6 | 5 | 10 | 6 | 4 | 2 | 18 | 2 |
| 18 PER (national stock index) | | 2 | 5 | 10 | 7 | 2 | 4 | 5 | | 11 | 1 | 6 | 5 | 10 | 3 | 1 | 6 | 10 | 7 |
| 19 Bond performance index | | 2 | 5 | 10 | 1 | 10 | 4 | 5 | | 2 | 11 | 2 | 5 | 2 | 12 | 4 | 6 | 5 | 7 |
| 20 Level of total building permits | | 10 | 5 | 10 | 7 | 10 | 4 | 5 | | 11 | 11 | 6 | 1 | 10 | 12 | 4 | 6 | 10 | 2 |
| 21 Level of total building starts | | 10 | 5 | 10 | 7 | 10 | 4 | 5 | | 11 | 11 | 6 | 5 | 3 | 1 | 4 | 6 | 10 | 7 |

*Source: Own calculations based on the total sample (218 REITs)*
*Notes: The ranking is performed in descending order based on the share of significant coefficients as of the total number of significant coefficients. The highest ranking corresponds to cells marked in red colour, the orange cells refer to the second highest rankings, and the yellow cells to the third highest rankings. The cells marked in grey colour indicate that no ranking was performed as none of the 21 variables did show a significant negative coefficient regarding returns of REITs domiciled in France.*

excluding food and the energy basket, can be observed with data in monthly and quarterly time intervals. Consequently, no inflation-hedging characteristic[180] can be ascertained in this study.

In a second step, the REITs included in the analysis were grouped according to both their country of origin and their property type specialisation or diversification. Taking limitations regarding the availability of market capitalisation figures into account, equally-weighted portfolios were compiled.
Figure 6.12 summarises the results of the regression analyses by ranking the number of significant connections between an explanatory variable and REIT returns, which is expressed as a share of the total number of significant relationships. In this sense, it should be noted that the limited availability of data impeded the ability to assign distinct ranking numbers.
For Australia, REITs seem to be susceptible to interest rate changes, with a negative impact of interest rates on REIT returns. Generally, the REITs headquartered in Australia historically showed a relatively low leverage ratio. However, the significant negative relationships between REIT returns and interest rates during the time periods between 1990 and 1994 and from 1995 to 1999 changed to significant positive relationships between 2000 and 2004. In contrast, the positive relationships with general stock market returns confirm the expectations discussed in the context of the stepwise regression analysis. However, the results regarding the dividend yield corresponding to the national stock index contradict the previous findings.
Similar to Australian firms, REITs domiciled in Belgium exhibit a comparatively low leverage ratio but show negative relationships between REIT stock returns and both short-term and long-term interest rates. In addition, there exists little evidence of an inflation hedging-capability of REITs domiciled in Belgium.
The relationships between Canadian REIT returns and both dividend yields and general stock market returns conform to the explanations provided in the context of the stepwise regression analysis. The negative connections with interest rates can be associated with the findings already discussed; i.e., that, in an inter-country compari-

[180] According to GANESAN/CHIANG (1998, p. 55), an "[…] asset is considered to be a hedge against expected (or unexpected) inflation when its returns move on a one-for-one basis with expected (or unexpected) inflation".

son, Canadian REITs exhibited the highest mean average book measures of leverage between 2004 and 2008.

The data obtained for REITs domiciled in France are restricted to monthly time series collected between 2005 and 2009. However, the significant impact of the national stock market, the consumer climate and the leading indicator on REIT returns correspond to the expectations previously described.

For REITs headquartered in the Netherlands, the projected impact of changes in dividend yields as well as the leading indicator on REIT returns is confirmed.

Similarly, REITs that originated either in New Zealand or in South Africa show a positive impact of the leading indicator as well as of variables indicating consumer behaviour, such as the consumer climate and retail sales on REIT returns.

Due to the restricted availability of data, the statistical relationships between variables describing Turkish REITs do not allow for expedient interpretation.

For REITs headquartered in the United States, the expectations of positive connections to the leading indicator and the general stock index variable were fulfilled. Similarly, the increased number of negative relationships between REIT returns and the dividend yield variable conforms to expectations. Apart from the absence of an inflation-hedging characteristic, there is little evidence that a change in the level of building permits is negatively associated with REIT returns. Potentially, a rise in building permits, thus increasing the supply in the future, might lead to a fall in the valuations of the real estate portfolio owned by the REIT.

In addition, Figure 6.13 presents the impacts of explanatory variables that were measured at quarterly time intervals only.

Specifically, GDP is frequently positively correlated with REIT returns (for Australia, Belgium and the Netherlands), although a negative relationship was detected in a few cases (i.e., Belgium, United States). Further, very few significant positive connections between returns on appraisal-based direct real estate indices and REIT stock prices was observed.

The main results of an examination of REITs according to their property sector classifications are summarised in Figure 6.14.

***Figure 6.13: Ranking of the (significant) results of the regression analysis by country of origin (quarterly time series).***

| *Explained variable: REIT stock returns* | *Country of origin* | Australia | | Belgium | | Canada | | Nether-lands | | New Zealand | | South Africa | | United States | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Explanatory variables (calculated as returns)* | *Type of connection* | + | - | + | - | + | - | + | - | + | - | + | - | + | - |
| 1 CPI | | 9 | 9 | | | | | | | 5 | 7 | | | | |
| 2 CPI excl. food and energy | | 9 | 9 | | | | | | | 5 | 7 | | | | |
| 3 PPI | | 9 | 9 | | | | | | | 5 | 1 | | | | |
| 4 Level of consumer climate | | | | | | | | | | 5 | 1 | 1 | 5 | | |
| 5 Level of GDP | | 3 | 9 | 1 | 3 | 8 | 4 | 1 | 10 | 5 | 7 | 6 | 5 | 10 | 1 |
| 6 Unemployment rate | | | | | | | | | | 5 | 7 | | | | |
| 7 Level of industrial production | | 9 | 2 | | | | | | | 5 | 7 | | | | |
| 8 Level of ind. prod.: construction | | 9 | 9 | | | | | | | 5 | 7 | | | | |
| 9 Level of total building starts | | 9 | 9 | | | | | | | 1 | 7 | | | | |
| 10 App.-based r. e. ind.: all properties | | | | | | | | | | | | | | 10 | 4 |
| 11 App.-based r. e. ind.: apartments | | | | | | | | | | | | | | 10 | 17 |
| 12 App.-based r. e. ind.: hotel | | | | | | | | | | | | | | 17 | 17 |
| 13 App.-based r. e. ind.: office | | | | | | | | | | | | | | 17 | 1 |
| 14 App.-based r. e. ind.: retail | | | | | | | | | | | | | | 4 | 17 |

*Source: Own calculations based on the total sample (218 REITs)*

*Notes: The ranking is performed in descending order based on the share of significant coefficients as of the total number of significant coefficients. The highest ranking corresponds to cells marked in red colour, the orange cells refer to the second highest rankings, and the yellow cells to the third highest rankings. Cells marked in grey colour indicate that the corresponding country-specific variable had not been available (see Appendix 6.1 for further information); the variable did not show a significant coefficient regarding REIT returns or the relationship between the variable and REIT returns had already been considered in the analysis of monthly returns (see Figure 6.12). To reduce complexity, the ranks of the variables available at quarterly time intervals have been included in the figure only while the ranks of the remaining variables, which have been already considered in the analysis of monthly time series, have been omitted.*

For REITs concentrated on the holding and management of apartment or land lease properties, the expected relationships between REIT returns and the general stock market index, the dividend yield and the level of total building starts were confirmed. In contrast, no reasonable conclusions could be drawn regarding the direction of the relationship between REIT returns and interest rates.

Except for neighbourhood shopping centres, REITs focusing on any type of retail properties exhibited positive relationships with the consumer climate and the leading indicator variable. Neighbourhood shopping centres may constitute an exception as these properties presumably represent the only retail type considered in this study that is heavily focused on the sale of convenience goods, which might be less affected by external influences. Nevertheless, some REITs concentrating on single-user retail, on community or on merchandise centres exhibited a negative relationship between REIT returns and the consumer climate.

Furthermore, some evidence leads to the assumption that the returns on office-focused REITs as well as on firms mainly holding industrial buildings are positively related to the leading indicator and are negatively related to the unemployment rate.

The attractiveness of self-storage properties could increase in a difficult market environment, potentially leading to higher stock returns, when homes are foreclosed upon and people must move to apartments with a smaller leasable area and store their remaining goods in a self-storage facility. However, the absence of a high number of significant negative relationships between variables reflecting the current state of the economy and REITs prevents verification of this hypothesis.

In addition, Appendix 6.4 summarises the results obtained when using explanatory variables that are available at quarterly time intervals only. Notably, no explicit results regarding the direction of the relationship between appraisal-based direct real estate investment returns and REIT returns were observed. This finding was obtained even though data on the appraisal-based returns of specific property types were collected. Furthermore, the directional relationship between REIT returns and the GDP variable differs across the categorised firms, with no distinct results.

Overall, the results document that the REIT returns are connected with the development of general stocks. The development of the underlying real estate assets, approximated through appraisal-based real estate indices, does not directly translate

## *Figure 6.14: Ranking of the (significant) results of the regression analysis by property sector classification (monthly time series).*

| *Explained variable: REIT stock returns* / *Property sector allocation* | Apart-ments | | Commu-nity centres | | Free stan-ding | | Health care | | Indus-trial | | Land lease | | Lodging and resorts | | Merch-andise centres | | Neigh-borhood centres | | Offices | | Self-storage | | Special-ty | | Diversi-fied | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Explanatory variables (calculated as returns)* / *Type of connection* | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - |
| **1 CPI** | 13 | 2 | 16 | 1 | 14 | 5 | 9 | 7 | 19 | 12 | 10 | 2 | 13 | 4 | 19 | 3 | 9 | 14 | 8 | 2 | 13 | 11 | 5 | 4 | 18 | 11 |
| **2 CPI excl. food and energy** | 13 | 2 | 12 | 3 | 19 | 1 | 14 | 1 | 9 | 6 | 10 | 1 | 13 | 4 | 14 | 4 | 15 | 14 | 18 | 2 | 13 | 1 | 5 | 4 | 15 | 7 |
| **3 PPI** | 8 | 18 | 2 | 15 | 6 | 15 | 4 | 1 | 9 | 19 | 3 | 12 | 3 | 10 | 2 | 10 | 15 | 14 | 15 | 6 | 8 | 2 | 5 | 4 | 18 | 11 |
| **4 Long-term interest rate (10 years)** | 5 | 2 | 6 | 3 | 1 | 15 | 4 | 14 | 17 | 2 | 3 | 12 | 2 | 10 | 5 | 4 | 9 | 7 | 15 | 6 | 8 | 11 | 5 | 4 | 1 | 4 |
| **5 Short-term interest rate (3 months)** | 7 | 7 | 16 | 15 | 9 | 2 | 17 | 1 | 2 | 6 | 1 | 2 | 13 | 2 | 9 | 4 | 9 | 2 | 8 | 16 | 13 | 2 | 1 | 4 | 5 | 17 |
| **6 Term structure of interest rates** | 11 | 7 | 12 | 10 | 1 | 11 | 9 | 7 | 9 | 6 | 10 | 12 | 13 | 4 | 9 | 10 | 15 | 1 | 3 | 6 | 1 | 11 | 5 | 4 | 9 | 3 |
| **7 Level of total retail sales** | 8 | 13 | 2 | 3 | 6 | 5 | 4 | 14 | 4 | 12 | 3 | 2 | 5 | 10 | 5 | 16 | 4 | 2 | 3 | 10 | 1 | 11 | 1 | 4 | 1 | 4 |
| **8 Level of consumer climate** | 3 | 7 | 1 | 3 | 1 | 5 | 9 | 7 | 19 | 2 | 10 | 2 | 8 | 1 | 2 | 1 | 4 | 7 | 3 | 2 | 1 | 2 | 5 | 1 | 1 | 11 |
| **9 Level of the leading indicator** | 2 | 13 | 2 | 15 | 1 | 11 | 1 | 20 | 1 | 19 | 1 | 12 | 1 | 19 | 2 | 10 | 4 | 2 | 2 | 16 | 1 | 8 | 1 | 4 | 1 | 7 |
| **11 Unemployment rate** | 13 | 7 | 6 | 10 | 6 | 3 | 4 | 11 | 9 | 1 | 10 | 2 | 13 | 4 | 14 | 4 | 1 | 7 | 8 | 1 | 1 | 11 | 1 | 4 | 18 | 11 |
| **12 Level of ind. prod.** | 13 | 7 | 16 | 10 | 19 | 11 | 17 | 1 | 6 | 12 | 10 | 12 | 8 | 4 | 5 | 10 | 4 | 14 | 12 | 10 | 13 | 8 | 5 | 4 | 9 | 17 |
| **13 Level of ind. prod.: construction** | 20 | 18 | 16 | 15 | 9 | 20 | 14 | 20 | 19 | 19 | 10 | 12 | 19 | 19 | 19 | 16 | 15 | 14 | 18 | 16 | 13 | 11 | 5 | 4 | 9 | 11 |
| **14 Level of money supply: M1** | 13 | 13 | 16 | 1 | 9 | 15 | 9 | 11 | 9 | 12 | 3 | 12 | 8 | 19 | 9 | 16 | 1 | 2 | 15 | 16 | 13 | 2 | 5 | 4 | 13 | 17 |
| **15 Level of money supply: M3** | 11 | 2 | 12 | 3 | 9 | 15 | 17 | 1 | 6 | 6 | 3 | 12 | 8 | 4 | 14 | 4 | 9 | 14 | 18 | 10 | 8 | 11 | 5 | 4 | 13 | 4 |
| **16 National stock index** | 1 | 13 | 2 | 15 | 1 | 20 | 2 | 14 | 2 | 12 | 3 | 2 | 3 | 10 | 1 | 16 | 9 | 7 | 1 | 10 | 1 | 11 | 5 | 4 | 5 | 7 |
| **17 Small cap stock index** | 5 | 18 | 6 | 15 | 14 | 15 | 9 | 14 | 6 | 12 | 3 | 12 | 5 | 10 | 5 | 16 | 1 | 14 | 12 | 21 | 1 | 11 | 5 | 4 | 15 | 21 |
| **18 Dividend yield (national stock index)** | 20 | 1 | 12 | 3 | 14 | 3 | 17 | 6 | 9 | 2 | 10 | 2 | 13 | 2 | 19 | 10 | 4 | 7 | 3 | 6 | 8 | 8 | 5 | 1 | 9 | 1 |
| **19 PER (national stock index)** | 3 | 18 | 6 | 10 | 19 | 5 | 3 | 14 | 9 | 6 | 10 | 2 | 8 | 10 | 14 | 4 | 15 | 14 | 18 | 2 | 13 | 2 | 5 | 1 | 8 | 2 |
| **20 Bond performance index** | 8 | 13 | 6 | 15 | 9 | 5 | 4 | 14 | 4 | 5 | 10 | 12 | 19 | 10 | 9 | 10 | 15 | 2 | 8 | 10 | 8 | 11 | 5 | 4 | 5 | 7 |
| **21 Level of total building permits** | 13 | 7 | 16 | 3 | 14 | 5 | 14 | 7 | 17 | 6 | 10 | 2 | 19 | 10 | 14 | 1 | 9 | 7 | 3 | 10 | 13 | 2 | 5 | 4 | 15 | 11 |
| **22 Level of total building starts** | 13 | 2 | 6 | 10 | 14 | 11 | 17 | 11 | 9 | 12 | 10 | 2 | 5 | 10 | 9 | 16 | 15 | 7 | 12 | 16 | 13 | 11 | 5 | 4 | 18 | 17 |

*Source: Own calculations based on the total sample (218 REITs)*

*Notes: The ranking is performed in descending order based on the share of significant coefficients as of the total number of significant coefficients The highest ranking corresponds to cells marked in red colour, the orange cells refer to the second highest rankings, and the yellow cells to the third highest rankings.*

into REIT returns. Furthermore, the connections between REIT returns and the dividend yield on general stocks indicate that a REIT investment is benchmarked against general stock investments rather than against direct real estate investments. An exceptionally large explanatory power has been identified for the leading indicator variable. Accordingly, REITs seem to be affected by the expected future state of the economy. Although a considerable share of significant connections between returns on interest rates and REIT returns was observed, the direction of the relationship varies between countries of origin, property sector classifications and time horizons. It is probable that the influence on the cost of financing and the general economic projections inherent in the development of interest rates interfere with each other.

The results of the multiple regression analysis delivered further insights regarding the research sub-question asking for the factors that probably possess a high influence on the intrinsic value of a REIT. Accordingly, the components of the new REIT valuation approach, which are discussed in the following chapters, should consider the influence of the leading indicator and the general stock market return variable rather than direct real estate returns approximated through returns on appraisal-based real estate indices. If the development of the general stock market is not considered within the new valuation approach, the previous results as well as the review of the NAV approach indicate that large deviations between the intrinsic value of a REIT and REIT stock prices may occur even over the long-term.

## 6.5 Vector autoregressive models

The application of multiple-equation models requires the determination of both exogenous and endogenous variables. SIMS (1980)[181] argues that the determination of exogenous variables is often not based on solid economic or statistical arguments. Further, he points to economic theory's weak support of decision-making regarding the inclusion of variables in the model. The author observes that little attention is paid to the economic structure of a model when restrictions have to be defined. Rather, he believes that users of macro-econometric models often modify the results

[181] See SIMS (1972, 1980, 1981) for further information.

through ex-post decisions, which distorts the comparability between findings obtained from different researchers.[182]
Based on these considerations, SIMS (1980) introduced a model without an ex ante restriction regarding the data-generation process. In this model, the exogenous variables are arranged in a column vector. The dynamic development of all variables is based on their respective historical values. Historical values possessing the same lag are assigned to the same vector. As a result, there exists a time series with values as vectors, which is denominated as a vector autoregressive (VAR) model. This model represents a multivariate generalisation of the univariate AR*(p)* model considered before.[183]
In addition to the statistical approaches carried out until now, the VAR-based calculations deliver insight regarding lagged relationships between REIT returns and the variables listed in Figure 6.1. The VAR model should contribute further explanations to answering the research sub-question of which factors probably possess a high influence on the intrinsic value of a REIT. Specifically, the VAR model serves two functions: First, the model helps to investigate the forecasting ability of the variables used in the course of the multiple regression model. Second, the responses of REIT returns to shocks of the variables are identified and investigated. One requirement regarding the new approach to REIT valuation refers to delivering an assessment of the long-term profitability of the REIT instead of relying on past or present information only. In this context, the results of the tests explained in the following could deliver valuable insights regarding the power of variables to influence the future profitability of a REIT that should be considered in the calculations of the cash flows and discount rates of the new approach which are discussed in the following chapters.

### 6.5.1 Methodology of vector autoregressive models

In the following, the characteristics associated with the VAR approach are specified.

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182 CANOVA (1999), p. 77f; HACKL (2008), p. 368; SIMS (1980).
183 ASSENMACHER (2002), p. 287; WAGATHA (2005), p. 29f.

Two variables, $Y_1$ and $Y_2$, with their temporal development dependent on the values of the previous period, are considered. In this case, the following two-dimensional[184] VAR model of order one[185] can be established:

$$Y_{1t} = \beta_{10} + \beta_{11}Y_{1,t-1} + \beta_{12}Y_{2,t-1} + u_{1t} \qquad \textbf{(6.6)}$$

$$Y_{2t} = \beta_{20} + \beta_{21}Y_{1,t-1} + \beta_{22}Y_{2,t-1} + u_{2t}$$

Although the error terms $u_{1t}$ and $u_{2t}$ might be correlated in case of the same time-reference of the data, each one represents a random process with $E(u_{1t})=E(u_{2t})=0$.[186] Given simultaneously correlated covariances, the following holds:

$$cov(u_{1t},u_{2t})\neq 0 \qquad \textbf{(6.7)}$$ [187]

where

$$t = 1,\ldots, T$$

Generally, a VAR model of order $p$ with $g$ dimensions can be written as follows:

$$Y_t = \beta_0 + B_1Y_{t-1} + B_2Y_{t-2} + \ldots + B_pY_{t-p} + u_t \qquad \textbf{(6.8)}$$ [188]

The factor realisations occurring in $t$ are explained through the historical values of the factor as well as through the $k-1$ other factors. The number of $k$ relevant time series is described by means of the $(k\times 1)$ vector $Y_t=(Y_{1t},\ldots, Y_{kt})'$. This vector represents a function of lagged factor values that itself is weighted by the coefficients of the $(k\times k)$ matrices $B_1$ to $B_p$. Additionally, the function possesses a $(k\times 1)$ vector $\beta_0=(\beta_{10},\ldots, \beta_{k0})'$. The unexpected factor realisations are captured through the resid-

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[184] The dimension equals the number of variables. [ASSENMACHER (2002), p. 287.]
[185] The order relates to the maximum number of lags pertaining to the Y-variables. [ASSENMACHER (2002), p. 287; STROHE/ACHSANI (2005), p. 110.]
[186] ASSENMACHER (2002), p. 287.
[187] ASSENMACHER (2002), p. 287.
[188] ASSENMACHER (2002), p. 287; HAMILTON (1994), p. 291.

ual terms $u_t$.[189] Accordingly, the equation includes a k-dimensional white noise or innovation process of the residual terms $u_t=(u_{1t}, ..., u_{kt})'$[190].
In terms of the model specification, a very small process order may lead to inefficient estimators, whereas a large process order or the inclusion of an additional factor requires the estimation of a larger number of parameters, thus reducing the number of degrees of freedom. The lag length $p$ can be determined by means of information criteria. As a major criterion, the AIC has been suggested for use with several forms of the VAR model and is employed in the present examination as well.[191]
In addition, the VAR model demands that the underlying time series be stationary, which was tested through the point-optimal unit root test and, if necessary, non-stationarity corrected using the ARIMA model discussed previously.[192]

### 6.5.2 Assessment

The application of the VAR model in the present examination entails a balancing of advantages and disadvantages.
A major advantage of the VAR model is its relatively simple estimation by means of single equations. Furthermore, the model provides considerable system simulation capabilities as it captures the mutual dependencies between variables. Consequently, the VAR model should deliver results that extend those obtained with previous analyses. A VAR model does not consider an economic theory or assumptions about the interdependency of variables, thus being conducive to multivariate analysis. Instead, all variables being treated as exogenous. In contrast to common macro-

[189] OPFER (2004), p. 215; WAGATHA (2005), p. 30. The vector $\beta_0$ allows for the possibility of a non-zero mean $E(Y_t)$. [LÜTKEPOHL (2007), p. 9.]
[190] In this case, the following assumptions should hold: $E(u_t)=0$, $E(u_t u_t')=\sum_u$ and $E(u_t u_t')=0$ for $s\neq t$. If not stated otherwise, a non-singularly covariance matrix $\sum_u$ is assumed. [HAMILTON (1994), p. 257f; LÜTKEPOHL (2007), p. 9f.]
[191] HERRMANN (2005), p. 99; OPFER (2004), p. 215; WINKLER (2002), p. 229. Considering the AIC, the SIC, the Posterior Information Criterion (PIC) suggested by PHILLIPS (1994), and the AIC together with the SIC both modified by KEATING (1995), OZCICEK/McMILLIN (1999, p. 522-524) find that there exists no general preference for a lag selection technique in case of uncertainty about the lag length and the symmetry or asymmetry of lags. On the basis of an uncertainty about the symmetry and the length of lags, the results partly suggest the use of the AIC. [OZCICEK/McMILLIN (1999), p. 524.] Additionally, GREDENHOFF/KARLSSON (1999, p. 171) find that the AIC performs well in most cases.
[192] STROHE/ACHSANI (2005), p. 110.

econometric models, the researcher's knowledge is only required for the selection and, if necessary, the transformation of variables.[193]

Although the VAR model does not entail theoretical restrictions, limitations are imposed due to the choice of variables associated with the rapid-growing number of regressors. Additionally, a VAR model can show sensitivity towards the order of variables, the choice of the method for trend removal, different lag lengths or alternative levels of temporarily aggregated data.[194] Finally, several authors have called the usefulness of the VAR model when characterising the dynamics of data into question.[195]

### 6.5.3 Methodological approach

The VAR model was utilised in the following two analyses.

First, the VAR model was used to investigate whether the explanatory variables introduced recently are able to forecast REIT returns. The GRANGER (1969) causality test was employed to determine whether a lagged variable *X* shows a certain ability to forecast a variable *Y*.[196] Assuming a lag length *p*, the following autoregressive distributed lag model was estimated through the ordinary least squares (OLS) method:

$$Y_t = \beta_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_p Y_{t-p} + \gamma_1 X_{t-1} + \gamma_2 X_{t-2} + \ldots + \gamma_p X_{t-p} + u_t \quad \textbf{(6.9)}$$ [197]

Subsequently, the calculation of the F-statistic was accomplished to examine the null hypothesis $H_0$: $\gamma_1=\gamma_2=\ldots=\gamma_p=0$ against the hypothesis $H_1$: $\gamma_i \neq 0$ (for at least one *i*).[198] Consecutively, the sum of the squared residuals of Formula 6.9[199] was compared

[193] ASSENMACHER (2002), p. 287; HERRMANN (2005), p. 99; WAGATHA (2005), p. 29f.
[194] ASSENMACHER (2002), p. 288; SPENCER (1989), p. 452; WAGATHA (2005), p. 30.
[195] See, for example, RUNKLE (1987, p. 442) or SPENCER (1989, p. 453).
[196] STROHE/ACHSANI (2005), p. 110. This type of test was introduced by GRANGER (1969) and further refined by SIMS (1972).
[197] HAMILTON (1994), p. 304; STROHE/ACHSANI (2005), p. 110.
[198] STROHE/ACHSANI (2005), p. 110.
[199] The sum of the squared residuals takes the following form:

$$RSS_1 = \sum_{t=1}^{T} \hat{u}_t^2$$

with the sum of the squared residuals of a univariate autoregression for $Y_t$[200]. If $S_1$ of the following function,

$$S_1 = \frac{\dfrac{(RSS_0 - RSS_1)}{p}}{\dfrac{RSS_1}{(T-2p-1)}} \qquad \textbf{(6.10)}^{201}$$

exceeds the 5% critical value for an *F(p, T-2p-1)* distribution, the null hypothesis $H_0$ can be rejected. The rejection of $H_0$ implies that *X* Granger-causes *Y*.[202]

Second, the VAR model was applied for the analysis of dynamic responses to shocks in the system, which is called impulse response analysis. Impulse response analysis investigates the effect of a unit shock to a variable on the changes in other variables in future periods.[203]

The VAR model introduced in Equation 6.8 can be transformed into its infinity moving average representation, given as follows:

$$Y_t = \sum_{k=0}^{\infty} M_k u_{t-k} \qquad \textbf{(6.11)}$$

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[HAMILTON (1994), p. 304.]

[200] The univariate autoregression for $Y_t$ can be expressed as:

$$Y_t = \beta_0 + \lambda_1 Y_{t-1} + \lambda_2 Y_{t-2} + \ldots + \lambda_p Y_{t-p} + e_t .$$

with the sum of the squared residuals calculated in the following form:

$$RSS_0 = \sum_{t=1}^{T} \hat{e}_t^2$$

[HAMILTON (1994), p. 304.]

[201] HAMILTON (1994), p. 305.

[202] HAMILTON (1994), p. 305. $S_1$ would consist of an exact *F*-distribution for a regression with Gaussian disturbances and fixed regressors. However, as the Granger causality regressions have lagged dependent values, an asymptotically equivalent test is given by:

$$S_2 = \frac{T(RSS_0 - RSS_1)}{RSS_1}$$

The null hypothesis that *X* does not Granger-cause *Y* is rejected if $S_2$ is greater than the 5% critical values for a $\chi^2(p)$-variable. [HAMILTON (1994), p. 304f.]

[203] LÜTKEPOHL (2007), p. 43; STROHE/ACHSANI (2005), p. 111.

The *i,j*-th component of the matrix $M_k$ represents the response of the *i*-th variable to a shock in the *j*-th variable after *k* periods, assuming that the elements of the error vector $u_t$[204] are orthogonal.[205] As the elements of the error vector $u_t$ might be contemporaneously correlated, they can be transformed by choosing a lower triangular matrix $Q$[206] and obtaining orthogonalised innovations *e* from $u=Qe$. Transforming Equation 6.11 through orthogonalised innovations with $P_k=M_kQ$ results in the following model:

$$Y_t = \sum_{k=0}^{\infty} P_k e_{t-k} \qquad \textbf{(6.12)}$$ [207]

The *i,j*-th component of the matrix $P_k$ represents the impulse response of the *i*-th variable in *k* periods to a shock of one standard error in the *j*-th variable.[208]
The results of the analyses of the forecasting ability of variables as well as those of shocks are outlined in the following section.[209]

### 6.5.4 Results

Both the Granger causality test and the impulse response analysis were applied to the dataset used within the regression analysis which has been distinguished according to the country of origin. The results of the Granger causality test are summarised in Figure 6.15 for data measured in monthly time intervals and in Figure 6.16 for time series measured in quarterly data intervals. In addition, the outcomes from the

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204 In this context, the error vector $u_t$ reflects forecasting errors or so-called innovations, which can be expressed as:

$$u_t = Y_t - P[Y_t | Y_{t-1}, Y_{t-2}, \ldots]$$

with *P* representing the linear least squares projection of $Y_t$ in the space spanned by $[Y_{t-1}, Y_{t-2}, \ldots]$. [EUN/SHIM (1989), p. 244; STROHE/ACHSANI (2005), p. 111.]

205 EUN/SHIM (1989), p. 244; STROHE/ACHSANI (2005), p. 111.

206 In this case, the transformed innovation *e(t)* possesses an identity covariance matrix with *Euu'=S* and *QQ'=S*. [EUN/SHIM (1989), p. 244 & 254f; STROHE/ACHSANI (2005), p. 111.]

207 EUN/SHIM (1989), p. 244; STROHE/ACHSANI (2005), p. 111.

208 STROHE/ACHSANI (2005), p. 111. This shock is usually present in the form of a standard error. [STROHE/ACHSANI (2005), p. 111.]

209 In addition, the appendices summarise results pertaining to the time period between 1985 and 2009 with regard to the VAR model (Appendix 6.5), the Granger causality test (Appendix 6.6) and the impulse response analysis (Appendix 6.7).

impulse response analysis are illustrated in Figure 6.17 for monthly data, whereas the results of using quarterly data did not contribute to a considerable increase in insights but are included in Appendix 6.8. For the impulse response analysis, the bulk of significant relationships were observed in the first month or in the first quarter following the shock.[210]

With regard to monthly data on REITs domiciled in Australia, the Granger causality test indicated that both the leading indicator and the national stock index showed the most frequent significant results implying a relatively high forecasting ability concerning REIT returns.

Referring to the impulse response analysis corresponding to the time period between 1990 and 2009, the leading indicator has a significant positive effect on REIT returns in the second month. The previous finding, that the leading indicator affects REIT returns, is confirmed in the context of shocks leading to dynamic responses by REIT returns. Additionally, an unanticipated increase in the stock market was found to have a positive and significant effect on REIT returns during three time periods when considering monthly data.

Concerning monthly data of REITs domiciled in Belgium, no dominance of a certain variable in terms of Granger-causing REIT returns was observed. Instead, several explanatory variables, such as the leading indicator, short-term interest rates, the producer price index, the term structure of interest rates and the bond performance index Granger-cause REIT returns. Interestingly, the Granger relationships were all confined to the time period between 1995 and 2009. The impulse response analysis shows some evidence of both long-term interest rates and the level of retail sales, provoking a negative response of REIT returns. Similarly to Australian REITs, positive relationships with the national stock index are observed. Additionally, a negative response to an unexpected change in the dividend yield variable leads to the assumption that investors benchmark REIT investments against general stock investments.

[210] Specifically, 205 significant connections have been observed with the first month or quarter whereas 50 significant relationships have been identified with other months or quarters.

## *Figure 6.15: Number of significant relationships with REIT stock returns obtained from the Granger causality test (monthly time series).*

| | *Exogeneous variables (calculated as returns)* | Total: Number | Total: As a share of all relation-ships | Austra-lia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa | Turkey | United States |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CPI | 5 | 4.90% | | 1 | | | | 1 | | | 2 | | 1 |
| 2 | CPI excl. food and energy | 6 | 5.88% | | | 1 | | | 2 | | | | 1 | 2 |
| 3 | PPI | 2 | 1.96% | | 1 | 1 | | | | | | | | |
| 4 | Long-term interest rate (10 years) | 3 | 2.94% | 1 | | 1 | | | | | | | | 1 |
| 5 | Short-term interest rate (3 months) | 7 | 6.86% | 1 | 1 | 2 | | | | | 1 | | | 2 |
| 6 | Term structure of interest rates | 5 | 4.90% | | 1 | 2 | | | 1 | 1 | | | | |
| 7 | Level of total retail sales | 3 | 2.94% | | | | | | 2 | 1 | | | | |
| 8 | Level of consumer climate | 3 | 2.94% | | | 1 | | | 1 | | | 1 | | |
| 9 | Level of the leading indicator | 11 | 10.78% | 2 | 1 | 3 | 1 | | 2 | | | | | 2 |
| 11 | Unemployment rate | 5 | 4.90% | 1 | 1 | 1 | | | | | | | | 2 |
| 12 | Level of industrial production | 7 | 6.86% | | 1 | 1 | | | | | | 1 | 1 | 3 |
| 13 | Level of ind. prod.: construction | 1 | 0.98% | | 1 | | | | | | | | | |
| 14 | Level of money supply: M1 | 7 | 6.86% | 1 | | 2 | | 1 | | | | 2 | 1 | |
| 15 | Level of money supply: M3 | 4 | 3.92% | 1 | | | | | | 1 | | 1 | 1 | |
| 16 | National stock index | 8 | 7.84% | 2 | | 1 | | | | 1 | 1 | | | 3 |
| 17 | Small cap stock index | 0 | 0.00% | | | | | | | | | | | |
| 18 | Dividend yield (national stock index) | 6 | 5.88% | | 1 | | | | 2 | | 1 | | | 2 |
| 19 | PER (national stock index) | 7 | 6.86% | 1 | 1 | 1 | | | 1 | 1 | | 1 | | 1 |
| 20 | Bond performance index | 7 | 6.86% | | 1 | 2 | | | 2 | 1 | | 1 | | |
| 21 | Level of total building permits | 4 | 3.92% | | 1 | | | | | 1 | | | | 2 |
| 22 | Level of total building starts | 1 | 0.98% | | | 1 | | | | | | | | |
| Total | | **102** | | **10** | **12** | **20** | **1** | **1** | **14** | **7** | **3** | **9** | **4** | **21** |

*Source: Own calculations based on the total sample (218 REITs)*
*Notes: The ranking is performed in descending order based on the share of significant connections (i.e., rejecting the null hypothesis that the respective variable calculated as returns and listed in the second column of the same row as the ranking number does not Granger-cause REIT stock returns) as of the total number of significant connections. The highest ranking corresponds to cells marked in red colour, the orange cells refer to the second highest rankings, and the yellow cells to the third highest rankings. Cells marked in grey colour indicate that the corresponding country-specific variable did not show a significant connection regarding REIT returns.*

In the context of REITs originating in Canada, the leading indicator Granger-causes REIT returns most frequently. In terms of the impulse response analysis, the leading indicator variable shows a significant positive effect on REIT returns in the second month over a time period comprising monthly time intervals between 2005 and 2009.

Apart from the leading indicator, the second rank in terms of frequency of Granger relationships corresponds to money supply M1, the bond performance index, the term structure of interest rates and short-term interest rates.

Although only data between 2005 and 2009 were considered when analysing REITs domiciled in France, only the leading indicator variable Granger-causes REIT returns. An unexpected change in the producer price index leads to a significant positive relationship in month two.

***Figure 6.16: Number of significant relationships with REIT stock returns obtained from the Granger causality test (quarterly time series).***

| *Exogeneous variables (calculated as returns)* / *Country of origin* | Australia | Belgium | Canada | Nether-lands | New Zealand | South Africa | Turkey | United States |
|---|---|---|---|---|---|---|---|---|
| 1 CPI | 0 | | | | 0 | | 0 | |
| 2 CPI excl. food and energy | 0 | | | | 0 | | 0 | |
| 3 PPI | 1 | | | | 0 | | 0 | |
| 4 Level of consumer climate | | | | | 0 | 0 | 0 | |
| 5 Level of GDP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 6 Unemployment rate | | | | | 0 | | 0 | |
| 7 Level of industrial production | 0 | | | | 0 | | | |
| 8 Level of ind. prod.: construction | 1 | | | | 0 | | 0 | |
| 9 Level of total building permits | | | | | | | 0 | |
| 10 Level of total building starts | 1 | | | | 0 | | 0 | |
| 11 Appraisal-based r. e. ind.: all properties | | | | | | | | 1 |
| 12 Appraisal-based r. e. ind.: apartments | | | | | | | | 0 |
| 13 Appraisal-based r. e. ind.: hotel | | | | | | | | 0 |
| 14 Appraisal-based r. e. ind.: office | | | | | | | | 1 |
| 15 Appraisal-based r. e. ind.: retail | | | | | | | | 0 |

*Source: Own calculations based on the total sample (218 REITs)*

*Notes: Cells marked in grey colour indicate that the corresponding country-specific variable had not been available (see Appendix 6.1 for further information) or the relationship between the variable and REIT returns had already been considered in the analysis of monthly returns (see Figure 6.15). A significant connection implies rejecting the null hypothesis that the respective variable calculated as returns and listed in the second column of the same row as the ranking number does not Granger-cause REIT stock returns.*

When examining REITs domiciled in Japan, solely money supply M1 exhibits a Granger relationship with REIT returns. In addition, the application of the impulse response analysis revealed that unexpected changes in both the consumer climate and the total retail sales are positively connected with REIT returns. Importantly, three of the thirteen Japanese REITs focus their investments on merchandise centres.

Each of the four different variables, namely core inflation, total retail sales, the leading indicator, the dividend yield and bond performance, Granger-caused the returns of Dutch REITs in two cases. An unexpected change in core inflation had a significant negative impact on REIT returns in month one over the time period between 1990 and 1994 and from month one to month three with regard to the time period from 1990 until 2009. An unexpected change in the leading indicator variable led to a significant positive impact from the first until the second month when using data ranging from 2005 until 2009. A shock in the dividend yield variable leads to a negative change in REIT returns in month one when considering time spans between 1990 and 1994, from 2005 until 2009 and, when quarterly data were considered, for two time periods. A significant negative effect was related to the PPI, whereas a shock in either the total retail sales or the consumer climate variable was positively connected with REIT returns.
An increase in consumption may lead to higher REIT returns. Although the bulk of sampled firms domiciled in the Netherlands hold portfolios diversified across property types, these firms own retail properties to a considerable extent.

For firms headquartered in New Zealand, seven variables appear to Granger-cause REIT returns. Remarkably, six of the seven explanatory variables were found to Granger-cause REIT returns over the time period between 1995 and 2009. Notably, a shock in the leading indicator variable led to a positive change in REIT returns regarding three time horizons.

Analysing a time horizon between 2005 and 2009 with REITs headquartered in Singapore, three variables were identified to Granger-cause REIT returns. The variables are short-term interest rates, the general stock market and the dividend yield corresponding to the national stock index.

# *Figure 6.17: Number of significant relationships with REIT stock returns obtained from the impulse response analysis (monthly time series).*

| | Total | | Australia | | Belgium | | Canada | | France | | Japan | | Netherlands | | New Zealand | | Singapore | | South Africa | | Turkey | | United States | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Exogeneous variables (calculated as returns)* | Number | Share of the total number of relationships | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - | + | - |
| 1 CPI | 9 | 4.43% | | | 2 | | | | | | | | 1 | 2 | | | | | 1 | | | 1 | | 2 |
| 2 CPI excl. food and energy | 5 | 2.46% | | | | | | | | | | | | 2 | | | | | | | | | | 3 |
| 3 PPI | 9 | 4.43% | | | | | 1 | | 1 | | | | | 3 | | | 1 | | | | | | 1 | 2 |
| 4 Long-term interest rate (10 years) | 12 | 5.91% | | 2 | | 2 | | 1 | | | | | | 1 | 1 | | | | 1 | 1 | | | 1 | 2 |
| 5 Short-term interest rate (3 months) | 8 | 3.94% | | | | 1 | | | 1 | | | | 1 | | 1 | | | | | 1 | | | 1 | 2 |
| 6 Term structure of interest rates | 7 | 3.45% | 1 | 1 | | | | | | | | | | 1 | 1 | 1 | | | | | | | | 2 |
| 7 Level of total retail sales | 9 | 4.43% | | 2 | | 2 | 1 | | | | 1 | | 2 | | | | | | | | | | 1 | |
| 8 Level of consumer climate | 10 | 4.93% | 1 | 1 | | | | 1 | | | 1 | | 2 | | | 1 | | | 2 | | 1 | | | |
| 9 Level of the leading indicator | 18 | 8.87% | 2 | | 2 | | 1 | | 1 | | | | 1 | | 3 | | | | 2 | | | 1 | 4 | 1 |
| 10 Unemployment rate | 6 | 2.96% | | 1 | | | 1 | 1 | | | | | 1 | | | | | | | | | | 1 | 1 |
| 11 Level of industrial production | 9 | 4.43% | | | | | | 1 | | | | | 1 | 2 | | | | | | 1 | 1 | 1 | 1 | 1 |
| 12 Level of ind. prod.: construction | 8 | 3.94% | | | 2 | 1 | 3 | | | | | | 1 | | | | | | 1 | | | | | |
| 13 Level of money supply: M1 | 5 | 2.46% | | 1 | | | | | | | | | | | | 1 | | | 1 | | 1 | | | 1 |
| 14 Level of money supply: M3 | 8 | 3.94% | | 3 | | | | | | | | | | | 1 | 1 | | | | | | 1 | | 2 |
| 15 National stock index | 18 | 8.87% | 3 | | 3 | | 1 | 1 | 1 | | | | | 1 | | | | | 2 | | 1 | | 5 | |
| 16 Small cap stock index | 4 | 1.97% | | | | | | | | | | | | | | | | | | | 1 | 1 | 2 | |
| 17 Dividend yield (national stock index) | 16 | 7.88% | 1 | 2 | | 2 | | 1 | | | | | | 2 | | 1 | | | | 1 | | 1 | 1 | 4 |
| 18 PER (national stock index) | 17 | 8.37% | | 1 | 2 | 1 | 1 | | | | | | 1 | 1 | 3 | 1 | | | 1 | | 2 | | 3 | |
| 19 Bond performance index | 12 | 5.91% | 1 | 1 | 1 | | | | | | | | | | 1 | 2 | 1 | | 3 | | | | 2 | |
| 20 Level of total building permits | 8 | 3.94% | 1 | 1 | | 1 | | | | | | | | | | 1 | | | | 2 | | | | 2 |
| 21 Level of total building starts | 5 | 2.46% | | | 1 | 1 | | 1 | | | | | | | | | | | | 1 | | | | 1 |
| **Total** | **203** | | **10** | **16** | **13** | **11** | **9** | **7** | **4** | **0** | **2** | **0** | **11** | **15** | **11** | **9** | **2** | **0** | **14** | **7** | **7** | **6** | **23** | **26** |

*Source: Own calculations based on the total sample (218 REITs)*
*Notes: The highest number of significant connections (see Section 6.5.3 and Appendix 6.7 for explanations how to determine significant connections) corresponds to cells marked in red colour. If no significant connections have been detected or if the country-specific variable had not been available (see Appendix 6.1 for further information), the corresponding cells are marked in grey colour.*

For REITs domiciled in South Africa, both the CPI variable and money supply M1 Granger-caused REIT returns most often in this study. For the time period between 1995 and 1999, a shock in the CPI variable exhibited a significant positive relationship with REIT returns in the first month. Additionally, an unexpected change in money supply M1 entailed a significant positive relationship with REIT returns in month two when using data from 2005 until 2009. Therefore, little evidence was obtained regarding the possibility that REIT returns respond with a lag to unexpected changes in the money supply.

A comparatively small number of significant relationships were detected with regard to REITs domiciled in Turkey. Specifically, four explanatory variables exhibited significant Granger relationships exclusively when analysing a time period between 2000 and 2004. Further, a significant positive impact of a shock in the PER on REIT returns was observed with regard to two time periods. Low PERs could imply a higher attractiveness of general stocks in comparison to REITs. However, one of the significant relationships between the PER and REIT returns occurred in the period between 2005 and 2009, in which a positive connection between REIT returns and general stock market returns was observed.[211] Presumably, investors did not distinguish between REIT and general stock investments during the recent period.

The highest number of Granger relationships with regard to data on United States REITs was obtained for the industrial production and the general stock market variables. In the context of the impulse response analysis, a significant positive effect regarding the national stock index variable was obtained most frequently. As for Belgian REITs, a shock regarding the dividend yield variable was mostly associated with a significant negative relationship with REIT returns. Appraisal-based direct real estate investment returns relating either to all property types or to office properties exhibited a Granger relationship and showed significant negative effects when considering data measured in quarterly time intervals from 1990 until 2009 and between 1995 and 2009.

[211] See Section 6.4.2 for further information.

Overall, the results of the Granger causality test and of the impulse response analysis revealed large disparities across REIT regimes in the ability of the explanatory variables listed in Figure 6.1 to either forecast or provoke a change in REIT returns. Accordingly, a method of forecasting expected REIT returns in a valuation tool might not hold when it is applied to different REIT regimes. Notably, the leading indicator variable exhibited a certain degree of predictive power, with an unexpected change mostly resulting in a positive connection. Furthermore, a significant negative impulse was observed with long-term interest rates in cases with Australia, Belgium, Canada, the Netherlands, South Africa and the United States as countries of origin. Considering that REITs employ long-term debt, an increase in interest rates could provoke a lagged response of REIT returns to changes in the cost of financing.

# 7 Determination of the value components imputable to operating and investing activities

Legal restrictions demand that properties constitute the bulk of the assets owned by a REIT. Additionally, the previous analyses have documented that the real estate holding, management and operating business typically contributes to the major share of revenues generated by a REIT.

In light of the importance of real estate-specific business activities, this chapter is structured as follows to address the research sub-question regarding the structure of the new REIT approach. Section 7.1 aims at the development of cash flow calculation schemes. Section 7.2 elaborates on the inclusion of the value derived from non-operating assets. Section 7.3 discusses the approach to determining the cost of equity necessary to discount the cash flows. Finally, Section 7.4 includes the calculation of a value pertaining to the implicit planning period.

## 7.1 Cash flow calculation schemes

As explained previously, research on corporate valuation has devoted a large part of its attention to the derivation of cash flows. In contrast, the literature on REITs has considered the analysis of cash flows to only a negligible extent. The scientific insights concerning REIT valuation as well as financial information published by REITs are considered here to derive a cash flow calculation scheme in the following sections. All information used in such schemes should preferably be chosen according to its accessibility within publicly available financial information on REITs. This approach is necessary to ensure that the calculation of the model can be replicated while mitigating the obstacle of restrictions regarding data availability. The direct method for calculating cash flows was chosen for use in this study. As explained before, this method is less commonly applied than the indirect method of calculating FCFs. However, this method enhances traceability as all items included in the cash flow calculation can be directly observed.[1]

[1] In contrast, the indirect method, as it is used with the FFO calculation, starts with the net income measure. Consequently, not all items of the cash flow calculation are directly observable.

Calculation schemes associated with the explicit planning period were derived in two ways. First, a cash flow calculation scheme summarising the operating activities was developed (7.1.1). Second, a cash flow calculation scheme capturing the impact of investing activities was established (7.1.2).

### 7.1.1 Derivation of the cash flow calculation scheme pertaining to operating activities

Taking the large share of revenues arising from the real estate holding, management and operating business into account, particular attention will be devoted to the development of a cash flow calculation scheme (7.1.1.1).[2] Further, items that have been subject to scientific discussion regarding their inclusion in a cash flow calculation scheme but were excluded from the cash flow calculation scheme are briefly reviewed (7.1.1.2). Subsequently, the variables employed in the cash flow calculation scheme are investigated by means of statistical methodologies (7.1.1.3). If necessary, the cash flows derived in Section 7.1.1.1 were modified on the basis of the findings from the application of statistical approaches. Finally, recommendations regarding the forecast of the chosen cash flow calculation items are made (7.1.1.4).

#### 7.1.1.1 Explanations regarding the items included in the cash flow calculation scheme

As stated earlier, the explicit planning period captures cash flows occurring in the years subsequent to the key date of the valuation but prior to the first year of the implicit planning period. Principally, the items included in the following scheme are published in the REITs' financial statements. However, the amount of information disclosed by a REIT differs across firms. Consequently, a given REIT might not publish some items that need to be included in the calculation scheme proposed in the following. To avoid distortions in the estimation of the cash flows, a recommendation regarding the treatment of missing items is provided. Additionally, two or more items that are needed to calculate FCFs are sometimes summarised in a single

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[2] In this work, the cash flow from operating activities relates to the cash flows obtained from the real estate holding, management and operating business.

measure included in the financial statements.[3] If this aggregation does not contradict the calculation prescribed by the following scheme, the items can be included. For example, the financial statements might quote a single financial figure that includes both the rental revenues and the other income item. In this case, the item included in the cash flow calculation scheme is substituted for the rental revenues and other income item. Formula 7.1 summarises the direct calculation method.

| | | |
|---|---|---|
| | **Rental revenues** | **(7.1)** |
| + | **Other income** | |
| = | **Gross effective income (GEI)** | |
| - | **Operating expenses** | |
| = | **Net operating income (NOI)** | |
| + | **Operating distributions received from unconsolidated joint venture holdings** | |
| - | **Straight-line rents adjustment** | |
| - | **Stock-based compensation expense** | |
| -/+ | **Increase/decrease of non-cash working capital** | |
| = | **FCF from operating activities** | |

The items included in this scheme are discussed in the following sections.

### 7.1.1.1.1 Rental revenues and other income

Presumably, the rental revenues item represents the most important component in the present cash flow calculation. In this regard, rents generated by the property portfolio constitute an integral part of the item under review. In addition, the income achieved through administering operating property types such as hotels or nursing

[3] Although a part of the missing information may be recoverable through directly contacting the REIT, this is not a prerequisite in this study.

homes is included in this item. If disclosed separately, tenant reimbursements[4] and minimum and percentage rents[5] are considered as rental revenues as well.

Although rather unlikely, the rental revenues item might not be published by the REIT. In this case, it is suggested to derive an approximation by means of multiplying a weighted average capitalisation rate associated with the real estate portfolio by the value of total real estate assets.

If a REIT does not publish a weighted average capitalisation rate that captures the condition of the whole real estate portfolio, a ratio should be estimated applying the five subsequent steps. First, capitalisation rates are obtained from real estate market reports. Preferably, the collected data should conform to the respective regions and property types that are covered by the real estate portfolio owned by the REIT.[6] Second, assuming that publicly available information about the REIT includes data regarding the sizes[7] of the individual real estate assets, the properties are categorised into groups, with each cluster including all properties belonging to the same region[8] and to the same sector. Third, for each group, the respective value of real estate assets is expressed as a share of the total value of real estate assets. Fourth, each group-specific share is multiplied by the corresponding capitalisation rate obtained from market reports. Fifth, the results of the multiplication are added together to arrive at an estimate of the overall capitalisation rate.

The use of appraisal-based property values is desirable for the identification of the total value of real estate assets. Book values of properties instead of appraisal-based values will be used as approximations if the REIT publishes the former.[9]

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[4] Tenant reimbursements include the tenant's share of expenses such as the common area maintenance and are paid by a tenant to the REIT as the landlord. [FRIEDMAN/HARRIS/DISKIN (2005), p. 503.]

[5] The analysis of annual reports has revealed that REITs focused on retail properties such as single-user retail, neighbourhood centres, community centres and merchandise centres receive both minimum and percentage rents. While the minimum rent is also called base rent, the percentage rent is linked to the volume of turnover generated by the tenant. [REIT annual reports.]

[6] If not published in market reports, the capitalisation rate might be derived through dividing annual rents by property prices in case the latter two items are available.

[7] The analysis of annual reports has revealed that the measure used to approximate the size of individual real estate assets differs between REITs. Measures that are commonly employed by REITs include the book market value, the fair market value and the number of rooms.

[8] In order to reduce the complexity of the capitalisation rate estimation as well as to cope with data limitations, the properties should be classified according to regions instead of countries or cities.

[9] Differences between property book and market values might be reduced at least due to two reasons. First, REITs primarily invest in properties in superior locations with rental income being secured by

If a REIT has generated earnings classified as other income, these earnings are added to the cash flow calculation as well. The other income item includes earnings beyond the income received by the REIT for leasing a certain space. Potential constituents of this item include application, laundry or cable television fees charged by the REIT.[10]

Adding the rental revenues item and the other income item together results in the so-called Gross Effective Income (GEI).

#### 7.1.1.1.2 Operating expenses

Until now, the items summarising rental revenues and other income have been included in the cash flow calculation scheme without considering potential expenditures. Consequently, the GEI will be adjusted for operating expenses.
Financial statements published by REITs typically state operating expenses,[11] which can be subdivided into real estate operating expenses, General and Administrative (G & A) expenses and infrequently Selling, General and Administrative (SG & A) expenses. Real estate operating expenses occur on a regular basis and mainly comprise energy costs, property taxes, repair and maintenance costs, cleaning expenses, utilities expenses, such as electricity or water bills paid by the landlord, administration fees, insurance costs, management fees and other expenses. G & A expenses relate to the costs of running a business as a whole, such as the salaries of the management team, document filing and reporting costs. Extending G & A expenses by selling expenses that arise in connection with the sale of goods or services results in so-called SG & A expenses. Major selling expenses include advertising costs and salesperson salaries.[12]

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leasing contracts instead of participating in risky real estate developments for the most part. Considering the reduced risk profile of the underlying investments, the fluctuations in property prices are supposed to be comparatively low. Second, deviations between book and market values are possibly reduced as REITs are likely to hold properties for a shorter time horizon in comparison to other investors.

[10] BRUEGGEMAN/FISHER (2005), p. 262.

[11] Operating expenses are incurred in the process of generating revenue. [SHIM/SIEGEL (2008), p. 24.]

[12] BLOCK (2006), p. 158; BRUEGGEMAN/FISHER (2005), p. 262; CAPOZZA/SEGUIN (1998), p. 131; GALATY/ALLAWAY/KYLE (2002), p. 401; REIT annual reports; SHIM/SIEGEL (2008), p. 24.

Ideally, these expenses should be included in the item under consideration associated with the real estate holding, management and operating business. However, financial statements often do not separate total expenses according to the activities carried out by a REIT. As observed previously, the real estate holding, management and operating business typically accounts for the major share of the activities carried out by a REIT. Thus, the real estate operating expenses and the G & A or SG & A expenses are both included in the item under review. The partitioning of expenses according to business activity would increase the complexity of the valuation tool to a disproportionate extent. For example, if insufficient information were available, operating expenses would have to be partitioned based on estimations. Additionally, a fragmentation of expenditure items could reveal that positions such as overhead costs cannot be allocated to a single activity and thus would demand separate forecasting and discounting.

A drawback of summarising the G & A, SG & A and real estate operating expenses in a single item arises if the different cash flow calculation schemes introduced in this study are associated with unequal discount rates. Although the expense items considered are discounted at the rate pertaining to the real estate holding, management and operating business, they might in part be associated with another cash flow calculation scheme exhibiting a different discount rate. This circumstance could distort the calculated firm value.

Deducting the operating expenses item from the GEI results in the net operating income[13] generated by the property portfolio owned by a REIT. Based on the NOI, the adjustments explained in the following sections are suggested to derive a free cash flow from operating activities.

[13] The NOI figure employed in this calculation may not conform to the NOI figures published by REITs in their annual reports. Instead, the NOI figure in this cash flow calculation represents the revenues generated by means of the real estate holding, management and operating business net of operating expenses.

#### 7.1.1.1.3 Operating distributions received from unconsolidated joint venture holdings

One possible kind of REIT involvement in the real estate holding, management and operating business entails participation in joint ventures[14]. Joint ventures can participate in the acquisition, ownership, management and operation of properties. Generally, REITs may enter into so-called acquisitional or dispositional joint ventures.

Acquisitional joint ventures involve the purchase of properties in a joint ownership that are typically financed through equity or debt or a combination of both. A major reason for REITs to participate in an acquisitional joint venture is the acquisition of managerial skills. Given their local nature, real estate markets are potentially beset with informational asymmetries. As information is costly, a joint venture between a REIT and partners that possess exclusive knowledge may become fruitful.[15]

Although research on joint venture participation by REITs is scarce, some evidence exists demonstrating that the advantage of acquiring managerial skills is rewarded through the stock markets in terms of better stock performance.[16] Further advantages include the expansion of the investment universe without causing a high level of risk; the ability to purchase real estate assets, which would otherwise result in a concentration risk or become impossible; cost reductions and revenue enhancements.[17] The advantage of acquiring managerial skills should also prevail when

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[14] Joint ventures typically represent the combination of resources and management expertise of two or more firms to a specific project. Particularly, it is supposed that the companies participating in the joint venture continue to exist independently, which represents a major demarcation against a merger. The firm initiating the joint venture, denominated as the parent, typically sets up a captively held separate entity that can be jointly controlled by the joint venture partners. [CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 277; ELAYAN (1993), p. 13; KOGUT (1988), p. 319.]

[15] CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 276; ELAYAN (1993), p. 16; McCONNELL/NANTELL (1985), p. 521; RAVICHANDRAN/SA-AADU (1988), p. 107. ELAYAN (1993, p. 25) provides evidence of a reduction in informational asymmetries when entering into a joint venture. Additionally, a joint venture probably increases the alignment of interests between the partners as these parties hold an equity interest in the entity. [CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 279.]

[16] RAVICHANDRAN/SA-AADU (1988, p. 115-117) observe a significant increase in the value of common stock with firms announcing their participation in a real estate joint venture. The authors mainly attribute this finding to enhanced information about local real estate markets. [RAVICHANDRAN/SA-AADU (1988), p. 117.] ELAYAN (1993, p. 16) contends that companies focusing on a certain real estate market segment exhibit a comparative advantage due to enhanced managerial expertise. In this sense, CAMPBELL/WHITE-HUCKINS/SIRMANS (2006, p. 284) observe that joint ventures between REITs and partners who are engaged in the management of the underlying real estate assets are associated with a positive effect on stock performance, which they relate to managerial synergies.

[17] HESS/LIANG (2004), p. 78. Indeed, HESS/LIANG (2004, p. 80) deliver evidence that the propensity of a REIT to enter joint ventures is positively associated with the property size.

REITs participate in investments in foreign markets. Further benefits associated with joint ventures involving international investments potentially include the hiring of inexpensive labour; the overcoming of political or legal barriers or a competitive advantage if the REIT can leverage its advanced real estate knowledge in markets with fewer professional competitors.[18] Acquisitional joint ventures may also involve property developments or redevelopments undertaken within the cash flow calculation scheme concerning investing activities.

The term dispositional joint venture refers to selling parts of the REIT's property holdings into a joint venture. Though the generation of liquidity represents a major advantage associated with dispositional joint ventures, further benefits include the reduction or discontinuation of mandatory interest payments, the possibility of keeping a certain amount of debt off of the balance sheet, a smoothing of the income stream by means of management fees received from the joint venture partner, increased managerial flexibility as income and asset rules are circumvented, potential cost reductions or revenue enhancements and the availability of more options regarding the future strategy of the REIT investment. In this case, the joint venture partner often represents a financial institution, with the REIT typically acting as a minority shareholder that is compensated for the management of the property through a fee. However, some empirical evidence indicates a negative stock market reaction in terms of lower performance values in cases when REITs participate in dispositional joint ventures.[19]

Given the preceding review of activities carried out by a REIT, the participation in a joint venture might or might not be consolidated in the financial statements.

In consolidated joint ventures, the REIT either owns a majority interest or exercises significant control over substantial operating decisions.[20] Consolidated joint ventures

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[18] Adapted from CHUNG/KOFORD/LEE (1993, p. 277f). However, CAMPBELL/WHITE-HUCKINS/SIRMANS (2006, p. 284) do not find a positive effect on stock performance when investigating both joint ventures with foreign partners and joint ventures that invest in real estate abroad.

[19] CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 276-279; HESS/LIANG (2004), p. 78. Specifically, CAMPBELL/WHITE-HUCKINS/SIRMANS (2006, p. 283f) document a relatively low performance of REITs being engaged in dispositional joint ventures. The authors suppose that the share of property cash flows, which would otherwise be distributed as dividends for the benefit of shareholders, is transferred by the REIT to the joint venture partner. [CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 284.]

[20] Major operating decisions relate to the acquisition or sale of properties, the selection of property management companies, and amendments in the financing policy or the approval of budgets. Furthermore, the

may include co-investments of the REIT and institutional investors within a fund structure. The real estate holding, management and operating income generated from consolidated joint ventures is already captured in the real estate revenues item.

Unconsolidated joint ventures denote joint venture interests that are not consolidated in the financial statements published by a REIT. In this case, a third party typically holds significant control over major operating decisions. Earnings that are generated by unconsolidated joint ventures and are distributed to the REIT are added to the NOI subject to the condition that they are generated from the real estate holding, management and operating business.[21] Apart from the argument regarding the benefits of REITs participating in consolidated or unconsolidated joint ventures, the addition of this item to the calculation scheme is necessary as it includes actual cash flows received from the real estate holding, management and operating business carried out by means of a joint venture entity.

If the earnings from unconsolidated joint ventures are not published by the REIT or are not directly observable, no substitute is utilised. This choice was made because the estimation of this item would require disproportionate outlay, given that some evidence indicates that this item may not account for an overwhelming part of the cash flow calculation scheme.[22]

#### 7.1.1.1.4 Straight-line rents adjustment

The cash flow, as a sum of various revenues, will be adjusted if the income statement reports rental revenues on a straight-line basis. Generally, a lease contract may stipulate that rents be adjusted upwards by a certain amount over a specific period.

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analysis of annual reports published by REITs reveals that joint venture participations of a REIT are typically subject to certain agreements. In this regard, the REIT and the partner might be required to contribute additional capital or the joint venture may incur additional debt. Moreover, the transfer of joint venture interests is typically restricted under the governing agreements. [REIT annual reports.]

[21] The analysis of company reports uncovers that REITs hold properties through unconsolidated joint ventures as well.

[22] HESS/LIANG (2004, p. 78f) observe that unconsolidated assets, which are supposed to relate to joint ventures of REITs holding a minority voting interest, accounted for a share of 4.5% of total assets at year-end 2002. Given a similar income-generating capability of properties held in unconsolidated joint ventures in comparison to properties held directly or in consolidated joint ventures, the share of income from unconsolidated joint ventures should be relatively low.

In this context, REITs may report average rental revenues over the full lease term.[23] This treatment can lead to deviations between the cash flows that are actually received and the rental revenues that are listed in the income statement. To capture the actual cash flow, it seems reasonable to consider rental revenues that are not reported on a straight-line basis. An exception occurs if a REIT received an up-front payment in the first year of the lease that cannot be separated from the remaining rental revenues on the basis of the information published by the company. In this case, the rental revenues reported on a straight-line basis are used. This procedure avoids the inclusion of the up-front payment in the cash flow calculation scheme, which would otherwise probably distort the actual rental revenues that are potentially achievable in the future.

#### 7.1.1.1.5 Stock-based compensation expense

Stock-based compensation expense represents a non-cash item and includes shares and options to purchase shares that are granted to employees. Specifically, the analysis of financial statements showed that the stock-based compensation expense is typically included in the operating expenses item. If published in the financial statements, the stock-based compensation expense is added to the cash flow calculation scheme as a separate variable.[24]

In the case where the stock-based compensation expense is not published, the item is not considered, as its estimation is associated with a relatively high cost, whereas its impact on the cash flow is thought to be comparatively low.

#### 7.1.1.1.6 Non-cash working capital

As explained before, the working capital item equals the difference between current assets and current liabilities. To capture its effect on the cash flows, the so-called non-cash working capital is considered in this analysis. Non-cash working capital equals the difference between non-cash current assets and non-debt current liabilities. Subtracting both current assets of discontinued operations and cash from the

[23] BRUEGGEMAN/FISHER (2005), p. 592f; GRAHAM/KNIGHT (2000), p. 20f.
[24] MULFORD/COMISKEY (2005), p. 70; REIT annual reports.

current assets item results in the non-cash current assets item. Non-debt current liabilities are obtained through subtracting both the liabilities from discontinued operations and the current portion of long-term debt from the current liabilities item.[25]

Apart from cash, the working capital position of a REIT might include borrowings under their unsecured credit facilities, proceeds from debt and equity offerings or net proceeds from divestitures of properties. An increase in the non-cash working capital item equals a cash outflow as cash is tied to the working capital position but cannot be used for other activities, whereas a decrease in this figure constitutes a cash inflow.[26]

#### 7.1.1.2 Explanations regarding the items not included in the cash flow calculation scheme

In this section, items that were eliminated from the present cash flow calculation scheme but were included in other cash flow calculation schemes are briefly discussed, with particular reference to the reasons for their exclusion.

Similar to the FFO calculation, depreciation and amortisation expenses were not considered in this cash flow calculation. This type of expense was ignored as actively managed real estate assets do not necessarily depreciate in value. Evidence is delivered through the profits REITs generate from selling parts of their real estate portfolios. Because this cash flow calculation starts with revenues instead of net income, depreciation and amortisation expenses were simply excluded from the calculation.

The depreciation and amortisation expenses item usually includes the amortisation of lease intangibles[27]. Based on the preceding discussion regarding the exclusion of depreciation and amortisation expenses, these intangibles, which can be classified as

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[25] See DAMODARAN (2002, p. 262 & 352) and THAM/PAREJA (2004, p. 150) for further information.

[26] DAMODARAN (2010), p. 26; THAM/PAREJA (2004), p. 97 & 150.

[27] Lease intangibles can include in-place leases, leasing costs or costs associated with the customer relationship in the leasing business. [DAVIS (2008), p. 30; REIT annual reports.]

capital expenditures, are probably deducted on a straight-line basis but were ignored in this cash flow calculation.[28]

Furthermore, impairment losses[29] were not deducted from the cash flow calculation. As impairment losses represent a form of depreciation, they were not considered in the cash flow calculation for the same reason that the depreciation and amortisation expenses item was not.[30]

The income attributable to discontinued operations in the real estate holding, management and operating business was not added to the cash flow calculation. This approach was chosen because these earnings were generated from property investments that ceased in the year of reporting and thus do not generate future earnings.[31]

The minority interests' share of the income[32] of the subsidiaries' other shareholders represents a non-cash item. On the one hand, it is argued that ignoring minority interests' share of income in the calculation would overstate the free cash flow. On the other hand, the deduction of minority interests' share of operating income from the free cash flow would imply that this item has to be projected as well; thus, the results can be affected by forecasting errors.[33]
As a consequence, it is suggested to calculate the enterprise value in a first instance and to subtract the book value of the minority interests, as reported immediately before the key valuation date, thereafter. Accordingly, the minority interests' share

[28] REIT annual reports; WELTMANN (2005), p. 176.
[29] An impairment loss is usually attributed to the difference between the book value of a property and its lower fair value. This impairment loss is reported at the lower of the property book value or its fair value less the costs of sale. [NIKOLAI/BAZLEY/JONES (2009), p. 530.]
[30] Additionally, impairment losses usually represent non-recurring events while the calculated cash flow should deliver an approximation of the actual cash generating capability of the REIT. [Adapted from JOHNSTON (1992, p. 132).]
[31] Providing support to this approach, KOLLER/GOEDHART/WESSELS (2005, p. 346) argue that discontinued operations should not be considered in the FCF calculation, as discontinued operations are not longer a part of the company's operations.
[32] Minority interests represent the proportionate share of a subsidiaries net assets that are held by third parties. Minority interests' share of income are deducted in the statements of operations from a companies' income in order to correct for an overstatement of the consolidated earnings. The minority interests' share of income position may include the joint venture partners' share of operating income as well as the income share attributed to preferred unitholders and limited partnership unitholders. [MORRIS (2004), p. 26f; REIT annual reports.]
[33] JOHNSTON (1992), p. 133.

of income was not reduced from the FCF calculation but was considered in the final calculation of the value of equity.[34]

Preferred stock dividends were not explicitly considered in the cash flow calculation. This approach has been suggested in the literature on FCFs to the firm, in contrast to the calculation of cash flows to equityholders.[35]

In addition, net borrowings[36] were not included in the cash flow calculation as changes in the level of debt do not directly affect the cash flows to the firm.[37]

Generally, it is assumed that the REIT does not pay income taxes. Although some REITs document an income tax provision in their consolidated statements of income, such an item's occurrence is likely to be irregular. In addition, the investigation of financial reports revealed that REITs try to prevent the payment of tax duties. As a consequence of omitting taxes from the cash flow calculation, deferred tax liabilities or assets[38] were excluded as well. Assuming that the REIT is not taxed on the income derived from the holding, management and operation of real estate assets, the before-tax cash flows were assumed to equal the after-tax cash flows.[39]

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[34] Adapted from MORRIS (2004, p. 26f).

[35] Considering the cash flows to equityholders, it is argued, that any claim on the cash flows which is superior to the claims of common stockholders should be subtracted in the cash flow calculation. [See, for example, DAMODARAN (2002, p. 353), MULFORD/COMISKEY (2005, p. 11) or STOWE/ROBINSON/PINTO (2007, p. 137-139).]

[36] Net borrowings represent the difference between new debt issued and debt repayments. [DAMODARAN (2002), p. 352; STOWE/ROBINSON/PINTO (2007), p. 139.]

[37] DAMODARAN (2002), p. 352; STOWE/ROBINSON/PINTO (2007), p. 139. If the cash flows would have been measured from the perspective of an equityholder, the effect of changes in the level of debt on the cash flows to equityholders needs to be considered. [DAMODARAN (2002), p. 352.]

[38] Deferred tax liabilities are typically reported as a long-term liability in the balance sheet. This type of liabilities occurs if a firm determines a depreciation expense in its financial statements that differs from the basis in its tax returns. The difference may arise if a company uses straight-line depreciation to determine taxes reported in the financial statements but applies an accelerated depreciation when computing taxes actual owed. As a consequence, the tax return profits can be lower in comparison to the book profits, which defers the payment of taxes for an indefinite time period. [KOLLER/GOEDHART/WESSELS (2005), p. 175; VAN HORNE/WACHOWICZ (2008), p. 158.]

[39] The assumption that before-tax cash flows equal after-tax cash flows is based on the supposition that many REITs distribute all of their income as dividends and is investigated in Section 8.5 in more detail.

### 7.1.1.3 Statistical examinations of the cash flow calculation items

As documented in a previous section, the cash flows included in a DCF model are of major importance. Accordingly, it is helpful to investigate whether the components of the cash flow calculations relate to a certain valuation benchmark such as dividends per share returns or stock returns.

Hence, a significant relationship between the benchmark and the cash flow calculation item provides an indication that the respective item reflects parts of the REIT activities over the reporting period. The different cash flow constituents were analysed according to their value-relevance with the help of statistical tests. In this context, the term "value-relevance" relates to the ability of a particular accounting component to forecast future payoffs from the REIT.[40] Subsequent to the description of the dataset and its editing for statistical analysis (7.1.1.3.1), both a multiple regression model (7.1.1.3.2) and a test of incremental information content (7.1.1.3.3) will be described.[41]

#### 7.1.1.3.1 Description of the dataset and its editing for statistical analysis

The components of the cash flow calculation scheme explained in Formula 7.1 were examined on the basis of both a multiple regression model and a test of incremental information content.[42]

For this purpose, data from the REIT sample were collected for two time horizons: from 1994 until 2008 and from 1999 until 2008 with annual time intervals.[43] The availability of data by country of origin is summarised in Figure 7.1. Unfortunately, the availability of certain cash flow calculation items was limited. The corresponding numbers of observations pertaining to the items under review are included in the subsequent figures, which summarise the results of the analyses.

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[40] Adapted from BEAVER (1998).

[41] Again, all connections are reported at a five percent level of significance.

[42] Given data limitations, the other income item included in Formula 7.1 has not been considered within the statistical examinations.

[43] Given a large amount of missing data, the analysis of data concerning the fiscal year 2009 has been omitted. All data were collected from annual reports in combination with Bloomberg and SNL Financial. Stock prices and dividends per share were compiled at one-year intervals.

***Figure 7.1: REITs used in the analysis of the cash flow calculation items.***

| | 1994-2008 | | 1999-2008 | |
|---|---|---|---|---|
| | Adjusted total stock returns | Dividends per share returns | Adjusted total stock returns | Dividends per share returns |
| **Total number of REITs considered** | 48 | 39 | 125 | 122 |
| **Australia** | 1 | 0 | 12 | 12 |
| **Belgium** | 1 | 1 | 7 | 6 |
| **Canada** | 0 | 0 | 9 | 9 |
| **Netherlands** | 0 | 0 | 6 | 6 |
| **New Zealand** | 0 | 0 | 4 | 4 |
| **South Africa** | 0 | 0 | 3 | 3 |
| **United States** | 46 | 38 | 84 | 82 |

*Source: Own calculations based on the total sample (39-125 of 218 REITs)*

To ensure comparability between variables, the cash flow calculation items were divided by the corresponding number of shares.[44] As they are required for the following analysis, continuous returns were calculated from REIT stock prices and REIT dividends per share. In this study, adjusted annual total REIT stock returns were derived. In particular, the total return on an index exclusively including listed real estate firms was deducted from the REIT-specific continuous total return. This procedure was chosen as it is argued that returns derived from the country index are likely to be associated with macroeconomic factors.[45] Consequently, adjusted total REIT returns should serve as an appropriate benchmark for the dependent variable employed in this work as these probably possess a stronger connection with firm-specific factors.

#### 7.1.1.3.2 Multiple regression model

A multiple regression model was employed to characterise the relationship between the cash flow components as the independent variables and adjusted total stock re-

[44] Although the recent considerations suggest the use of the diluted number of shares, this approach would lead to a further reduction regarding the length of the data analysis. Accordingly, the basic number of shares is employed in this work.
[45] See, for example, DECHOW (1994, p. 13).

turns and dividends per share returns as the dependent variables. Principally, the regression model described in the preceding chapter was applied in this context. However, all independent variables were scaled by the beginning of period stock price. CHRISTIE (1987, p. 240) argues that this procedure helps to alleviate possible spurious correlations due to size and helps to prevent biased results due to heteroscedasticity.

The outcomes of regressing the cash flow calculation items against the adjusted total stock returns are summarised in Figure 7.2. The corresponding findings with the use of the dividends per share returns as the dependent variable are depicted in Figure 7.3.[46]

***Figure 7.2: Summary of the results of the multiple regression analysis with adjusted total stock returns as the dependent variable.***

| | 1994-2008 | | | 1999-2008 | | |
|---|---|---|---|---|---|---|
| | Number of sampled firms | Number of significant relationships | | Number of sampled firms | Number of significant relationships | |
| *Dependent variable* | | + | - | | + | - |
| **Adjusted total stock returns** | 48 | | | 125 | | |
| *Cash flow calculation items (independent variables)* | | | | | | |
| **Rental revenues** | 48 | 3 | 4 | 123 | 2 | 2 |
| **Operating expenses** | 45 | 3 | 0 | 112 | 5 | 1 |
| **Change in non-cash working capital** | 46 | 1 | 1 | 119 | 2 | 0 |
| **Straight-line rents adjustment** | 6 | 1 | 0 | 38 | 1 | 1 |
| **Op. distrib. received from uncons. j.v. holdings** | 2 | 0 | 0 | 12 | 0 | 0 |
| **Stock-based compensation expense** | 0 | 0 | 0 | 11 | 0 | 0 |

*Source: Own calculations based on the total sample (48/125 of 218 REITs)*

Overall, the regression of the cash flow calculation items against adjusted total stock returns leads to a considerable fraction of insignificant results. One reason for the finding of few significant connections between the dependent variable and the independent variables could be the much higher volatility observed with adjusted total stock returns in comparison to the volatility of the independent variables, particularly in recent years, thus probably leading to a lower degree of connection between the time series. Furthermore, the explanatory power of the cash flow calculation items relevant to REIT returns might be reduced, as the items are obtained from

[46] See Appendix 7.1 for more detailed results.

financial statements on an annual basis. In contrast, the stock market might have incorporated information included in these items prior to their publication in the financial statements. For example, some evidence exists to indicate that REIT stock market returns lead the returns of indices including appraisal-based direct real estate investment data.[47] In addition, precise estimation is also hampered by the use of a relatively long time interval.

Moreover, the considered cash flow calculation items might exhibit a significant impact when aggregated into a single cash flow measure. As examined previously, the real estate holding, management and operating business clearly represents the most important business activity pursued by a REIT. Accordingly, it was predicted that the rental revenues item would be of high importance when calculating cash flows from the real estate holding, management and operating business. However, very few significant connections between the rental revenues item and adjusted total REIT stock returns are observed. The use of both adjusted total stock returns and dividends per share returns as dependent variables revealed relatively few and even negative correlations with the rental revenues item. This result also challenges the assumption that REITs exhibit a positive relationship between rental revenues and dividends per share as a large fraction of earnings must be distributed. However, the analysis of the underlying variables shows that numerous REITs tried to maintain stable dividend distributions. In some cases, the actual share of earnings distributed by a REIT exceeded that required by legislation. In such cases, REITs might also be able to retain earnings, which can be used to stabilise the dividend payments over time. In contrast, the examination of the rental revenues item, which was scaled by the number of shares and thereafter by the stock price, shows a decrease for several REITs in recent years. One explanation for this result could be deteriorating market conditions that reduced the contractual rents. Another reason might be the pronounced rise in the number of shares as well as considerable progression in share prices between 1999 and 2008.

The distortions described here are observed when using the operating expenses variable as a regressor and adjusted total stock returns as the dependent variable. Notably, the few significant results for the time period between 1994 and 1998 conform

[47] See, for example, SEILER/WEBB/MYER (1999, p. 180).

to the assumption that REITs that realise expense reductions are able to distribute larger dividends. With regard to the remaining explanatory variables included in the calculation, there exist only a few REITs exhibiting a significant relationship between the change in non-cash working capital and the two dependent variables. The magnitude of the non-cash working capital position could demonstrate a connection with the real estate-specific business activity carried out by a REIT. In this sense, it should be noted that this position accounts for a relatively small fraction of the rental revenues item. As a consequence, the impact on dividends per share returns or adjusted total stock returns seems to be reduced.

***Figure 7.3: Summary of the results of the multiple regression analysis with dividends per share returns as the dependent variable.***

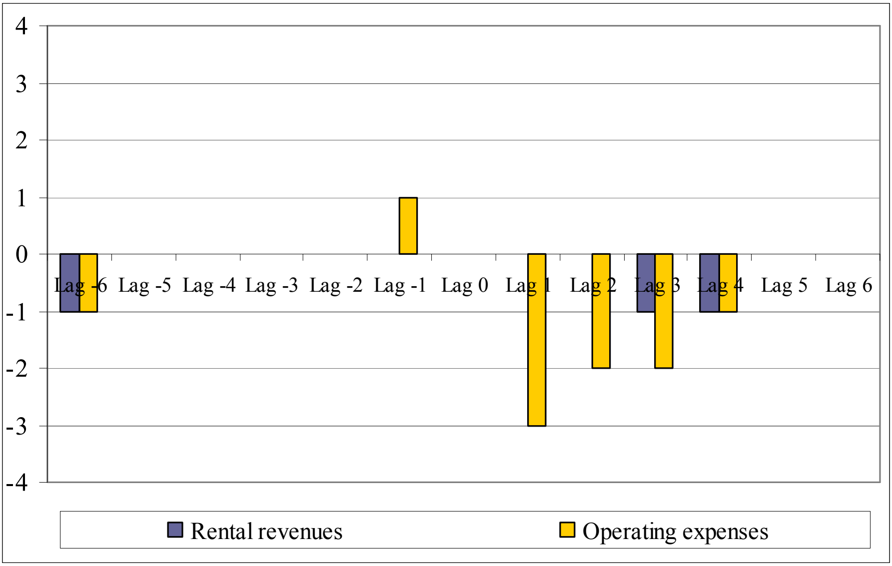
| | 1994-2008 | | | 1999-2008 | | |
|---|---|---|---|---|---|---|
| | Number of sampled firms | Number of significant relationships | | Number of sampled firms | Number of significant relationships | |
| *Dependent variable* | | + | - | | + | - |
| **Dividends per share returns** | 39 | | | 122 | | |
| *Cash flow calculation items (independent variables)* | | | | | | |
| **Rental revenues** | 39 | 3 | 1 | 120 | 9 | 7 |
| **Operating expenses** | 38 | 0 | 2 | 110 | 0 | 8 |
| **Change in non-cash working capital** | 37 | 0 | 0 | 117 | 3 | 2 |
| **Straight-line rents adjustment** | 6 | 0 | 0 | 36 | 2 | 1 |
| **Op. distrib. received from uncons. j.v. holdings** | 1 | 0 | 0 | 11 | 0 | 0 |
| **Stock-based compensation expense** | 0 | 0 | 0 | 11 | 0 | 1 |

*Source: Own calculations based on the total sample (39/122 of 218 REITs)*

Given these considerations, a time lag might occur between changes in REIT stock market returns and the corresponding cash flow calculation item. In this context, EASTON/HARRIS/OHLSON (1992) and KOTHARI/SLOAN (1992) deliver evidence that earnings commonly reflect the information of stock prices with a lag of up to three years. The assumption of a lagged relationship has been addressed through the calculation of cross-correlations.[48] The significant relationships obtained within the analysis are summarised in Figure 7.4 for the time period from 1994 until 2008 and in Figure 7.5 for the time span beginning in 1999 and ending in 2008.[49]

[48] See, for example, BROSIUS (2004, p. 969-975) for further information regarding the calculation of cross-correlations.
[49] Taking data limitations into account, Figure 7.4 includes two cash flow calculation items only.

***Figure 7.4: Summary of significant cross-correlations (1994-2008).***




*Source: Own calculations based on the total sample (9 of 218 REITs)*

The magnitudes of the correlations at each time lag are not presented for reasons of simplicity. Instead, a value of one is assigned to each significant positive correlation between the dependent variable and the respective cash flow calculation item, whereas a value of negative one is assigned to each significant negative correlation.

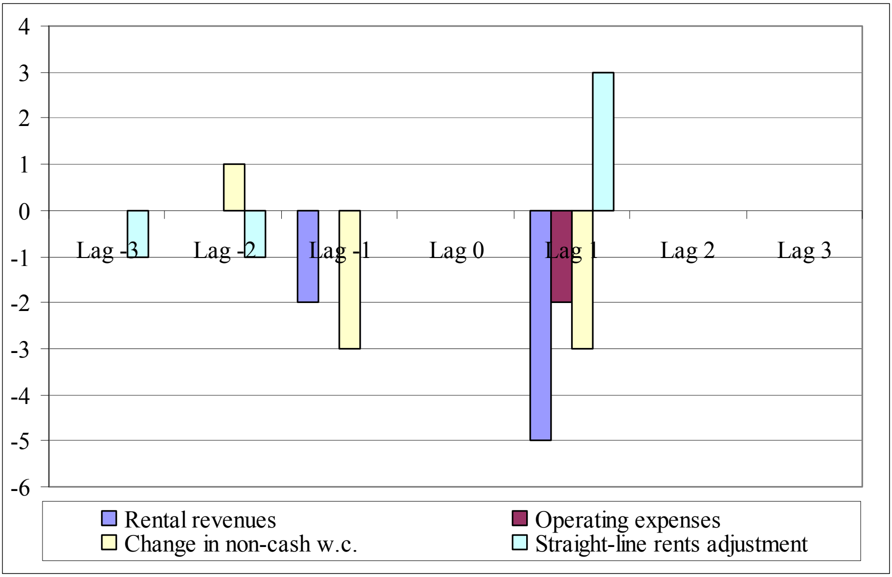
Subsequently, the sum of these values was calculated for each time lag. For example, if two REITs exhibit a negative correlation at lag one while three REITs possess a positive correlation at the same lag, the aggregated figures possess a value of plus one.

A positive (negative) lag *k* belonging to a particular cash flow calculation item implies that the item in period *t* shows a correlation with the corresponding adjusted total stock return in period *t*+*k* (*t*-*k*).

Given this definition, a bulk of bars with positive lags would imply that adjusted total stock returns incorporate information about the cash flow items with a lag. However, despite the findings presented in Figure 7.4, this assumption is also rather unlikely given that each lag represents a single year. In this context, it should be noted that 19 significant observations were collected from nine firms.

In contrast, Figure 7.5 summarises the findings obtained for the time period from 1999 until 2008. In this period, 20 firms showed a total of 29 significant relationships. Some findings point to the assumption that stock prices incorporate information that will later be included in financial statements.

***Figure 7.5: Summary of significant cross-correlations (1999-2008).***




*Source: Own calculations based on the total sample (20 of 218 REITs)*

#### 7.1.1.3.3 Test of incremental information content

A test of incremental information content was used to investigate whether one component provides supplemental information content when compared to another.[50]

For this purpose, a variation of the random-walk model was used to assess the incremental information content associated with the independent variables. If a ran-

[50] VINCENT (1999), p. 84.

dom-walk process of shares is observed, no serial correlation between share prices does exist. According to the random-walk hypothesis, share prices follow a random-walk, with fundamental or technical share price analysis being obsolete. The expected value of the return does not change in a random-walk model. Future information is the only source of impact on prices, albeit these cannot be forecast.[51] The random-walk model is commonly used to estimate the unexpected component of a dependent variable in comparison to the market return.[52] This assumption can be formulated as follows:

$$P_{t+1} = P_t + e_t \qquad \textbf{(7.2)}$$ [53]

where

$P_{t+1}$ = share price at time $t+1$
$P_t$ = share price at time $t$
$e_t$ = normally distributed random variable with an expected value of zero

Several authors demonstrate that the random-walk model performs as well as time series models when investigating earnings[54] and cash from operations measures[55]. Given this, the model was applied to the independent variables as components of a REIT cash flow calculation. The unexpected component was computed as the difference between the value in period $t$ and the value at the end of the preceding time period $t$-$1$. The model can be expressed in the following form:

[51] PERRIDON/STEINER (2007), p. 201; STEINER/BRUNS (2002), p. 43 & 227. However, empirical evidence indicates that the assumption of stationarity of stock prices according to the random-walk model does not hold. [PERRIDON/STEINER (2007), p. 202.]
[52] See, for example, FINGER (1994) or WATTS/LEFTWICH (1977, p. 269).
[53] STEINER/BRUNS (2002), p. 227f.
[54] WATTS/LEFTWICH (1977, p. 255) compare the ability of a random-walk model to describe the process of generating annual earnings to that of the Box and Jenkins' techniques. The authors find that the random-walk model shows a good ability to describe the earnings generating process, while evidence of misspecification is found in case of the Box and Jenkins' techniques. [WATTS/LEFTWICH (1977), p. 269.]
[55] FINGER (1994, p. 210) examines the ability of earnings to predict future earnings and cash flows from operations. In this study, the author provides evidence that the random-walk model outperforms autoregressive processes of order two in terms of forecasting ability. [FINGER (1994), p. 215f.]

$$R_t = \alpha_0 + \alpha_1 \times (\frac{X_{1t} - X_{1t-1}}{P_{t-1}}) + \alpha_2 \times (\frac{X_{2t} - X_{2t-1}}{P_{t-1}}) + \ldots + \alpha_p \times (\frac{X_{pt} - X_{pt-1}}{P_{t-1}}) + e_t \quad \textbf{(7.3)}$$

where

$R_t$ = annual total return of the REIT adjusted for the host country's listed real estate market index or dividends per share returns at time $t$

$\alpha_0$ = constant

$\alpha_1, \ldots, \alpha_p$ = regression coefficients

$X_1, \ldots, X_p$ = cash flow calculation items

$e_t$ = residual error term

The results of the test of incremental information content are presented in Figures 7.6 and 7.7. Specifically, Figure 7.6 comprises the outcomes obtained when using adjusted total stock returns as the dependent variable, whereas the results included in Figure 7.7 entail the use of the dividends per share returns as the explained variable.[56]

***Figure 7.6: Summary of the results of the test of incremental information content with adjusted total stock returns as the dependent variable.***

| | 1994-2008 | | | 1999-2008 | | |
|---|---|---|---|---|---|---|
| *Dependent variable* | Number of sampled firms | Number of sampled firms with a significant relationship | Share of the significant relationships as of the number of sampled firms | Number of sampled firms | Number of sampled firms with a significant relationship | Share of the significant relationships as of the number of sampled firms |
| Adjusted total stock returns | 48 | | | 125 | | |
| *Cash flow calculation items (independent variables)* | | | | | | |
| Rental revenues | 48 | 3 | 6.25% | 123 | 7 | 5.69% |
| Operating expenses | 45 | 1 | 2.22% | 112 | 3 | 2.68% |
| Change in non-cash working capital | 46 | 2 | 4.35% | 119 | 5 | 4.20% |
| Straight-line rents adjustment | 6 | 0 | 0.00% | 38 | 0 | 0.00% |
| Op. distrib. received from uncons. j.v. holdings | 2 | 0 | 0.00% | 12 | 0 | 0.00% |
| Stock-based compensation expense | 0 | 0 | 0.00% | 11 | 1 | 9.09% |

*Source: Own calculations based on the total sample (48/125 of 218 REITs)*

[56] More detailed results concerning the test of incremental information content are included in Appendix 7.2.

In this analysis, no signs for the coefficients are included in Figures 7.6 and 7.7. The coefficients are intended to measure the association between the dependent variables and the differential information delivered by the explanatory variables. In this regard, the information content for each explanatory variable is specified while holding the other regressors fixed. Expectations regarding the magnitudes or the signs of the coefficients are difficult to formulate.[57]

Similar to the results obtained from the multiple regression analysis, few significant results were obtained with the test of incremental information content. However, apart from the volatility of stock prices, which may not capture fundamental information or do so more efficiently, it should be considered that each of the analysed cash flow calculation items represents only a fraction of the FCF, which is ultimately discounted to estimate an intrinsic value.[58]

***Figure 7.7: Summary of the results of the test of incremental information content with dividends per share returns as the dependent variable.***

| | 1994-2008 | | | 1999-2008 | | |
|---|---|---|---|---|---|---|
| *Dependent variable* | Number of sampled firms | Number of sampled firms with a significant relationship | Share of the significant relationships as of the number of sampled firms | Number of sampled firms | Number of sampled firms with a significant relationship | Share of the significant relationships as of the number of sampled firms |
| **Dividends per share returns** | 39 | | | 122 | | |
| ***Cash flow calculation items (independent variables)*** | | | | | | |
| **Rental revenues** | 39 | 1 | 2.56% | 120 | 11 | 9.17% |
| **Operating expenses** | 38 | 1 | 2.63% | 110 | 7 | 6.36% |
| **Change in non-cash working capital** | 37 | 2 | 5.41% | 117 | 8 | 6.84% |
| **Straight-line rents adjustment** | 6 | 0 | 0.00% | 36 | 2 | 5.56% |
| **Op. distrib. received from uncons. j.v. holdings** | 1 | 0 | 0.00% | 11 | 0 | 0.00% |
| **Stock-based compensation expense** | 0 | 0 | 0.00% | 11 | 0 | 0.00% |

*Source: Own calculations based on the total sample (39/122 of 218 REITs)*

With regard to the rental revenues item, the consideration of both adjusted total stock returns and dividends per share returns as dependent variables resulted in a large number of significant relationships when compared to their connection with the remaining explanatory variables. In terms of the number of significant relation-

[57] JENNINGS (1990), p. 930; WILSON (1986), p. 179

[58] A comparison between the free cash flow measure and other measures such as FFO or EPS has been omitted as the proposed valuation tool relies on a combination of measures, with one FCF arising from operating activities and a second from investing activities.

ships, the item shows the highest information content except for the use of dividends per share returns as the dependent variable during the time period between 1994 and 1998.
Few significant coefficients were obtained for the operating expenses variable. Neglecting possible distortions, the item seems to deliver some incremental information content.
The non-cash working capital item exhibits few significant relationships with both adjusted total stock returns and dividends per share returns. Given the few evidence of incremental information content attached to this item, its inclusion in the cash flow calculation scheme might be relevant, although the magnitude of the item is typically lower than that of the rental revenues or the operating expenses item, for example. Presumably, the non-cash working capital item could exhibit an incremental information content concerning REITs domiciled in Australia. This assumption relies on the previous finding that Australian REITs are engaged in the real estate trading or the development business to a considerable extent.[59] However, the test of incremental information content considered in this section did not result in significant coefficients regarding the Australian REITs included in the sample.[60]
For the straight-line rents adjustment, very little evidence regarding incremental information content does exist.

Apart from the availability of a limited amount of data, no significant coefficients were obtained for the item summarising operating distributions received from unconsolidated joint venture holdings. However, the data collection process indicated that the availability as well as the magnitude of operating distributions received from unconsolidated joint ventures increased in recent years. In particular, the participation of REITs in investments in countries outside of their domiciles or their interest in real estate development activities represents an argument for a further increase in this item, potentially yielding incremental information content in the future.

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[59] In this context, BARKHAM (1997, p. 442) notes that the real estate assets owned by real estate firms concentrating on the property trading business are classified as current assets.
[60] Specifically, two REITs headquartered in Australia have exhibited a significant coefficient with the rental revenues variable when using adjusted total stock returns from 1999 until 2008 whereas one Australian REIT possesses a significant coefficient attributed to the rental revenues variable during the time period beginning in 1994 and ending in 2008 with adjusted total stock returns acting as the dependent variable.

Although a limited amount of data were available to examine the incremental information content of the stock-based compensation expense item, one significant coefficient was identified over the time period from 1999 until 2008, with adjusted total stock returns used as the explained variable. In this context, the magnitude of the stock-based compensation expense item showed considerable variation dependent on the REIT.

#### 7.1.1.4 Recommendations regarding the projection of the cash flow calculation items

Overall, the results of the multiple regression analysis and the test of incremental information content discussed recently lead to the recommendation to include all items considered in Formula 7.1. Despite the limited number of significant relationships, even items that probably exhibited small magnitudes on average, such as stock-based compensation expense, might make incremental contributions to information content for certain REITs.

Having established a cash flow calculation scheme, the items included in Formula 7.1 need to be projected over the explicit planning period. Consequently, the following sections present recommendations regarding the forecast of the individual cash flow components.[61]

As indicated earlier, use of the valuation tool is appropriate when evaluating firms for which data are available for at least five consecutive years preceding the key valuation date. Formula 7.4 relates to the calculation of an arithmetic mean used for the projection of several cash flow calculation items to be discussed later.[62]

$$S_{iurref} = \frac{1}{5}\sum_{i=t-5}^{t-1}\frac{iur_i}{ref_i} \qquad \textbf{(7.4)}$$

[61] Additionally, Appendix 7.3 summarises the approach to forecast cash flows from both operating and investing activities.

[62] See Section 7.3.1.1.3 for a brief comparison of the arithmetic and the geometric mean.

where

$S_{iurref}$ = mean ratio of the item under review to a reference figure

$t$ = fiscal year pertaining to the key valuation date

$iur_i$ = item under review in the fiscal year $i$

$ref_i$ = reference figure in the fiscal year $i$

A time horizon of five years is likely to capture a smoothed distribution of the item under review. This assumption is made given data limitations and the finding that a considerable number of REITs has been listed on a stock exchange during the twenty-first century. Consequently, a mean ratio of the item under review to a reference figure was calculated over a time period of five years before the key valuation date. The share $S_{iurref}$ was then multiplied by the forecast regarding the reference figure in each year of the explicit planning period to obtain a projection for $iur_i$.
In addition, it should be noted that the user of the valuation tool ought to critically review the calculated ratio. Considering the possibility that a REIT experienced a large growth of a certain item in the past, the user may decide to modify the ratio according to his or her expectations.

#### 7.1.1.4.1 Rental revenues and other income

Generally, the task of forecasting rental revenues should be facilitated by the existence of contractually fixed rental payments.[63] Nevertheless, the rental revenues item may show fluctuations during the explicit forecasting period, which are partly a result of three factors.
First, the acquisition or sale of properties leads to a change in the portfolio size, which itself influences the magnitude of the rental revenues item. Changes in the

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[63] GIAMBONA/HARDING/SIRMANS (2008, p. 117f) document that lease lengths vary from a single day in the case of hotels, a half year with regard to apartment properties, four years when industrial properties are considered, six years in the case of office properties and seven years pertaining to retail properties. The length of office leases typically lasts between three to 15 years with most leases having a length between three to five years. As of 2002, the average lease length in the United Kingdom for office properties was less than 13 years, for retail buildings 16 years and for industrial facilities 13.4 years. In contrast, apartment buildings may have year-to-year leases. [BRUEGGEMAN/FISHER (2005), p. 592; CLAPP (1993), p. 44; SAYCE et al. (2006), p. 77.]

size of the property portfolio may exert important impacts on the rental revenues item. Presumably, an increase or decrease in the size of the real estate portfolio is attached to common market conditions as well as to the stage of the REIT in its life cycle.
Second, the termination of a tenancy may lead to a change in the rental revenues item. Particularly, the occupancy rate for the overall real estate portfolio might be subject to variations also due to the cyclicality of real estate markets. Apart from property types that typically exhibit variations in their occupancy rates during a single year, REITs usually aim to distribute the expiries of leasing contracts evenly over future years. This strategy also contributes to the conclusion of lease contracts at different rents prevailing at several stages of the rental cycle. Potential deviations regarding the rents at which properties are leased are not considered in this work. Further, as the projection of occupancy rates is difficult to accomplish, no forecast is conducted.
Third, rental adjustments potentially alter the size of the rental revenues item. In this regard, the analysis of annual reports revealed that REITs domiciled in Belgium, Canada, the Netherlands, South Africa and the United States hold properties that entail provisions regarding an indexation to the CPI. In contrast, the rents generated by residential and commercial properties in France are typically connected with the construction cost index.[64]

In summary, it is recommended to link the projection of the rental revenues item to the expectations regarding the growth of the real estate portfolio. For this purpose, the arithmetic mean of the growth rates in total real estate assets over five consecutive years preceding the key valuation date is calculated and used as a rate to forecast the magnitude of real estate assets in a first step. The growth rate should be adjusted if the amount of development activities listed in the financial statements prior to the key valuation date significantly exceeds that of previous years. In a second step, Formula 7.4 is applied, using the rental revenues as the item under review and the total real estate assets as the reference figure. In a third step, the calculated mean ratio is multiplied by the real estate assets that were projected over the explicit

[64] REIT annual reports. However, REITs may also be exposed to increases in operating expenses as a result of inflation.

planning period. The indexation of rents is not explicitly considered in the calculation, as it is assumed that the values attached to the real estate assets also reflect changes in the CPI or in construction costs.

#### 7.1.1.4.2 Operating expenses

As introduced earlier, operating expenses include a variety of expenditures that are incurred on a regular basis. Given the diversity of expenditures included in this item, its projection over the explicit planning period might be difficult. As an approximation, the operating expenses item can be forecast by expressing it as a percentage of the GEI. However, before recommending this approach, the following considerations must be discussed. First, whether the ratio of operating expenses-to-GEI shows variation depending on specific REIT features must be investigated. Second, if disparities become obvious, standard ratios subject to individual REIT attributes are suggested.

Major factors that could influence the magnitude of the ratio of operating expenses-to-GEI include the firm size; the country of REIT headquarters and the regional and sectoral real estate portfolio allocations.[65]

With regard to firm size, REITs might be able to realise economies of scale. Economies of scale occur if the total costs of a firm rise disproportionately less than its output.[66] Generally, the existence of economies of scale for REITs has been confirmed[67] by some researchers and challenged by others[68]. Specifically, an increase in

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[65] Additionally, some authors analysed whether the size of expenses shows differences between REITs that are managed internally and REITs being externally managed. [See, for example, ANDERSON et al. (2002, p. 609) or MILLER/SPRINGER (2007, p. 17f).] Given the observation that REITs gradually converted from externally to internally managed firms over recent years, the impact of this characteristic on the expense ratio is not considered in this study.

[66] ANDERSON/LEWIS/SPRINGER (2000), p. 4.

[67] See, for example, AMBROSE/HIGHFIELD/LINNEMAN (2005, p. 346f), ANDERSON et al. (2002, p. 600), BERS/SPRINGER (1997, p. 275) or YANG (2001, p. 76) who all investigated REITs domiciled in the United States.

[68] Evidence regarding REITs headquartered in the United States is provided by AMBROSE/PENNINGTON-CROSS (2000, p. 18), McINTOSH/LIANG/TOMPKINS (1991, p. 16) and MILLER/SPRINGER (2007, p. 21). AMBROSE/PENNINGTON-CROSS (2000, p. 18) deliver mixed results as the authors observe economies of scale with REITs when output is measured through the square feet for lease but not if output is approximated either by total assets or through total revenues. McINTOSH/LIANG/TOMPKINS (1991, p. 16) document that REITs with a small firm size exhibited

firm size is argued to lead to reductions in insurance, maintenance and advertising costs, for example, until a size is reached at which fixed costs account for a comparatively small percentage of total revenues while variable costs cannot be further reduced.[69] Although these findings have been criticised[70], various authors document economies of scale effects for G & A expenses and several forms of real estate operating expenses.[71]

Additionally, the ratio of operating expenses-to-GEI could show variation depending on the country of REIT headquarters. Analysing REITs domiciled in different Asian countries, SHAM/SING/TSAI (2009, p. 244) observe significant disparities in the ratio of total expenses-to-revenues dependent on the country of headquarters.[72] This finding can be partly explained through the possibility that operating expenses, such as costs of labour, utilities expenses and costs of building materials, may vary between countries.

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superior returns without showing a higher riskiness when compared to REITs possessing a large firm size. This finding rather rejects the assumption of economies of scale.

[69] MUELLER (1998), p. 151. Specifically, MUELLER (1998, p. 151) argues that REITs displaying a market capitalisation of approximately three billion USD or higher may realise much smaller cost reductions with an increase in size when compared to firms exhibiting a lower market capitalisation.

[70] AMBROSE et al. (2000, p. 220) observe that REITs domiciled in the United States do not achieve economies of scale through expense controlling but by means of rental growth, which is found to be higher with small capitalised REITs. Further, AMBROSE/LINNEMAN (2001, p. 149f) do not detect a significant relationship between the firm size and the ratio of G & A expenses-to-revenues.

[71] SHAM/SING/TSAI (2009, p. 242-244) document economies of scale effects for interest expenses, G & A expenses, asset manager fees, utilities expenses but not with property management fees, repair and maintenance expenses, revenues and operating income. The study covered a sample over a time period from 2001 until 2007 including a total of 74 REITs domiciled in Hong Kong, Japan, Malaysia or Singapore. [SHAM/SING/TSAI (2009), p. 234-244.] In addition, multifold evidence on REITs headquartered in the United States is available. AMBROSE/HIGHFIELD/LINNEMAN (2005, p. 341) discover that firms with a larger size are associated with lower overhead expense ratios in comparison to companies exhibiting a small size. Similarly, CAPOZZA/SEGUIN (1998, p. 141f) point to economies of scale as they observe declining ratios of G & A expenses-to-total assets with increasing firm size. CAPOZZA/ LEE (1995, p. 370-374) claim that the ratio of G & A expenses-to-total assets amounts to 1.7% for REITs belonging to a low size quantile possessing an average market capitalisation of 29 million USD and reduces to 0.9% for REITs included in a high size quantile, exhibiting a mean market capitalisation of 279 million USD.

[72] Analysing data provided by SHAM/SING/TSAI (2009, p. 236), total expenses except of interest expenses account for 37.06% of the revenues on average. Distinguished according to the country of headquarters, Hong Kong REITs exhibit a share of total expenses to revenues of 33.11%, Japanese REITs of 36.84%; Malaysian REITs possess a fraction of 71.25% and Singaporean REITs of 38.30%. [Source: Own calculations based on data by SHAM/SING/TSAI (2009).]

Similarly, the size of the ratio of operating expenses-to-GEI could be affected by the regional real estate portfolio allocation. In this regard, it is assumed that REITs showing diversification across regions incur more expenses than firms concentrated on a certain geographical market. In comparison to a regionally focused portfolio, geographical diversification might lead to an increase in monitoring costs due to the need to hire more property management firms.[73] Cost savings due to quantity discounts realised by geographically focused REITs, which are able to commission a single firm for the management of their properties, are typically not realisable. Considering that REITs also purchase properties in foreign markets by means of acquisitional joint ventures, additional costs associated with joint ownership investments could contribute to a rise in the ratio of operating expenses-to-GEI.
Taking into account that little research has been devoted to analysing the association between operating expenses and the regional real estate portfolio allocation, presumably, no significant relationship has been yet reported.[74]

A fourth factor that probably influences the magnitude of the operating expenses-to-GEI ratio is the sectoral portfolio allocation. As for geographical portfolio composition, REITs focused on a property type are likely to incur fewer operating expenses than firms diversifying their portfolios across multiple real estate sectors. In this regard, a diversified portfolio requires managerial knowledge concerning more than one property type.[75] Likewise, participation in acquisitional joint ventures to obtain additional knowledge about property sectors would incur additional costs. Considering that property management firms typically focus their services on a limited number of real estate sectors, a higher extent of monitoring costs and a reduced possibility of cost savings might be associated with REITs' diversification across property types. In contrast, the preceding analysis of the real estate assets held by REITs revealed that firms concentrating their holdings in a sector such as lodging and resorts own geographically diversified portfolios, which may lead to enhanced property management expenses.

[73] BERS/SPRINGER (1997), p. 276.
[74] For example, AMBROSE et al. (2000, p. 221) do not find significant evidence regarding economies of scale when the REIT portfolio is concentrated on a certain region.
[75] BERS/SPRINGER (1997), p. 276.

Overall, the assumption that REITs targeting a particular real estate sector incur a lower ratio of operating expenses-to-GEI than REITs diversified across property types has been confirmed in several studies[76] but also challenged by a few[77].

Summarising the findings of previous research, property operating expenses probably account for a comparatively large share of total revenues, approximately 20 to 30 percent.[78] In addition, G & A expenses, expressed as a share of total revenues, are likely to vary between one and eleven percent.[79]

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[76] AMBROSE/LINNEMAN (2001, p. 147-150) find that the ratio of G & A expenses-to-total revenues shows differences by property type. ANDERSON et al. (2002, p. 609) conclude that REITs focused on a specific real estate sector experience lower levels of operating costs in comparison to REITs diversified across property types. Similarly, CAPOZZA/LEE (1995, p. 374) observe that G & A expenses for diversified REITs are comparatively high but low for firms concentrated on certain sectors such as apartments or retail.

[77] Although this assumption has not directly been examined, some authors consider expenses when testing for efficiency. LEWIS/SPRINGER/ANDERSON (2003, p. 78) do not identify a significant impact of diversification across property types on efficiency. Similarly, SHAM/SING/TSAI (2009, p. 242) reject the existence of a connection between diversification strategies and scale efficiency when studying REITs domiciled in Asian countries.

[78] Using data by AMBROSE/PENNINGTON-CROSS (2000, p. 23), a mean ratio of property level expenses-to-total revenues of 30.29% is calculated. Depending on the year of observation, AMBROSE/PENNINGTON-CROSS (2000, p. 8-11) collected data on 125 to 175 REITs headquartered in the United States between 1994 and 1998. Studying a sample of 120 REITs headquartered in the United States, YANG (2001, p. 70) observes a share of total expenses to total assets of 8.08% with operating expenses accounting for the highest share of 3.06% of the total assets. In addition, the author included repair and maintenance expenses displaying a share of 0.36%, utility expenses owning a share of 0.20% and property management expenses possessing a fraction of 0.10% of total assets. [YANG (2001), p. 70.] The data included in the study by SHAM/SING/TSAI (2009, p. 236), reveal that property management expenses (4.61%), asset manager fees (31.54%), utilities expenses (2.41%) as well as repair and maintenance expenses (2.31%) account for an overall share of 40.87% of total revenues. It should be noted that the mean value of asset management fees is distorted through an outlier included in the sample of Singaporean REITs. Excluding the data on Singaporean REITs, the share of asset management fees to total expenses amounts to 2.26%, whereas the average ratio of property operating expenses-to-total revenues amounts to 22.08%.

[79] AMBROSE/HIGHFIELD/LINNEMAN (2005, p. 331) calculated an average share of G & A expenses of 7.30% with a standard deviation of 15.33%. Furthermore, the ratio of G & A expenses-to-sales shows differences by property type focus, i.e., recreation 11.43%, office 10.60%, restaurant 9.45%, diversified 8.99%, hotel 7.48%, retail 6.21%, industrial 6.56%, health care 5.73%, residential 5.08% and self-storage 3.68%. The authors employed data over a time period between 1990 and 2001 consisting of 187 REITs domiciled in the United States. [AMBROSE/HIGHFIELD/LINNEMAN (2005), p. 330-334.] The data published by AMBROSE/PENNINGTON-CROSS (2000, p. 23), reveal that G & A expenses account for a mean share of total revenues of 4.10%. Examining the data collected by SHAM/SING/TSAI (2009, p. 236), G & A expenses account for a share of total revenues of 1.18%.

In light of the recent evidence of significant relationships between the size of operating expenses and firm size, country of headquarters and sectoral portfolio allocation, Figure 7.8 summarises the results.[80]

## *Figure 7.8: REIT expenses as a share of total revenues.*

| *Arithmetic mean values (2004-2008)* | Number of sampled firms | Total expenses | G & A expenses | Property operating expenses |
|---|---|---|---|---|
| Apartments | 17 | 45.33% | 5.00% | **40.33%** |
| Community centres | 12 | 35.94% | 8.51% | 27.43% |
| Free standing | 11 | 16.15% | 6.99% | 9.16% |
| Health care | 11 | 22.19% | 6.04% | 16.13% |
| Industrial | 11 | 30.64% | 7.79% | 22.85% |
| Land lease | 3 | 44.12% | 7.10% | 37.01% |
| Lodging and resorts | 12 | 40.67% | 3.93% | 36.75% |
| Merchandise centres | 19 | 36.05% | 4.54% | 31.50% |
| Neighbourhood centres | 5 | 32.53% | 6.24% | 26.29% |
| Offices | 44 | 34.73% | 5.64% | 29.08% |
| Self-storage | 5 | **47.50%** | 8.98% | 38.52% |
| Specialty | 2 | 34.57% | **22.55%** | 12.02% |
| Diversified | 24 | 34.90% | 8.46% | 26.43% |
| | | | | |
| Australia | 20 | 28.49% | 7.92% | 20.57% |
| Belgium | 3 | 17.53% | **10.04%** | 7.49% |
| Canada | 19 | **46.77%** | 3.62% | **43.15%** |
| France | 7 | 30.04% | 8.85% | 21.19% |
| Japan | 13 | 34.32% | 1.67% | 32.65% |
| Netherlands | 6 | 19.22% | 5.41% | 13.81% |
| New Zealand | 3 | 27.33% | 3.12% | 24.21% |
| Singapore | 5 | 35.74% | 2.35% | 33.39% |
| South Africa | 4 | 32.48% | 4.62% | 27.86% |
| Turkey | 0 | --- | --- | --- |
| USA | 96 | 35.70% | 7.61% | 28.09% |
| | | | | |
| High market capitalisation | 44 | 34.19% | 6.23% | 27.96% |
| Upper-middle market capitalisation | 44 | 35.81% | 6.07% | 29.75% |
| Lower-middle market capitalisation | 44 | **37.21%** | 6.54% | **30.67%** |
| Low market capitalisation | 44 | 31.44% | **7.16%** | 24.29% |

*Source: Own calculations based on the total sample (176 of 218 REITs)*
*Note: Highest mean values of the respective category are marked in red colour.*

[80] Given data limitations, information on 176 firms, representing a sub-sample of the 218 REITs, have been collected. The term total expenses equals the sum of G & A expenses and property operating expenses only. According to the previous explanations, i.e., that SG & A expenses are infrequently reported by REITs, no dataset had been available to include selling expenses in the analysis.

Indeed, the results show large differences in expenses, measured as a fraction of total revenues, when considering sectoral portfolio allocation.

Taking into account that REITs focusing on apartment properties hold a large number of assets in addition to the previous findings, i.e., a relatively low level of regional concentration according to the Herfindahl-Hirschman indices (see Figure 2.4), this class of REITs exhibits the highest property operating expenses. The large number of properties and the reduced level of regional concentration could also explain the relatively high property operating expenses associated with REITs focusing on self-storage properties.

The question of whether country-specific factors such as labour costs translate into different ratios is difficult to answer. Notably, Japanese REITs show a relatively low ratio of G & A expenses-to-revenues, which could be explained through the observation that these firms need to outsource management and advisory functions. The high property operating expenses associated with Canadian REITs are partly a result of three outliers, namely two firms focused on the operation of lodging and resort properties and one firm concentrated on health care assets. Indeed, the ratio of property expenses-to-total expenses pertaining to Canadian REITs focused on lodging and resort buildings clearly exceeds that of firms domiciled in other countries and focused on the same sector. One explanation for this finding could relate to the fact that Canadian REITs not only outsource the hotels' operations to third parties but also manage lodging and resort properties and/or restaurants themselves.

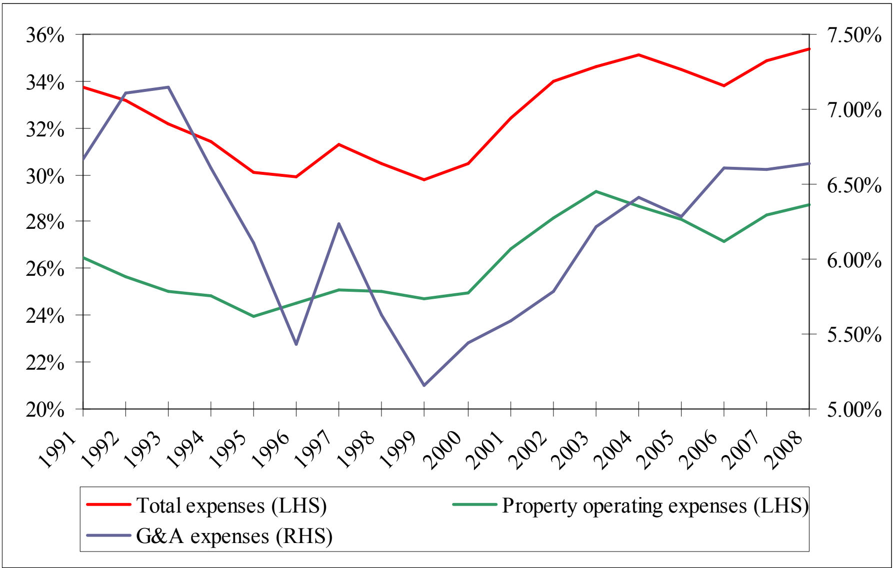
The results regarding the size of the REITs indicate the existence of a size effect concerning G & A expenses. In contrast, property operating expenses are likely to depend on the property sector classification of a REIT. Overall, the dependency of the ratio on sectors may outweigh potential economies of scale.

The calculation of annual mean expense ratios over the time period beginning in 1991 and ending in 2009 is summarised in Figure 7.9.

Both the G & A and the property operating expenses moved within a relatively stable corridor when expressed as a share of total revenues. Specifically, the G & A-to-rental revenues ratio varied in a range between 5.16% and 7.15%, the ratio of property operating expenses-to-total revenues in a corridor between 23.98% and 29.26%

and the share of total expenses to the rental revenues in a range between 29.78% and 35.39%.

***Figure 7.9: Development of REIT expenses as a share of total revenues.***




*Source: Own calculations based on the total sample (176 of 218 REITs)*

### 7.1.1.4.3 Operating distributions received from unconsolidated joint venture holdings

The recommended procedure to forecast the operating distributions received from unconsolidated joint venture holdings was derived on the basis of the following considerations.

The extent of operating distributions obtained from unconsolidated joint ventures might be reduced for a variety of reasons.

As documented before, REITs often show a relatively high degree of concentration on a specific region or property type. Consequently, the extent of investments beyond the focus of the real estate portfolio through a joint venture partner may account for a relatively small share of the total real estate joint assets.[81] In particular, a REIT might prefer to participate in an acquisitional venture to perform real estate development projects.

Furthermore, the advantages that have previously been attributed to dispositional joint ventures could be of minor importance to a REIT. Specifically, the generation of liquidity might be accomplished through other activities, such as equity or debt issuances. As documented above, the stock market penalised REITs for participation in dispositional joint ventures in the past.

In addition, some evidence exists that the ratio of unconsolidated joint venture assets-to-total assets has been below five percent in the recent past.[82] Consequently, the operating distributions received from unconsolidated joint ventures should be relatively low when expressed as a share of rental revenues if it is assumed that the earnings capability does not show large differences between properties held directly and those owned through joint ventures.

Despite these arguments, the operating distributions received from unconsolidated joint ventures might account for a considerable share of income in the future. Specifically, evidence indicates that the ratio of assets held through joint ventures-to-total assets owned by REITs has increased in recent years.[83] In comparison to equally- and majority-owned properties, the number of minority-owned properties expressed as a share of the total number of properties held by a REIT exhibited the highest growth rate from pre-1980 until the time period between 2000 and 2001.[84]

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[81] An exception is potentially observed with some REITs as the analysis of the REIT sample revealed that firms domiciled in Australia, France and Singapore exhibited a relatively high portfolio diversification across regions and property types.

[82] Particularly, HESS/LIANG (2004, p. 78f) observe that unconsolidated assets, that are supposed to relate to joint ventures of REITs holding a minority voting interest, amount to 4.5% of the total assets at the end of year 2002. Categorising property values as of year-end 2002 by ownership status, the authors find that minority-owned assets account for 2.6% of the total assets, equally-owned assets exhibit a share of 5.1% of the total assets, 4.8% of the total assets are majority-owned, 83.8% are fully owned by a REIT and 3.7% of the total assets cannot be allocated to one of the previous categories due to missing information. [HESS/LIANG (2004), p. 79.]

[83] Particularly, HESS/LIANG (2004, p. 80) document that the ratio of assets held under both consolidated and unconsolidated joint venture structures-to-total assets grew from 10.1% at year-end 1998 to 12.5% measured at the end of year 2002.

[84] HESS/LIANG (2004), p. 81. Specifically, the share of minority-owned properties increased from a mean share of 1.3% in the pre-1980 phase up to an average amount of 6.9% during the time horizon between 2000 and 2001. In comparison, in the pre-1980 phase majority-owned properties accounted for a

Assuming that minority-owned assets are held exclusively by unconsolidated joint ventures, the number of unconsolidated joint venture properties as a share of the total number of properties might grow in the future as well. This scenario could result in an increase in operating distributions obtained from unconsolidated joint ventures expressed as a share of GEI.

Additionally, scientific evidence indicates that the share of total assets that is held in joint ventures is dependent on the property type focus of a REIT. One publication shows that REITs concentrating their portfolios on hotel properties possess a relatively low share of joint venture properties to total properties, whereas REITs primarily holding malls hold a comparatively high proportion of their total number of properties in joint ventures.[85] Thus, the share of assets held in both consolidated and unconsolidated joint ventures probably shows large variation subject to the property type focus of a REIT.

In summary, the evidence regarding the share of total assets held in unconsolidated joint ventures is very limited. Similarly, the previous examinations of the cash flow calculation items revealed that operating distributions received from unconsolidated joint ventures did not show significant connections with adjusted total stock returns and dividends per share returns when considering a sample of REITs over two time periods between 1994 and 1998. Furthermore, the benefits of receiving operating distributions from unconsolidated joint ventures in comparison with other income sources might be partly reduced. In this sense, no precise argument was found in support of an increase in the operating distributions obtained from unconsolidated joint ventures as a share of total income.

Nevertheless, the distributions received from unconsolidated joint ventures should represent an earnings component similar to the rental revenues item described above. Based on this assumption, the item summarising operating distributions received from unconsolidated joint ventures is linked to the forecast of the rental revenues stream as the reference figure by means of Formula 7.4 and the resulting ratio used for forecasting the item under review.

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mean share of 1.7% and equally-owned buildings for 3.0% with majority-owned real estate assets exhibiting an average share of 4.1% and equally-owned buildings of 2.8% during the time horizon between 2000 and 2001.

[85] HESS/LIANG (2004), p. 82f.

#### 7.1.1.4.4 Straight-line rents adjustment, stock-based compensation expense and non-cash working capital

In the context of straight-line rents adjustments, this position should depend on the magnitude of rental revenues. Accordingly, a historical share is calculated through Formula 7.4 and used to forecast the adjustments.

The stock-based compensation expense item might be difficult to forecast, although the magnitude of this item is typically low in comparison to other components included in the cash flow calculation scheme. As an approximation, it is suggested to calculate a mean annual growth rate on the basis of the size of the item for five years preceding the key date of valuation and to extract the mean value of the stock-based compensation expense item over the most recent five years. Subsequently, the mean value of the stock-based compensation expense item is used as a starting point and increased by the growth rate during each year of the explicit forecasting period.

The forecast of the change in non-cash working capital is difficult to establish, as alterations of this item are typically not stable over time. Instead of projecting this item based on an analysis of the REIT, it is suggested to tie the changes in non-cash working capital to changes in the rental revenues item by means of Formula 7.4 before calculating forecasts of the item under review.[86]

### 7.1.2 Derivation of the cash flow calculation scheme pertaining to investing activities

Reconsidering the examination of valuation tools, researchers have raised the criticism that both the NAV and the FFO-based approaches do not adequately capture the creation or destruction of value through property disposals. In this regard, GORE/STOTT (1998, p. 324f) contend that the omission of gains or losses on the sale of real estate may result in an erroneous REIT valuation. Here, the analysis of annual reports documents gains or losses realised by REITs due to adjustments of their real estate portfolios by means of acquiring new buildings or selling parts of their existing real estate assets.

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[86] DAMODARAN (2010), p. 26f; REIT annual reports.

Consequently, the impacts of these operations, together called real estate investing activities, are captured in the following sections. One possible way to address these considerations relates to the inclusion of capital gains or losses[87] in the valuation tool. However, this procedure would neglect the existence of additional items that potentially affect the cash flows from investing activities. Accordingly, those items that are supposed to be able to influence the cash flow calculation to a notable extent were included in the following derivation. Similar to the calculation of the cash flows associated with the real estate holding, management and operating business, the direct method of estimating cash flows was utilised in this context.

| | | |
|---|---|---|
| | **Net cash received from sale of real estate assets** | **(7.5)** |
| + | **Capital distributions received from unconsolidated joint venture holdings** | |
| - | **Cash paid for real estate acquisitions** | |
| - | **Capital improvements** | |
| - | **Leasing costs** | |
| - | **Cash paid for additions to interests in unconsolidated joint venture holdings** | |
| - | **Other real estate-related equity investments** | |
| = | **FCF from investing activities** | |

Explanations regarding the items included in this cash flow calculation scheme, including a proposal regarding their projection over the explicit planning period, are provided in the following sections.

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[87] In order to identify whether a property transaction has resulted in a capital gain or capital loss, the gross sales price has to be determined at the beginning. The gross sales price could equal cash or may relate to another property received in exchange for the disposed asset. In addition, existing liabilities against the property assumed by the vendor are included in the gross sales price. Reducing the gross sales price by selling expenses such as legal, recording and brokerage fees results in the net sales proceeds. The so-called adjusted basis, represents a property's original basis (cost of land and improvements, acquisition and installation fees) plus the cost of any capital improvement, alterations or additions made during the property holding period less accumulated depreciation accrued until the selling date. Finally, the adjusted basis is subtracted from the net sales proceeds to determine a capital gain or a capital loss. [BRUEGGEMAN/FISHER (2005), p. 311; SIROTA (2004), p. 107.]

#### 7.1.2.1 Net cash received from sale of real estate assets

Net cash received from sale of real estate assets equals the net sales proceeds. The net sales proceeds equal the gross sales price less selling expenses.[88] Assuming that REITs sell properties on a recurring basis, the impact of this activity should be captured in the valuation tool. Considering the forecast of the asset size pertaining to the property investments, the net cash received from sale of real estate assets is projected as a share of the asset size according to Formula 7.4. However, the magnitude of this item is supposed to be dependent on the current status of the real estate market cycle. Given the difficulties faced in forecasting the future development of real estate markets, the projection of this item is problematic. Missing observations regarding this item might occur immediately after the inception of the REIT, when the firm likely starts to build up a real estate portfolio instead of selling buildings. In contrast, the likelihood of missing observations is reduced due to the requirement that the firm should have exhibited historical data over a minimum period of five consecutive years.

#### 7.1.2.2 Capital distributions received from unconsolidated joint venture holdings

Capital distributions received from unconsolidated joint venture holdings represent another cash outflow included in the cash flow calculation scheme associated with investing activities. Primarily, these distributions are thought to result from the sale of properties.[89] In contrast, cash flows obtained on a regular basis, such as rental revenues, are not included in the item under consideration as they are part of the calculation scheme attributed to the real estate holding, management and operating business.

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[88] BRUEGGEMAN/FISHER (2005), p. 311.

[89] The analysis of annual reports reveals that few REITs received refinancing proceeds from unconsolidated joint ventures. Proceeds from the refinancing of properties constitute the surplus of the difference between the amount of debt financing and the book value of the asset included in the financial statements. Refinancing proceeds may be realised if the fair market value clearly exceeds the book value of the asset. [ABRAMS/DOERNBERG (1999), p. 3-60-3-61.]

Taking into account the previous reasoning regarding the calculation of operating distributions received from unconsolidated joint ventures, the importance of dispositional joint ventures for the purpose of generating liquidity might be limited in this context. Presumably, acquisitional joint ventures largely relate to the participation of REITs in real estate development projects and include purchases of existing properties to a minor extent.

Assuming that REITs engage in few unconsolidated joint ventures with a minority ownership, the capital distributions received from these holdings might be reduced in comparison to the proceeds realised from the sale of real estate assets held directly by the REIT. Presumably, a lower degree of flexibility regarding property investment decisions within the joint venture holding can exist due to the following reasons.

First, the REIT typically cannot decide to sell a property without the consent of the joint venture partner. Even if the partner does not dismiss a sale, the length of time needed to sell a property owned in a joint venture might exceed that of selling a comparable building held directly by a REIT. This delay could arise when the partners need to reach a consensus when negotiating with the prospective buyer. Second, the marketability of a real estate investment might be prolonged or confined if the REIT participates in unconsolidated joint ventures to purchase properties with a relatively large transaction size or to enter foreign real estate markets that exhibit a comparatively small ratio of investable-to-total real estate assets. Third, the setting up of a joint venture might incur costs due to the needs to identify a qualified partner and to formulate appropriate agreements.

The preceding reasoning potentially indicates increased costs spent when pursuing real estate transactions within unconsolidated joint ventures[90] in comparison to properties acquired directly by the REIT. If the management of the REIT is aware of these arguments, it might consider ex ante a holding period that exceeds that of a property not owned by a joint venture entity. Similarly, these considerations lead to the presumption that the proportion of joint venture investments carried out by REITs is confined over the long-term. Given this argument, the results point to a

[90] Although an increased possibility of selling a property is potentially realised with a higher REIT shareholding in the joint venture, the preceding argumentation should apply to consolidated joint venture holdings as well.

minor importance of unconsolidated, in comparison to consolidated, joint venture holdings when measured as a share of total assets.[91] Similar to the prediction of the operating distributions received from unconsolidated joint ventures, the application of Formula 7.4 is proposed prior to a forecast, with the net cash received from the sale of real estate assets acting as the reference figure.

#### 7.1.2.3 Cash paid for real estate acquisitions

Apart from the sale of real estate assets, REITs typically acquire new properties to expand or to modify their real estate allocations.

The cash paid for real estate acquisitions includes the cost of land and improvements. Depending on the information transparency of the REIT, additional acquisition and installation fees are either included in the cash paid for real estate acquisitions or stated under a separate item. The magnitude of this position likely depends on the size of the real estate portfolio. To develop a forecast capturing the cash paid for real estate acquisitions, the past values of this item should be expressed as a percentage of the total real estate assets. Again, Formula 7.4 was used before a forecast, with the total real estate assets acting as a reference figure.

#### 7.1.2.4 Capital improvements

Capital improvements can be defined as capital outlays for major, non-recurring items. Such items may include expansion projects that aim to increase the rentable area of a property or renovation projects that contribute to an increase in the income of an existing leasable area. Examples of capital improvements include roof replacements, elevator modernisations or parking garage constructions. Tenant improvements may also constitute a portion of the capital improvements.[92] The relative size of capital improvements may depend on the strategy followed by a specific REIT. In this sense, a REIT might be focused on the acquisition and subsequent

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[91] Following HESS/LIANG (2004, p. 80), the sum of equally-owned and majority-owned assets held in joint ventures as a share of total real estate assets has a value of 9.14% whereas the respective share of minority-owned assets amounts to 2.4%. The figures represent mean values calculated between 1998 and 2002, which are obtained from REITs domiciled in the United States. [HESS/LIANG (2004), p. 78.]

[92] BRUEGGEMAN/FISHER (2005), p. 302; REIT annual reports.

management of properties with an extensive need for refurbishment. The development of these improvements may be connected with changes in the size of real estate assets. As an approximation, the share of capital improvements in the total real estate assets size should be calculated according to Formula 7.4 with the item projected thereafter.

#### 7.1.2.5 Leasing costs

Leasing costs may represent commissions paid by the REIT to outside leasing brokers to solicit tenants. The item under review should also include deferred leasing costs. Deferred leasing costs represent costs associated with the successful negotiation of leases that are capitalised and amortised on a straight-line basis. However, the comparability between REITs that publish their leasing costs incurred within a certain year and REITs that disclose deferred leasing costs might be reduced. Although both figures can differ over certain time periods, their long-term impact on FCFs should be equal.[93]

Leasing costs ought to be calculated as a share of the total real estate assets by means of Formula 7.4 and projected thereafter.

#### 7.1.2.6 Cash paid for additions to interests in unconsolidated joint venture holdings

Cash paid for additions to interests in unconsolidated joint venture holdings represents another cash outflow included in the calculation scheme pertaining to investing activities. This figure primarily comprises cash used to purchase land or buildings, to finance development projects, to ensure building improvements or to cover leasing costs.

Preceding a recommendation regarding the forecasting of this item, its significance for REITs is subject to the following considerations.

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[93] BRUEGGEMAN/FISHER (2005), p. 592; REIT annual reports.

On the one hand, the cash paid for acquisitions of existing properties by means of unconsolidated joint ventures might be reduced in the case of the bulk of REITs. This assumption relies on the previous argument, i.e., a typically reduced participation of REITs in acquisitional joint ventures due to an existing portfolio with a comparatively high degree of concentration on both regions and property types instead of pursuing investments in foreign markets.

On the other hand, the analysis of annual reports indicates that REITs' engagement in real estate development or redevelopment projects by means of unconsolidated joint ventures might exert a considerable impact on firm value in case of specific firms. Furthermore, HESS/LIANG (2004, p. 80f) observe that a relatively high share of newly constructed buildings is held by REITs through joint ventures. The authors suppose that REITs participate in real estate development activities and aspire to hold a minority interest in the completed development project.[94] Similarly, CAMPBELL/WHITE-HUCKINS/SIRMANS (2006, p. 279) document that approximately 75% of all acquisitional joint ventures are concerned with real estate development projects.[95]

These findings, in connection with a variety of potential advantages associated with the participation of a REIT in real estate development or redevelopment projects through unconsolidated joint ventures,[96] result in the view that the item under consideration could have a notable impact on the size of the cash flows from investing activities.

The cash used by the REIT to carry out real estate development activities within unconsolidated joint ventures potentially constitutes the highest share of the cash paid for additions to interests in unconsolidated joint ventures. However, the level of

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[94] HESS/LIANG (2004), p. 81.

[95] Specifically, 60% of all acquisitional joint ventures relate to development projects carried out by REITs cooperating with a financing institution and an additional 15% with a real estate development company as the partner. The authors analysed a sample of 185 joint ventures announced by REITs headquartered in the United States during the time period between 1994 and 2001. [CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 280.]

[96] Potential benefits comprise the relief of the financial statements from short-term negative income effects until an acceptable value of the project is reached, the exploitation of skills from a partner experienced in real estate development or redevelopment projects and the possibility to acquire a property without entering into a competitive bidding environment. [CAMPBELL/WHITE-HUCKINS/SIRMANS (2006), p. 279; HESS/LIANG (2004), p. 78.]

REIT participation in real estate development projects might be difficult to predict. Apart from legal restrictions, the engagement of REITs in real estate development projects can be affected by both external[97] and REIT-specific[98] influencing factors. Whereas a detailed forecast of this item would clearly increase the complexity of the valuation task, the following approximation is employed. Similar to the forecast of the operating distributions received from unconsolidated joint ventures, the calculation of an arithmetic mean according to Formula 7.4 and the subsequent forecast of this reference item is proposed. In this case, the sum of the cash paid for acquisitions, capital improvements and leasing costs will be employed as a reference figure. These items are considered because they are likely to equal the types of outflow caused through the participation of a REIT in an unconsolidated joint venture.

#### 7.1.2.7 Other real estate-related equity investments

Finally, other real estate-related equity investments might be included in the calculation of the cash flows pertaining to real estate investing activities. Other real estate-related equity investments can entail preferred equity investments, for example. This item might become important in the calculation of cash flows from real estate investing activities if the REIT pursues other real estate-related equity investments to a considerable extent. If this item was published, an average share of other real estate-related equity investments relative to the cash paid for acquisitions according to Formula 7.4 was calculated. In case the average share accounts for a considerable amount of the cash paid for real estate acquisitions, the share should be employed to forecast the item as well.

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[97] External influencing factors could entail the availability of a joint venture partner who shows the willingness to contribute cash or knowledge, the current level of construction costs or the state of the rental and property price cycle. In this regard, several authors point to a strong cyclality of real estate construction. [See, for example, PHYRR/ROULAC/BORN (1999, p. 53).]

[98] REIT-specific influencing factors may entail the current ability to raise cash in spite of the income distribution requirements or the capability of the firm to tie up capital over several years without receiving a considerable cash distribution.

## 7.2 Considerations regarding the inclusion of the value derived from non-operating assets

REITs may own assets that are not part of their operations. Accordingly, these non-operating assets, which may include cash, marketable securities or unused real estate assets can be sold without deteriorating the company's operations. This item should be captured at its liquidation value.[99]

In light of the review of the REIT legislation, assets owned by the REIT are largely confined to real estate. In comparison, the value attributed to non-operating assets might be negligible. If no significant amount of non-operating assets is detected, it is recommended to omit the calculation of a value of non-operating assets in the valuation tool.

## 7.3 Calculation of the cost of equity

The result of a DCF valuation shows a relatively high sensitivity towards the size of the discount rate employed in the model. Thus, this section is devoted to the derivation of a cost of equity attributed to the REIT. However, as FAMA (1991, p. 1589-1599) stresses, a particular asset-pricing model cannot completely reflect reality. Instead, the model helps to improve understanding about equity returns.[100]

The APV concept applied in this study requires the discounting of free cash flows to both equity- and debtholders at the unleveraged cost of equity to obtain the equity value. However, the unleveraged cost of equity represents a theoretical construct. As a consequence, the leveraged cost of equity observable for REITs is calculated in a first instance. Thereafter, the leveraged cost of equity are converted to the discount rate of an unleveraged REIT by means of the MODIGLIANI/MILLER (1963) formula introduced previously. Although the discount rate may be of major importance in the determination of the company's value, no generally accepted model to calculate the cost of equity has been established until now.[101]

Accounting for the potential sensitivity of the company's value to the discount rate as well as for the uncertainty about an appropriate model, two approaches to the

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[99] PEEMÖLLER (2005c), p. 41; PRATT/NICULITA (2007), p. 298.
[100] KANTOR (2008), p. 141.
[101] KOLLER/GOEDHART/WESSELS (2005), p. 303f.

calculation of a leveraged cost of equity are examined in the following. First, the determination of a discount rate on the basis of the capital asset pricing model is discussed (7.3.1). Second, a multi-factor model is introduced and examined in detail (7.3.2).

### 7.3.1 Capital asset pricing model

The capital asset pricing model represents one method of calculating the cost of equity. The applicability of the model to REITs will be investigated in the following. Initially, the CAPM is described in the context of its use with REITs (7.3.1.1). Subsequently, the application of the CAPM to REITs is critically evaluated (7.3.1.2). Finally, the course of the calculation of the items forming the CAPM is summarised, and the results are presented (7.3.1.3).

#### 7.3.1.1 Description

The CAPM, based on modern portfolio theory[102], represents an equation for estimating the required rate of return, which should be held at a state of equilibrium[103]. Because the CAPM represents an abstraction of real capital markets, the model relies on multiple assumptions and can be expressed by means of the following equation:

$$E(r_i) = r_f + \beta_i \left[ E(r_m) - r_f \right] \qquad \textbf{(7.6)}^{104}$$

where

$E(r_i)$ = expected rate of return on security $i$

$r_f$ = return on a risk-free investment

[102] See MARKOWITZ (1952) for further information.

[103] The state of equilibrium represents a fixed point in the actual asset pricing process where the collective action of all agents, who try to maximise their utility, does not lead to a change in the pricing process. [FOCARDI/FABOZZI (2004), p. 334.]

[104] See ARNOLD (2008, p. 330), FOCARDI/FABOZZI (2004 p. 334 & 512f) and PINTO et al. (2010, p. 57) for further information including the assumptions of the CAPM.

$\beta_i$ = sensitivity of the return on security *i* towards the return on the market portfolio

$E(r_m)$ = expected rate of return on the market portfolio

In the following, the application of the CAPM in the context of REITs is described in more detail. Specifically, the collection of a return on a risk-free investment (7.3.1.1.1), the calculation of a beta measure (7.3.1.1.2) and the estimation of the equity risk premium (7.3.1.1.3) are explained.

#### 7.3.1.1.1 Return on a risk-free investment

Generally, a risk-free investment should fulfil two principal assumptions. First, the security should not entail a default risk. Second, as the actual return ought to equal the expected return, the risk-free security must not pose a reinvestment risk. The choice of an adequate type of security fulfilling the two assumptions has been subject to controversial discussions. Short-term government debt, such as three-month treasury bills, and long-term government bonds possessing a maturity of ten years, for example, have been primarily considered as risk-free investments as these are supposed to exhibit no default risk. Some researchers suggest the use of three-month treasury bills as this form of investment better squares with the concept of the CAPM as a single-period model. Whereas a long-term government bond with a duration of more than one period could exhibit a risk premium because of the uncertainty about the price at each date prior to the bond expiry, the price of a treasury bill is secured at the end of the period. Assuming that the length of the planning period pertaining to the valuation model exceeds the duration of the security, a treasury bill investment is associated with a reinvestment risk as a risk-free investment has to be made at a new but unknown interest rate. The reinvestment risk is potentially reduced when using a long-term government bond. For this purpose, the forecasting period, over which a risk-free investment represents a constituent of the valuation model, should be matched with a zero-coupon bond exhibiting the same duration. In the strict sense, year-specific risk-free rates should be applied to each year of the cash flow forecasting period. However, DAMODARAN (2002, p. 155) argues that the present value effect of using year-specific risk-free rates instead of matching the duration of the risk-free investment with the forecasting period is relatively low. Following this argument, the duration of the risk-free security is matched with the length of the cash flow forecasting period. Depending on the availability of data, the maturity of a government bond should equal the length of the explicit planning period when calculating the cost of equity. With regard to the implicit planning period, a government bond exhibiting the longest maturity could be chosen as infinite cash flows need to be discounted.[105]

Aside from this, the interest rate of a long-term government bond should be extracted at the corresponding date of valuation because these data reflect the expectations of the market participants about the future development of interest rates. The interest rate is obtained from bonds issued by the government of the country where the REIT is domiciled.[106]

#### 7.3.1.1.2 Beta measure

The beta measure included in the CAPM expresses the sensitivity of a return on an asset to the return on the market portfolio comprising risky assets. Generally, the beta variable can be calculated by means of one of three approaches, namely from accounting data, through the analysis of fundamental features or on the basis of historical market prices.[107]

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[105] ARMITAGE (2005), p. 90; DAMODARAN (2002), p. 154f; NOWAK (2003), p. 71; PINTO et al. (2010), p. 50f & 85. DAMODARAN (2002, p. 155) assumes a normal upward-sloping yield curve with long-term government bonds typically yielding a return that exceeds the return on short-term government debt by two to three percent. Theoretically, the maturity of the risk-free investment should exactly match the forecasting period. However, this requirement may not be fulfilled due to a lack of appropriate data on a return on a risk-free investment with infinite maturity. Even the availability of data on long-term government bonds exceeding a maturity of ten years can be restricted. In comparison to a 30-year government bond, a ten-year government bond might be less susceptible to changes in the inflation rate while exhibiting a higher liquidity. [BALLWIESER/LEUTHIER (1986), p. 608; WIDMANN/SCHIESZL/JEROMIN (2003), p. 801.]

[106] See WEINBERGER (1995, p. 105) for further information. This approach prevents the consideration of a country risk premium in the CAPM since specific country or political risk is already reflected in the bond rate. [See DePAMPHILIS (2009, p. 673) for further information.]

[107] See DAMODARAN (2002, p. 182), PANKOKE/PETERSMEIER (2009, p. 119) and PINTO et al. (2010, p. 58) for further information regarding the beta measure.

The estimation of beta from accounting data is suggested for cases in which market prices are very noisy or non-existent. The unavailability of market prices is supposed to be less probable with the sampled REITs.[108]

Another approach, which utilises company-specific information for estimating the beta variable, relates to the analysis of fundamental features. With the fundamental approach, which shows a conceptual similarity with the Arbitrage Pricing Theory (APT) model, the size of the beta factor is primarily dependent on the company sector, the operative risk and the financial risk.[109] Several researchers advise against using the fundamental approach, which has not received the same amount of attention from researchers compared to the APT model.[110] Given the preceding observations, the estimation of fundamental betas is not pursued at this stage.

A third approach to estimating the beta factor relies on the use of historical market prices. In this context, the beta measure is derived by means of a regression model with the return on the market portfolio as the independent variable and the stock return on a security $i$ as the dependent variable.[111]

The choice of the length of the historical time series represents a controversial issue. On the one hand, an increasing time span of historical data employed in the analysis raises the possibility that the risk position of the company has changed in the meantime, resulting in non-representative estimations. On the other hand, the statistical confidence rises with the length of the estimation period. Particularly, scientific research indicates that the beta stationarity increases with the length of the estimation period. Taking the mixed results concerning the optimal forecasting length into account, a time horizon of five years, which has been commonly suggested, is recommended in this study.[112]

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108 DAMODARAN (1999), p. 21f.

109 See ARNOLD (2008, p. 740f), BEAVER/KETTLER/SCHOLES (1970, p. 659f), PANKOKE/PETERSMEIER (2009, p. 120) and ZIMMERMANN (1997, p. 268) for further information. See ROSS (1976) for further information regarding the APT model.

110 See, for example, ARNOLD (2008, p. 741) and ZIMMERMANN (1997, p. 267).

111 DAMODARAN (2002), p. 182; PANKOKE/PETERSMEIER (2009), p. 121; PINTO et al. (2010), p. 58.

112 BRIGHAM/EHRHARDT (2007), p. 261; DAMODARAN (2002), p. 187; THEOBALD (1981), p. 755. Considering a potential instability of the beta over a long time period, GROENEWOLD/FRASER (2000, p. 956) note that a time horizon of five years is a common choice regarding the beta estimation period. Employing stock data from the United Kingdom, THEOBALD (1981, p. 756) argues that the optimal forecasting length is between 180 to 210 months, while there exist only marginal gains when increasing the estimation period beyond 120 months. KIM (1993, p. 241) finds that the average length of

In addition, the frequency of data needs to be chosen as empirical research has documented systematic changes in the beta factor dependent on the choice of data interval.[113] COHEN et al. (1983, p. 140-143) find that the intervalling effect[114] is observable with daily time series but tends to be small with data intervals of 20 days. Comparing the beta estimates between stocks having a low capitalisation and those with a high capitalisation, BRAILSFORD/JOSEV (1997, p. 366) detect a difference with daily or weekly time intervals but no disparity with monthly time intervals. In summary, a size-specific bias is probably induced when employing data exhibiting time intervals of less than one month.[115] Based on these considerations, a monthly data interval is suggested.

#### 7.3.1.1.3 Equity risk premium

The equity risk premium typifies the incremental return, which compensates investors for holding equities instead of the risk-free asset. Whereas the equity risk premium should represent a forward-looking measure reflecting the expectations of investors, this future-oriented variable is not observable in the market. Generally, the size of the equity risk premium depends on the risk aversion of investors, economic risk, and catastrophic risk as well as on information and liquidity.[116]

The equity risk premium can be determined either by using its historical averages or by means of employing ex ante estimations.[117]

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an interval including stationary beta values is 51.19 months. Investigating time spans between one and twelve years, GROENEWOLD/FRASER (2000, p. 977f.) find that horizons of three, seven and eleven years provide slightly superior results in terms of forecasting performance. In addition the authors deliver evidence that the use of historical beta estimates over a time period of five years results in a higher forecasting performance in comparison to eight other models. [GROENEWOLD/FRASER (2000), p. 979.]

[113] See, for example, HAWAWINI (1980) or SMITH (1978).

[114] The intervalling effect relates to the sensitivity of the beta factor towards the length of the differencing interval over which the return of a stock is measured. [HAWAWINI (1980), p. 139.]

[115] PATTERSON (1995), p. 123. Several methods have been suggested to adjust data for the intervalling effect. [See, for example, COHEN et al. (1983) or SCHOLES/WILLIAMS (1977).] However, while the methods have not been declared as notably powerful with their applicability being called into question by several researchers [see, for example, BÜHLER/HAX/SCHMIDT (1999, p. 190f) and DIACOGIANNIS/MAKRI (2008, p. 120)], no method for correcting of the intervalling effect will be considered in the present examination.

[116] See DAMODARAN (2010, p. 170), PANKOKE/PETERSMEIER (2009, p. 116), PINTO et al. (2010, p. 44) and PRATT/GRABOWSKI (2008, p. 333) for further information.

[117] COPELAND/KOLLER/MURRIN (2000), p. 216.

For the extraction of the equity risk premium from historical data, past returns on the market portfolio are compared with the returns on a risk-free investment. The return on a risk-free investment should be derived from the rate of a long-term government bond, as suggested earlier. As indicated previously, the CAPM requires the calculation of the return on the market portfolio that includes all traded assets at their proportionate market values. As the market portfolio is difficult to compile, it is approximated by a stock index, which accounts for the weights of securities by means of a capitalisation-weighted calculation mechanism.[118] Complementary to utilising a general stock market index, LIN/YUNG (2004, p. 75-83) suggest accounting for the real estate sector by means of a listed real estate market index. To address the specific features of REITs outlined above, the calculation of the general equity risk premium will be executed through the use of long-term historical time series[119] on listed real estate market indices. However, based on the respective years of their legal introduction, many REITs do not exhibit long-term data. In this regard, the longest time series available for a national listed real estate market index are employed to calculate the commensurate equity risk premium. This approach assumes that local investors largely determine REIT stock prices.[120]

The estimation of the historical equity risk premium can be accomplished by means of calculating the average return on stocks and government bonds. The choice between calculating geometric means or arithmetic averages to measure the risk premium has been subject to controversy among researchers. If a long-term projection of the risk premium is demanded, the applicability of the geometric average seems to be superior to that of the arithmetic mean. This advantage squares with the aim of

[118] DAMODARAN (2002), p. 161 & 182; FOCARDI/FABOZZI (2004), p. 86.

[119] Regarding the time horizon of the empirical analysis of risk premiums, the use of short-term data would magnify the effect resulting from recent irregular events. In contrast, the consideration of data over a long time period reduces the impact of irregular events. [PRATT/GRABOWSKI (2008), p. 333.]

[120] PINTO et al. (2010), p. 58. In contrast, if it is assumed that all investors worldwide contribute equally to the determination of prices, a world market portfolio should be employed. In this context, all investors worldwide participate evenly in setting prices, which constitutes a main characteristic of the so-called international CAPM. However, the use of an international CAPM has caused difficulties due to the unavailability of an appropriate risk-free asset in correspondence with a global portfolio. Additionally, it seems to be difficult to theoretically justify the aggregation of national stock market indices into a world market index. While tests of the international CAPM on the basis of relationships among returns tend to advocate the model due to an explanatory power, especially when exchange rate risk is considered [see, for example, FERSON/HARVEY (1993)], studies based on asset share data tend to reject the use of the international CAPM [see, for example, ENGEL/RODRIGUES (1993)]. [BUCKLEY (2004), p. 476; PINTO et al. (2010), p. 58; RUGMAN (1996), p. 78.]

this study to develop estimates of the required rate of return, which are used for discounting long-term FCFs.[121]

Ex ante estimations to derive a risk premium suggest the subtraction of the risk-free rate of interest from the implied expected return on the stock market. Generally, ex ante estimations could be based on a bottom-up approach, on a top-down approach or on opinions.[122] The ex ante approaches are not pursued in this study. The major reason for omitting these procedures is a lack of comparability between data that are published by different sources. In addition, the data providers cover a considerably small fraction of the REIT sample. In the case of forecasts made by analysts, the utility of these data has been an area of controversy in the literature.[123]

As a variation of the ex ante approaches discussed previously[124], a dividend growth model suggested by FAMA/FRENCH (2002) was employed in the present examination. The model can be attributed to a line of research that calculates expected returns on the basis of valuation models.[125] FAMA/FRENCH (2002) forecast the equity risk premium using dividend and earnings growth measures. The authors observe that, in comparison to the use of mean historical equity risk premiums, the estimates based on dividend growth are more precise in terms of a lower standard

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[121] DAMODARAN (2002), p. 161-163; KOLLER/GOEDHART/WESSELS (2005), p. 304f; PINTO et al. (2010), p. 46. Some authors [see, for example, ARMITAGE (2005, p. 90) or PRATT/NICULITA (2007, p. 209)] propose the use of the arithmetic average as it should be more appropriate than the geometric mean when the cost of capital are calculated through the sum of parts. Other authors [see, for example, DAMODARAN (2002, p. 162) or PINTO et al. (2010, p. 49f)] argue that the geometric average should be preferred because this measure is able to accommodate a negative correlation between stock returns over time. CORNELL (1999, p. 39) asserts that the geometric average is superior in case the risk premium needs to be forecast over the long term, while the arithmetic average is conformable when the risk premium should be forecast on a year-by-year basis. See BUCKLEY (2004, p. 459) for the formula to calculate the geometric mean.

[122] See PRATT/GRABOWSKI (2008, p. 106) and REILLY/SCHWEIHS (1999, p. 12 & 64-66) for further information regarding the estimation of the equity risk premium.

[123] Several researchers argue that forecasts provided by analysts can be biased [CLAUS/THOMAS (2001), p. 1634f] or are irrational [ABARBANELL/BERNARD (1992), p. 1205]. In contrast, KEANE/RUNKLE (1998, p. 797) provide evidence that analysts conduct rational forecasts.

[124] Although the approach suggested by FAMA/FRENCH (2002) utilises historical dividend data, it has been assigned to the ex ante approaches. [HARRIS et al. (2003, p. 54).]

[125] Other approaches belonging to this group have been proposed by CLAUS/THOMAS (2001) and GEBHARDT/LEE/SWAMINATHAN (2001), for example.

error.[126] Following the suggestion by FAMA/FRENCH (2002), a dividend growth model was considered:

$$A(RD_t) = A\left(\frac{D_t}{P_{t-1}}\right) + A(GD_t) \qquad \textbf{(7.7)}$$

with
$$GD_t = \frac{(D_t - D_{t-1})}{D_{t-1}} \qquad \textbf{(7.8)}$$

where

| | |
|---|---|
| $A(RD_t)$ = | mean return on dividends |
| $D_t$ = | dividend for year $t$ |
| $D_{t-1}$ = | dividend for year $t-1$ |
| $P_{t-1}$ = | price at the end of year $t-1$ |
| $GD_t$ = | growth rate of dividends |

The model assumes that the dividend-price ratio remains stationary. However, the authors argue that the approach is largely robust to the non-stationarity of the dividend-price ratio. Likewise, the authors contend that in comparison to the historical equity risk premium, the return estimates based on dividends should be less sensitive to long-term shocks. Analysing the behaviour of stock dividends between 1951 and 2000, FAMA/FRENCH (2002, p. 651) state that dividend growth is largely unpredictable. Accordingly, they suggest the use of the historical mean dividend growth rate as a predictor. As a drawback, changes in the dividend policy may lead to biased stock return estimates. For example, if the share of firms paying no dividends increases continuously, the market dividend-to-price ratio declines over time, thus probably showing non-stationarity.[127] However, this disadvantage can be neglected with REITs that attempt to distribute the bulk of their earnings as dividends.

To ensure comparability between the calculation of the risk premium based on historical stock market prices and the dividend growth model suggested by

[126] FAMA/FRENCH (2002), p. 657. In this context, LEWELLEN (2004, p. 209) documents that the dividend yield shares a predictive power towards aggregated stock returns.

[127] FAMA/FRENCH (2002), p. 638-654.

FAMA/FRENCH (2002), the geometric average is calculated with the dividend growth model as well.

Finally, the risk-free rate attached to a long-term government bond is subtracted from the equity return obtained from the application of the FAMA/FRENCH (2002) model.

#### 7.3.1.2 Critical assessment

The CAPM has received both approval and criticism. This model has been commonly applied in the calculation of the required rate of return and depicts an economically grounded approach. The CAPM offers the possibility of quantifying risk in terms of a risk premium based on the objectivity of the markets. Furthermore, the model is comprehensive and simple to apply.[128]

A main point of criticism centres on the assumption of the model that the parameters remain stationary. In addition, the regression beta estimates are based on historical data, which do not inevitably provide an adequate approximation regarding future betas. Indeed, numerous studies substantiate that the historical betas of individual securities show non-stationarity. Taking few scientific evidence on REITs into account, the potential stability of the beta measure for REITs against the general stock market has been subject to controversial discussions.[129]

In addition, few scientists claim that the historical risk premium concerning general stocks will not persist in the future. Concurrently, the analysis of REITs domiciled in the United States has uncovered variations in the equity risk premium over time.[130]

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[128] BÖCKING/NOWAK (2000), p. 22; PANKOKE/PETERSMEIER (2009), p. 128; PINTO et al. (2010), p. 57.

[129] PANKOKE/PETERSMEIER (2009), p. 129. See, for example, BLUME (1975) or SUNDER (1980), who documented a non-stationarity of the beta measure when analysing general stocks. CHIANG/LEE/WISEN (2005, p. 395) and LIANG/McINTOSH/WEBB (1995, p. 442) provide evidence regarding a long-term stability of the REIT beta measure. Analysing REITs, LIANG/McINTOSH/TOMPKINS (1991, p. 12f) and KHOO/HARTZELL/HOESLI (1993, p. 125) identify changes in the beta variable over time. Especially, KHOO/HARTZELL/HOESLI (1993, p. 125) find significant beta declines when investigating REITs over a time period between 1972 and 1990.

[130] See, for example, LIU/MEI (1992, p. 411) or SIEGEL (1999, p. 10). It has been suggested that an observed decline in expected stock returns is likely to be permanent, either because of a more pronounced

In a real capital markets environment, the validity of the model has been challenged. Based on the variety of assumptions made by the CAPM, it is difficult to test the model using actual capital markets data. In this regard, ROLL (1977, p. 130f) questions the testability of the CAPM as the market portfolio is not observable in reality. The premise of perfectly competitive capital markets has at least become more realistic due to increasing internationalisation and an enhanced responsiveness of capital markets.[131] Attempts to test the model have yielded controversial results. Specifically, research published in the years after the introduction of the CAPM delivered empirical support for the model.[132] In contrast, recent research doubts its validity. Particularly, the use of the market return as the single explanatory variable regarding the return on a security has been called into question.[133] For example, a small company effect[134], which has been observed with general stocks and REITs[135], is not captured in the model.[136] In addition, OOI/WANG/WEBB (2009, p. 440) find that contrary to the assumption of the CAPM, idiosyncratic risk can explain a significant proportion of REIT returns.

As an extension, FAMA/FRENCH (1992, p. 427; 1993, p. 3) add a factor to express size and a book-to-market equity factor to the CAPM. Using this three-factor model, the authors find that the two factors added to the CAPM have the ability to explain a portion of the variability in stock market returns.[137] As a consequence, FAMA/FRENCH (1993, p. 54) assert that the CAPM does not include all risk factors needed to explain returns. Indeed, studies of REITs employing both the CAPM

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equity market participation or due to lower costs of creating a diversified portfolio. [FAMA/FRENCH (2002), p. 658.]

[131] PERRIDON/STEINER (2007), p. 281; RUDOLPH (1998), p. 53.

[132] See, for example, BLACK/JENSEN/SCHOLES (1972) or FAMA/MacBETH (1973).

[133] See, for example, FAMA/FRENCH (1992).

[134] The small company effect relates to the finding that small capitalised firms consistently earned higher returns in comparison to large capitalised firms even if the companies share the same market beta. [See, for example, BANZ (1981).]

[135] Scientific research on REITs has confirmed the existence of a size effect. Although COLWELL/ PARK (1990, p. 257) identify a reverse size effect in certain months, the authors observe the size effect with Mortgage-REITs. McINTOSH/LIANG/TOMPKINS (1991, p. 16) observe a small firm effect in terms of higher returns of small capitalised REITs but also find evidence that small capitalised REITs were less risky in comparison to high capitalised REITs. CHEN et al. (1998, p. 273f) detect that small capitalised REITs earn abnormally high returns and thus document a size effect. In summary, a small company effect has been observed with REITs although there is only a small amount of evidence.

[136] ARMITAGE (2005), p. 60; DIMSON/MARSH (1986), p. 130.

[137] FAMA/FRENCH (1992), p. 428.

and the FAMA/FRENCH (1992, 1993) model have provided evidence that the three-factor approach is more powerful for explaining the variation of security returns.[138]

Additionally, the applicability of the CAPM to REITs in terms of the availability of data should be scrutinised. Following the argument of DAMODARAN (1999, p. 8), a large standard error outweighs all advantages associated with the use of short-term data to calculate an equity risk premium. Although the expected equity risk premium should stay positive, historical equity risk premiums measured with short-term data can become negative when equity markets have experienced a sharp decline.[139] Indeed, the calculation of historical risk premiums of REITs over government bond rates has partly resulted in negative values. Pertaining to the confined availability of data on REITs, the use of national index data as an approximation of the market portfolio potentially includes a relatively high standard error.

As a further point of criticism, the observations used to calculate an equity risk premium stem from surviving firms, which are typically associated with higher returns. This so-called survivorship bias can result in calculated equity risk premiums that exceed the expected risk premiums. The survivorship bias has been observed with REITs as well. In this regard, it has been documented that REIT samples with a survivorship bias have delivered higher performance values than unbiased REIT samples.[140]

[138] See CHIANG/LEE/WISEN (2005, p. 395) or PETERSON/HSIEH (1997, p. 343).

[139] DAMODARAN (2010), p. 177.

[140] DAMODARAN (1999), p. 11; GOETZMANN/IBBOTSON (2006), p. 11; HAN/LIANG (1995), p. 254. See, for example, CHIANG/LEE/WISEN (2005, p. 385) who document that the NAREIT-index has displayed a survivorship bias, also due to the small size of the minimum market capitalisation pertaining to the index constituents. Concerning REITs, HAN/LIANG (1995, p. 240) criticise that previous studies on the performance of REITs focused on surviving firms only. As REITs could have gone bankrupt or have merged with other firms, a sample solely including survivor companies might not be representative regarding the performance of the whole industry. [HAN/LIANG (1995), p. 240.] Analysing REITs between 1972 and 1991, GLASCOCK/HUGHES (1995, p. 80) show that the average life of a REIT is 99.7 months. In this context, the authors suppose that a predetermined life, an exit from the stock exchange or a liquidation constitute major reasons for a termination of a REIT. [GLASCOCK/HUGHES (1995), p. 80.]

#### 7.3.1.3 Results

The application of the CAPM to the REIT sample introduced before involves the calculation of the risk-free rate (7.3.1.3.1), the beta variable (7.3.1.3.2) and the equity risk premium (7.3.1.3.3).[141]

##### 7.3.1.3.1 Return on a risk-free investment

In calculating the risk-free rate, the type of government bond could be distinguished between the explicit and the implicit planning periods of the valuation based on its maturity. Although data on yields pertaining to long-term government bonds with a maturity of 30 years are available for a few countries in which REITs are headquartered, the time span of the data is clearly reduced in comparison with those reflecting ten-year government bond rates. Considering the increased susceptibility of government bond rates with maturities beyond ten years to inflation rates in connection with a higher liquidity of ten-year government bond rates, the consistent application of government bond rates with a maturity of ten years is recommended. Similarly, the use of the yield on a ten-year government bond is suggested in the context of the calculation of the value pertaining to the implicit planning period as well. This procedure was chosen because the ten-year government bond shows a comparatively high degree of data availability across countries.

The interest rates approximating a risk-free investment measured in monthly time intervals over a time horizon beginning in 1990 and ending in 2009 are illustrated in Figure 7.10. The graph provides evidence for the necessity to use country-specific risk-free interest rates given considerable differences in the magnitudes of the government bond rates.[142]

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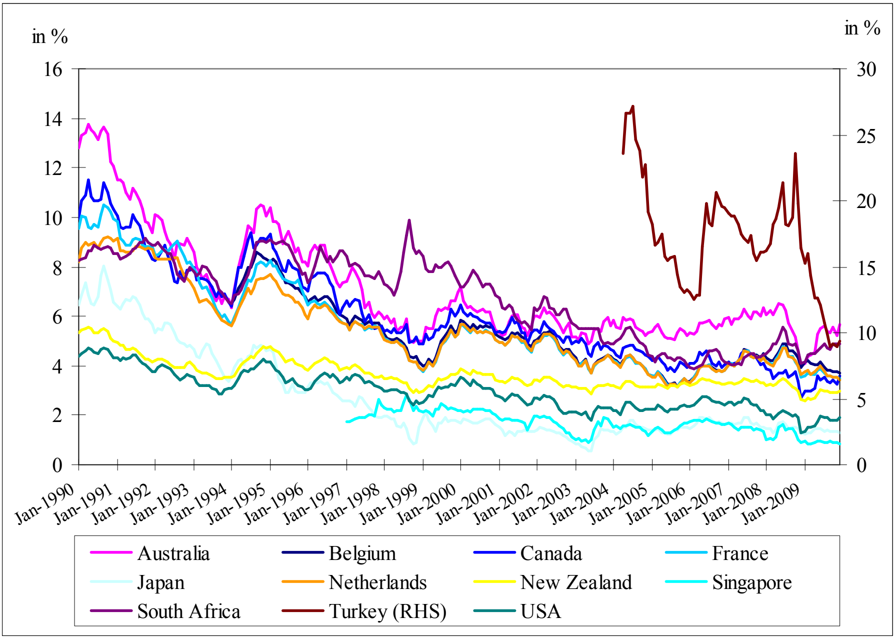
[141] Given the use of data with an annual time interval, the underlying dataset has not been adjusted according to the explanations in Section 6.2, if not stated otherwise.

[142] Except for Singapore, yields on ten-year government bonds have been collected from Bloomberg. In the case of Singapore, the yields on a seven-year government bond have been employed as a substitute.

***Figure 7.10: Yields of long-term government bonds for the country of REIT origin.***




*Source: Bloomberg*

### 7.3.1.3.2 Beta measure

As mentioned previously, the beta variable was calculated using a regression model.[143] When applying the regression model to REITs, the sensitivities of the REITs' returns to the independent variables were estimated over a period of five years.[144] The sensitivities were obtained by means of regressing the REIT returns on the changes in the exogenous variables, represented by the market portfolio in the

[143] Although the regression model explained earlier has been proposed for the analysis of equations exhibiting numerous independent variables, the methodology is identical to that of the model employing a single independent variable. Additionally, the multiple regression model shares the same assumptions as the single regression model and supplementary demands the absence of multicollinearity between the explanatory variables. Based on these similarities, the regression model is not explained in more detail at this stage of analysis.

[144] This estimation period is chosen in accordance with the recent examinations.

CAPM framework.[145] The returns on a market portfolio were approximated by the respective national stock market index on the one hand and the corresponding national listed real estate market index on the other hand.

In line with the recent explanations, the valuation tool calculated in the year 2010 should relate to the beta variable measured at monthly time intervals over a five-year time period between 2005 and 2009.
Considering the large number of outliers and the necessity of imputing multiple data points associated with the time horizon from 2005 until 2009, beta calculations were performed using both raw (unadjusted)[146] data and time series that were corrected according to the methods reviewed in the previous chapter.[147] Figure 7.11 shows that the beta estimates differ considerably between adjusted and unadjusted values, whereas the rankings of the beta values according to the country of origin remained fairly similar.
When using general stock market returns as the explanatory variable, the beta values appear to show a higher magnitude than those resulting from the application of listed real estate market returns. In this regard, REITs originating in Singapore, and to a lesser extent firms domiciled in Japan, exhibit considerable beta values related to unadjusted stock market returns. Although REITs domiciled in Singapore tend to employ a comparatively low leverage ratio, these firms participated in real estate development activities to a considerable extent. In contrast, real estate-specific activities carrying an enhanced risk-return profile are rather not engaged in by Japanese REITs, although these firms have employed a relatively high leverage ratio in recent years. REITs that originated in New Zealand did not pursue real estate development or trading activities to a notable degree and employ a comparatively low leverage ratio. In addition, a significant share of real estate development and trading activities performed by Australian REITs may contribute to beta values that exceed those of the average market when considering both listed real estate market and general stock market returns.

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[145] Adapted from CHEN et al. (1998, p. 273).
[146] In this context, undadjusted data refer to times series that have not been adjusted for the time series characteristics explained in Sections 6.2.2 until 6.2.7. However, time series have been converted into continuous returns as explained in Section 6.2.1.
[147] All 218 REITs have been considered in the analysis.

***Figure 7.11: Beta values by country of REIT origin.***

| | General stock market returns | | Listed real estate market returns | |
|---|---|---|---|---|
| | Unadjusted | Adjusted | Unadjusted | Adjusted |
| Australia | 1.65 | 2.67 | 1.27 | 0.27 |
| Belgium | --- | 1.31 | 0.73 | 0.18 |
| Canada | 1.05 | 0.29 | 0.73 | 0.09 |
| France | 0.65 | 0.47 | 1.06 | 0.33 |
| Japan | 2.40 | 1.05 | 0.59 | 0.05 |
| Netherlands | --- | 1.44 | 0.98 | 0.46 |
| New Zealand | 0.41 | 0.27 | --- | --- |
| Singapore | 5.58 | --- | 0.83 | 0.54 |
| South Africa | --- | 0.56 | --- | --- |
| Turkey | 0.57 | 0.67 | --- | --- |
| USA | 1.04 | 0.26 | 1.09 | 0.21 |
| Total | **1.44** | **0.58** | **1.02** | **0.23** |
| Number of significant observations | 122 | 114 | 194 | 103 |

*Source: Own calculations based on the total sample (218 REITs)*

Figure 7.12 categorises the beta values according to the property sector classification.

Remarkably, the beta values associated with firms concentrating their activities on community centres, merchandise centres, neighbourhood centres or industrial properties exceeded the average values, irrespective of using either unadjusted stock returns or unadjusted listed real estate returns. REITs focusing their portfolios on industrial properties participated in real estate development activities. In addition, REITs that focused their portfolio on any of the four property sectors exhibited above-average book measures of leverage.

***Figure 7.12: Beta values by property sector classification.***

| | General stock market returns | | Listed real estate market returns | |
|---|---|---|---|---|
| | Unadjusted | Adjusted | Unadjusted | Adjusted |
| Apartments | 1.77 | 0.64 | 0.95 | 0.29 |
| Community centres | 1.45 | 0.45 | 1.12 | 0.30 |
| Free standing | 1.01 | 0.83 | 0.78 | 0.20 |
| Health care | 1.25 | 0.72 | 0.94 | 0.33 |
| Industrial | 1.47 | 0.63 | 1.26 | 0.14 |
| Land lease | --- | 0.50 | 0.65 | --- |
| Lodging and resorts | 1.26 | 0.10 | 1.26 | 0.09 |
| Merchandise centres | 1.99 | 0.20 | 1.05 | 0.14 |
| Neighbourhood centres | 2.06 | 0.21 | 1.27 | 0.26 |
| Offices | 1.35 | 0.82 | 0.93 | 0.29 |
| Self-storage | 0.60 | 0.17 | 0.96 | 0.29 |
| Specialty | 1.33 | 1.96 | 1.04 | 0.07 |
| Diversified | 1.27 | 0.38 | 1.06 | 0.21 |
| Total | **1.44** | **0.58** | **1.02** | **0.23** |
| Number of significant observations | 122 | 114 | 194 | 103 |

*Source: Own calculations based on the total sample (218 REITs)*

In this context, the use of unadjusted stock or listed real estate market returns is recommended. On the one hand, the adjustments described above would require a disproportionately high outlay. On the other hand, unadjusted returns reflect the actual returns realised by an investor in the past.

Given that the discount rate should equal the return required by shareholders, actual values ought to be used. However, the beta values extracted from historical data may not square with beta values observed in the future. Consequently, the stability of the beta measure over time was subject to analysis. Again, both adjusted and unadjusted data were employed, using both the general stock market index and the listed real estate market index as explanatory variables. To assess the stability of the coefficients over time, monthly data over three time periods, namely from 1995 to 1999, from 2000 to 2004 and from 2005 to 2009, were employed.

On the one hand, a modified version of the single-index market model, including dummy variables was employed to test the stability of beta values pertaining to individual REITs over time.[148]

On the other hand, portfolios were formed to examine the long-term stability of betas corresponding to different portfolio sizes.[149]

The results of the model employing dummy variables are summarised in Figure 7.13.

***Figure 7.13: Results of the stability test based on a single-index (dummy variable) market model.***

| | | General stock market returns | | Listed real estate market returns | |
|---|---|---|---|---|---|
| | | Unadjusted | Adjusted | Unadjusted | Adjusted |
| Number of sampled REITs | | 89 | 89 | 84 | 84 |
| Number of REITs showing stability of the beta measure | | 17 | 47 | 53 | 76 |
| Share of stable beta REITs as of the total number of sampled firms | | 19.10% | 52.81% | 63.10% | 90.48% |
| Number of significant coefficients | $B_1$ | 22 | 12 | 71 | 32 |
| | $B_2$ | 3 | 2 | 2 | 5 |
| | $B_3$ | 69 | 40 | 31 | 5 |

*Source: Own calculations based on the total sample (84/89 of 218 REITs)*

The beta measure is expected to be stable over time if neither of the coefficients $B_2$ and $B_3$ exhibits a significant relationship with the corresponding explanatory variable. Based on the results of the dummy variable model, the stability of beta when using the listed real estate market index exceeds that when employing the general

[148] A similar approach has been employed by FABOZZI/FRANCIS (1977, p. 1093f) when analysing alpha and beta values over bull and bear market conditions.

[149] A similar portfolio approach has been utilised by BLUME (1971) and LEVY (1971).

stock market index as the dependent variable. This finding holds irrespective of the use of either adjusted or unadjusted data. However, the use of adjusted data would increase the stability of the beta with regard to the analysed time period from 1995 until 2009.

Given that a large fraction of instability corresponds to the coefficient $B_3$, which is itself associated with the time period between 2005 and 2009, the exclusion of outliers potentially contributed to the improved stability when using adjusted data.

The results of the portfolio approach to examining the stability of the beta measure over time are summarised in Figure 7.14.

The portfolios were derived as follows: beginning with the monthly data corresponding to the time period from 1995 until 1999, the estimated beta values were ranked in ascending order. Subsequently, a first portfolio consisting of $n$ REITs that exhibited the $n$ smallest beta values was compiled. Next, a second portfolio was established by collecting the REITs possessing the next $n$ smallest beta values. These portfolio calculations were repeated until the number of remaining REITs was below $n$. Overall, a sample of 89 REITs was collected for use with the portfolio approach. These REITs were allocated to portfolios of different sizes with $n=1,2,3,5,8,10,15$. Subsequently, the same procedure was applied to the two following time periods. [150]

Then, the risk measures for portfolios of $n$ REITs were calculated, assuming an equal investment in each security. In this context, the risk measures of a period $t$ can be viewed as the expectations of the investor regarding future risk, whereas the risk measures associated with a period $t+1$ are regarded as the realised risk. To compare successive periods to each other, product moment correlation coefficients were calculated from the portfolio-based risk measures.

Considering unadjusted stock market returns, a product moment correlation coefficient of 0.854 was obtained when analysing the connection between the period from 1995 until 1999 and the time period beginning in 2000 and ending in 2004. Calculating the explanatory power by squaring the correlation coefficient yields a value of 0.73, leaving 0.27 of the variation in forecasting risk values unexplained. The unexplained portion shrinks to 0.07 if a portfolio of 15 securities is chosen.

[150] Adapted from BLUME (1971, p. 6f). The number $n$ has been restricted to 15 as otherwise, the number of portfolios would be too small.

***Figure 7.14: Product moment correlation coefficients provided by the portfolio approach.***

| General stock market returns | | | | |
|---|---|---|---|---|
| Number of securities per portfolio | Unadjusted | | Adjusted | |
| | 1995-1999 and 2000-2004 | 2000-2004 and 2005-2009 | 1995-1999 and 2000-2004 | 2000-2004 and 2005-2009 |
| 1 | 0.854 | 0.902 | 0.729 | 0.889 |
| 2 | 0.868 | 0.933 | 0.723 | 0.936 |
| 3 | 0.903 | 0.943 | 0.808 | 0.965 |
| 5 | 0.909 | 0.943 | 0.877 | 0.967 |
| 8 | 0.899 | 0.967 | 0.811 | 0.979 |
| 10 | 0.936 | 0.962 | 0.958 | 0.977 |
| 15 | 0.964 | 0.982 | 0.982 | 0.982 |
| | | | | |
| **Listed real estate market returns** | | | | |
| **Number of securities per portfolio** | **Unadjusted** | | **Adjusted** | |
| | **1995-1999 and 2000-2004** | **2000-2004 and 2005-2009** | **1995-1999 and 2000-2004** | **2000-2004 and 2005-2009** |
| 1 | 0.841 | 0.912 | 0.547 | 0.543 |
| 2 | 0.866 | 0.930 | 0.635 | 0.623 |
| 3 | 0.898 | 0.951 | 0.688 | 0.666 |
| 5 | 0.913 | 0.961 | 0.759 | 0.726 |
| 8 | 0.910 | 0.969 | 0.842 | 0.807 |
| 10 | 0.910 | 0.973 | 0.879 | 0.844 |
| 15 | 0.961 | 0.990 | 0.907 | 0.868 |

*Source: Own calculations based on the total sample (89 of 218 REITs)*

Accordingly, the product moment correlation coefficients' dependence on the number of securities per portfolio indicates that extrapolated assessments regarding future risk are more accurate when using larger portfolios instead of a single security, for example. Given similar correlation coefficients, the choice between listed real estate market returns and general stock market returns does not considerably affect the stability of the results. Furthermore, the correlation coefficients listed in Figure 7.14 that were obtained with portfolios consisting of a single REIT exceeded those obtained by BLUME (1971, p. 7) or LEVY (1971, p. 56-61)[151] when analysing general stocks. Considering that past works regarding the stability of the beta measures of general stocks delivered controversial results, it should be noted that these studies were mostly confined to time periods prior to 1990. Nevertheless, some evidence exists regarding a relatively high degree of REIT beta stability in recent years.

Overall, the results indicate a certain degree of beta stability. Specifically, the outcomes of the single-index model lead to the recommendation to employ listed real estate market returns when calculating the market index. Consequently, the advantage of stable beta values potentially outweighs the disadvantage of restricted availability of data when using a listed real estate market index.

#### 7.3.1.3.3 Equity risk premium

The equity risk premium considered in the valuation model was processed on the basis of historical mean equity risk premiums and by means of using the FAMA/FRENCH (2002) dividend growth model.

The historical geometric mean equity risk premium was calculated on an annual basis by choosing the longest time series available. For this purpose, both the national stock market index and the country-specific listed real estate market index were treated as approximations of the market portfolio.
The estimates concerning the historical geometric mean equity risk premium are

[151] However, it should be noted that the authors considered other time periods that might not be comparable to the time periods chosen in the present study.

illustrated in Figure 7.15[152] when using listed real estate market returns and in Figure 7.16 when using general stock market returns.

***Figure 7.15: Historical geometric mean equity risk premiums (based on listed real estate market returns).***

| Country of origin | Annual rolling returns | Starting month of the time period under consideration (ending month: December 2009) | Year-end returns | Starting year of the time period under consideration (ending year: 2009) |
|---|---|---|---|---|
| Australia | **1.11%** | Jan-1991 | **2.05%** | 1991 |
| Belgium | **0.96%** | Jan-1994 | **0.69%** | 1994 |
| Canada | **-0.52%** | Jun-2001 | **2.09%** | 2001 |
| France | **4.34%** | Jan-1991 | **6.35%** | 1991 |
| Japan | **-3.23%** | Jan-1991 | **-1.44%** | 1991 |
| Netherlands | **-0.15%** | Jan-1991 | **2.26%** | 1991 |
| Singapore | **-4.89%** | Jan-1997 | **-2.83%** | 1997 |
| USA | **1.43%** | Dec-1972 | **8.30%** | 1972 |

*Source: Own calculations based on data retrieved from Bloomberg*

Despite the assumption that a higher risk should be rewarded with a higher return, a negative mean equity risk premium was obtained for several countries. The use of

***Figure 7.16: Historical geometric mean equity risk premiums (based on general stock market returns).***

| Country of origin | Annual rolling returns | Starting month of the time period under consideration (ending month: December 2009) | Year-end returns | Starting year of the time period under consideration (ending year: 2009) |
|---|---|---|---|---|
| Australia | **1.20%** | Jan-1971 | **2.07%** | 1971 |
| Belgium | **-0.95%** | Jan-1994 | **-0.53%** | 1994 |
| Canada | **2.34%** | Jun-1982 | **2.98%** | 1982 |
| France | **1.96%** | Jan-1971 | **2.54%** | 1971 |
| Japan | **-5.56%** | Jan-1988 | **-4.55%** | 1988 |
| Netherlands | **4.42%** | Jan-1984 | **4.82%** | 1984 |
| New Zealand | **-2.50%** | Dec-1988 | **-2.44%** | 1988 |
| Singapore | **-0.28%** | Jan-1997 | **2.23%** | 1997 |
| South Africa | **2.90%** | Dec-1993 | **3.58%** | 1993 |
| Turkey | **0.50%** | Apr-2004 | **0.64%** | 2004 |
| USA | **2.13%** | Jan-1971 | **2.50%** | 1971 |

*Source: Own calculations based on data retrieved from Bloomberg*

[152] Given data limitations, no rates of return have been calculated for REITs domiciled in New Zealand, South Africa and Turkey.

general stock market returns for calculating the market risk premium could become advantageous as more reasonable estimates are obtained. For example, the consideration of stock market data available over a longer time horizon for Canada and the Netherlands led to a positive market risk premium in comparison to negative values attributed to the use of annual rolling listed real estate market returns.

The results of the calculation of the equity returns approximated through the FAMA/FRENCH (2002) dividend growth model are summarised in Figure 7.17.

***Figure 7.17: Equity returns based on the FAMA/FRENCH (2002) dividend growth model.***

| Starting year of the time period under consideration (ending year: 2008) | Average return on dividends | Number of sampled REITs depending on the starting year |
|---|---|---|
| 1993 | 8.88% | 1 |
| 1994 | 10.41% | 1 |
| **1995** | **13.10%** | **45** |
| 1996 | 12.43% | 5 |
| 1997 | 10.08% | 5 |
| 1998 | 17.69% | 10 |
| 1999 | 11.21% | 10 |
| 2000 | 12.91% | 17 |
| 2001 | 6.95% | 5 |
| 2002 | 14.14% | 4 |
| 2003 | 21.07% | 12 |
| 2004 | 15.72% | 23 |

*Source: Own calculations based on the total sample (1-45 of 218 REITs)*

Given data limitations when considering time series over longer time intervals, the average return on the total sample was calculated depending on the starting year of the time period under consideration. As explained earlier, the equity returns should stem from the calculation of dividend growth over a long-term period. However, the availability of REIT data is restricted with regard to longer time horizons. Taking both arguments into consideration, a time period between 1995 and 2008 was used to calculate an equity return estimate. The corresponding equity risk premium was calculated by subtracting the yield of a long-term government bond corresponding to the country of origin of the respective REIT from the equity return estimate. The results both of using historical market risk premiums and an estimation by means of the dividend growth model are summarised in Figure 7.18.

***Figure 7.18: Required rates of return using the CAPM.***

| Country of origin | Required rate of return using historical market risk premiums | | Required rate of return using the dividend growth model-based risk premiums | |
|---|---|---|---|---|
| | General stock market-based | Listed real estate market-based | General stock market-based | Listed real estate market-based |
| Australia | 7.63% | 7.06% | 17.94% | 15.09% |
| Belgium | 2.60% | 4.30% | 13.62% | 10.55% |
| Canada | 6.80% | 3.35% | 16.01% | 10.57% |
| France | 4.76% | 8.06% | 9.78% | 13.63% |
| Japan | -12.07% | -0.65% | 29.68% | 8.30% |
| Netherlands | 9.81% | 3.29% | 17.36% | 12.87% |
| New Zealand | 4.58% | --- | 8.67% | --- |
| Singapore | 0.06% | -2.44% | 65.65% | 11.14% |
| South Africa | 10.76% | --- | 11.35% | --- |
| Turkey | 9.68% | --- | 11.51% | --- |
| USA | 5.80% | 5.14% | 13.46% | 13.94% |

*Source: Own calculations based on the total sample (1-45 of 218 REITs) and data retrieved from Bloomberg*

In this context, the required rates of return differ considerably depending on the use of historical market risk premiums on the one hand and with regard to the application of the dividend growth model on the other hand. The large share of earnings that has to be distributed by REITs may contribute to excessive dividend payments, which translate into comparatively high required rates of return regarding REITs when using the dividend growth model. However, the distribution requirement may not affect the return demanded by shareholders. In this regard, it is recommended to use the general stock market-based returns relying on historical market risk premiums for all countries of origin except Belgium, Japan and Singapore. The three exceptions represent the only cases in the sample with the country-specific risk-free rate of interest in 2009 being above the corresponding general stock market-based returns. Given that the riskiness of the respective REIT investment is supposed to be higher than that of a risk-free investment, the return expectations regarding these three countries should be approximated by employing the respective values derived from the dividend growth model when using listed real estate market-based returns as a foundation.[153]

### 7.3.2 Multi-factor model

Considering the criticism regarding the explanation of security returns with a single independent variable, multi-factor models have been proposed. A multi-factor model may constitute a further tool for the estimation of a required rate of return. In this sense, macroeconomic, statistical and fundamental factor models have been introduced.[154]

Macroeconomic factor models employ observable economic time series as factors. The chosen variables probably reflect the state of as well as the expectations regarding the economy. Presumably, the random security return should respond linearly to macroeconomic shocks. The APT approach, one type of multi-factor model, represents a common way to equate security returns with macroeconomic variables. Accordingly, the multiple regression model calculated in the previous chapter represents a variant of macroeconomic factor models.[155]

Second, statistical factor models employ principal components-based factor analysis or maximum likelihood analysis to identify variables that supposedly explain security returns. A factor analysis relying on the principal component analysis has been applied in the previous chapter.[156]

Irrespective of whether stocks or REITs are analysed, tests comparing multi-factor models and based either on statistical factors or on macroeconomic variables have

[153] Given the restricted data availability, it should be noted that the returns based on the FAMA/FRENCH (2002) dividend growth model have been calculated using REITs belonging to several REIT regimes. Accordingly, the previous recommendation resulting from the application of factor analysis, i.e., to carry out a REIT valuation under consideration of the country of origin associated with the REIT, cannot be addressed in this calculation.

[154] BRIGHAM/EHRHARDT (2008), p. 231; CONNOR (1995), p. 42.

[155] CONNOR (1995), p. 42-46.

[156] CONNOR (1995), p. 42.

proposed the use of the latter type of factors.[157] However, the analyses employed in the preceding chapter revealed that the explanatory power of a variety of independent variables vary significantly depending on the country of origin and the time period under consideration. Given this evidence, the application of the APT model as an alternative method to calculate the cost of equity is omitted in this chapter.

Fundamental factor models are based on the premise that security returns are partially related to firm-specific attributes. Recent research has indicated that the required rate of return is also influenced by idiosyncratic risk factors.[158] Consequently, a multi-factor model based on fundamental variables is introduced in the following sections.

For this purpose, the method is introduced in Section 7.3.2.1. Thereafter, fundamental factors that are thought to share significant explanatory power on security returns are discussed (7.3.2.2). Additionally, the advantages and disadvantages of the model are considered in greater detail (7.3.2.3). After a description of the course of the analysis, the results of the application of the model, including their interpretation, are presented (7.3.2.4).

#### 7.3.2.1 Description

When investigating REITs[159] or general stocks[160], several authors have examined the explanatory power of fundamental factors for stock returns.

Obviously, a multi-factor model, based on fundamental variables, has not been subject to the academic scrutiny levelled against the CAPM or the APT. Unlike the CAPM, the models utilising fundamental factors have not been introduced on the basis of a profound theoretical model. Apart from the theoretical foundations, a major difference between the CAPM and the following approach relates to the type of independent variables included in the equation. Consequently, particular attention will be devoted to the selection of independent variables included in the model.

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[157] See, for example, CHEN (1983, p. 1409) and CHEN/JORDAN (1993, p. 85) in terms of general stocks. CHEN/HSIEH/JORDAN (1997, p. 521) document the superiority of the macroeconomic variable approach when investigating REITs domiciled in the United States.

[158] CONNOR (1995), p. 42. See, for example, REINGANUM (1981, p. 320), who finds evidence of a size effect but remains sceptical whether the idiosyncratic risk component is completely diversified away.

[159] See, for example, CHEN et al. (1998) or LING/NARANJO/RYANGAERT (2000).

[160] See, for example, CHAN/KARCESKI/LAKONISHOK (1998) or FAMA/FRENCH (1993).

Although the macroeconomic factors have already been examined, the selection of the fundamental factors will be discussed in the following section.[161]

#### 7.3.2.2 Assumptions about the factors

Complementing the research on the incorporation of macroeconomic variables in a multi-factor model, fundamental factors have been examined in terms of their explanatory power towards security returns. In the following, a choice of fundamental factors is considered that have documented a significant relationship with general stocks and partly against REITs; with studies on REITs summarised in Figure 7.19.

Scientific evidence indicates a positive association between security returns and the proportion of leverage.[162] For REITs that originated in the United States, REDMAN/MANAKYAN (1995, p. 171f) find no significant relationship between REIT returns and leverage when considering a time period from 1986 to 1990. Furthermore, CHAUDHRY/MAHESHWARI/WEBB (2004, p. 217) observe no connection between REIT returns and leverage over the time period between 1994 and 1998 but identify a significant explanatory power of the leverage variable when analysing a time span from 1996 to 2000. In addition, ALLEN/MADURA/SPRINGER (2000, p. 149f) document that financial leverage shares a significant positive relationship with the stock market beta associated with REITs between the years 1992 and 1996. Although evidence on the relationship between REIT returns and the leverage component is rare, the findings probably indicate a trend towards increased explanatory power of the leverage component during recent years. This assumption was investigated in the current study by means of including the leverage component.

The leverage ratio is obtained from the previous analysis of the book measure of leverage. The REIT sample was divided into a group including the bottom 30%, a

[161] See, for example, COCHRANE (2005) for further information regarding the CAPM, the APT and fundamental factor models.

[162] See, for example, BHANDHARI (1988, p. 527f) or MARTIKAINEN (1991, p. 103).

category encompassing the middle 40% and a class including the top 30% of the ranked values with regard to the size of the leverage component.[163]

Several researchers analysing general stocks have identified a positive relationship between average returns and the book-to-market equity ratio[164].[165] In contrast, a significant relationship between the book-to-market equity ratio and REIT returns has been debated in the literature.[166] The lack of evidence regarding a statistical relationship might be a result of the reduced availability of studies analysing REITs.

***Figure 7.19: Empirical results on studying models including fundamental factors with REITs.***

| Author(s) | CHEN et al. (1998) | CONNORS/ JACKMAN (2000) | McINTOSH/ LIANG/ TOMPKINS (1991) | PETERSON/ HSIEH (1997) |
|---|---|---|---|---|
| Sample (maximum number of exchange-traded US-Equity-REITs used) | 55 | 49 | 175 | 88 |
| Time period | 1978-1994 | 1973-1999 | 1974-1988 | 1976-1992 |
| Market portfolio | | | | |
| Small-minus-big | | | | |
| High book-to-market minus low book-to-market equity | | | | |

= considered in the cited reference with finding a statistical significance
= considered in the cited reference without finding a statistical significance
= not considered in the cited reference

*Source: Own considerations based on scientific research*

[163] Adapted from FAMA/FRENCH (1993, p. 8f).
[164] The book-to-market equity ratio represents the relationship between the book value and the market value of a company. [FAMA/FRENCH (1993), p. 3.]
[165] See, for example, FAMA/FRENCH (1993, p. 3) or FAMA/FRENCH (1998, p. 1997).
[166] A choice of studies considering REITs domiciled in the United States has evolved. Examining REITs between 1978 and 1994, CHEN et al. (1998, p. 275) do not find a significant relationship between the book-to-market equity factor and REIT returns. In contrast, both CONNORS/JACKMAN (2000, p. 55), analysing REITs over a time span between 1973 and 1999, and LEE/LEE/CHIANG (2008, p. 172f), studying REITs from 1978 to 2003, approve a significant relationship between the two variables.

The book-to-market equity ratio was included in the present examination as well. In this case, the REIT sample was divided into a group including the bottom 30% of the ranked values in terms of book-to-market equity, a category encompassing the middle 40% and a class including the top 30%.[167]

As explained before, research on both general stocks and REITs has delivered evidence regarding a small company effect. A factor accounting for firm size was included in the model by means of the following process.[168] First, the market capitalisation of each sampled REIT was calculated on an annual basis by multiplying the stock price by the number of shares in June of each year *t*. Second, each REIT was ranked according to its market capitalisation at annual intervals. Third, the REITs were split into three groups, namely a group including the 30% of REITs possessing the lowest market capitalisation, a class incorporating the middle 40% of REITs with a medium market capitalisation and a category including 30% of the total sample possessing the highest market capitalisation. This classification deviates from the categorisation employed by FAMA/FRENCH (1993, p. 8f), who create two groups according to the size of securities to address their findings in FAMA/FRENCH (1992, p. 441), i.e., that the book-to-market equity exhibits superior explanatory power in comparison with the size effect. However, no differentiation in terms of the classification of factors was performed in this study, as no unambiguous evidence of a compelling relationship between the book-to-market equity factor and REIT returns exists.

Several authors have offered evidence that firms possessing a high earnings-price ratio, also called the earnings yield[169], tend to have high returns, with companies possessing a low earnings yield potentially exhibiting low returns.[170] However,

[167] Adapted from FAMA/FRENCH (1993, p. 8f). In this regard, only non-negative book-to-market equity ratios are observed with the sampled REITs. Although FAMA/FRENCH (1993, p. 8) excluded companies that exhibited a negative book equity due to the threat of a high default risk, several authors argue that the omission of these stocks does not have a significant effect on the results of the study. [BROWN/ LAJBCYGIER/LI (2008), p. 95.]
[168] Adapted from FAMA/FRENCH (1993, p. 7-10).
[169] The earnings yield represents the inverse of the PER. [LAMONT (1998), p. 1563.]
[170] See, for example, JAFFE/KEIM/WESTERFIELD (1989, p. 148) or LAM (2002, p. 177f). Investigating the PER as an inverse of the earnings price ratio, BASU (1977, p. 680f) documents this finding as well.

FAMA/FRENCH (1992, p. 445) observe that the explanatory power of earnings yields on stock returns dissolves when using a model including both a size and a book-to-market equity variable. LING/NARANJO/RYANGAERT (2000, p. 126) document a positive relationship between the PER and REITs.[171] Considering the finding that REITs distribute the bulk of their earnings to shareholders, the use of the earnings yield with REITs can probably be substituted through the application of the dividend yield.[172] In addition, several authors find a significant relationship between dividend yields and security returns with general stocks[173] and REITs[174].[175] In line with these considerations, the dividend yield corresponding to the sampled REITs was employed in the present calculation instead of the PER. The REIT sample was divided into a group including the bottom 30% of the ranked values in terms of the size of the dividend yield, a category encompassing the middle 40% and a class including the top 30%.[176]

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[171] It should be noted that LING/NARANJO/RYANGAERT (2000, p. 126) utilised a PER on general stocks. Furthermore, the question of whether the relationship between both variables is positive or negative depends on the type of REIT-related excess return used in the equation. [LING/NARANJO/RYANGAERT (2000), p. 126.]

[172] For example, EICHHOLTZ/VELD/SCHWEITZER (1997, p. 10) suggest that the dividend yield represents the inverse of the PER with REITs being obliged to distribute the bulk of their earnings to shareholders.

[173] FAMA/FRENCH (1988, p. 3) and LEWELLEN (2004, p. 209) find a predictive ability of the dividend yield regarding stock returns.

[174] Using data on REITs domiciled in the United States between 1971 and 1991, LI/WANG (1995, p. 474-479) document a predictive power of the dividend yield. Analysing a time period between 1980 and 1989, LIAO/MEI (1998, p. 281-283) detect a considerable connection between dividend yields and the returns on both Equity-REITs and real estate stocks. BROOKS/TSOCALOS/LEE (2000, p. 546-554) find a coincidence between the cycles of property share prices and dividend yields when employing British property stock data from 1965 to 1998. Furthermore, LIU/MEI (1998, p. 22f) observe a significant relationship between US-American REIT returns and dividend yields while the property stock returns from Australia, France, Japan, South Africa and the UK do not show a significant relationship. The authors utilised data over a time span from 1980 to 1991. [LIU/MEI (1998), p. 6.] However, it should be noted that all authors mentioned until now obtained the dividend yield from a general stock index. [BROOKS/TSOCALOS/LEE (2000), p. 548; LI/WANG (1995), p. 474; LIAO/MEI (1998), p. 280; LIU/MEI (1998), p. 12.] In contrast, LING/NARANJO/RYANGAERT (2000, p. 118-125) find a significant positive relationship between US-REIT returns and the dividend yield on both a general stock index and a REIT index using data over a time span ranging from 1980 to 1996.

[175] The assertion that firms with low dividend payout ratios tend to show a higher riskiness will be neglected at this stage, as REITs typically possess a relatively high payout ratio. [See BEAVER/KETTLER/SCHOLES (1970, p. 660) regarding the association between the dividend payout ratio and general stock returns.]

[176] Adapted from FAMA/FRENCH (1993, p. 8f).

### 7.3.2.3 Critical assessment

A variety of studies have illustrated that the inclusion of fundamental factors in regression models is rewarded by a relatively high explanatory power towards security returns. Specifically, several analyses concerning general stocks have documented that the supplementation of fundamental factors can enhance the explanatory power of models previously based solely on macroeconomic variables.[177]

As explained before, scientific studies have delivered evidence that the returns of REITs are associated with fundamental variables. Investigating the CAPM, the FAMA/FRENCH (1992, 1993) model and a multi-factor model including both the factors used within the FAMA/FRENCH (1992, 1993) model and macroeconomic variables, CONNORS/JACKMAN (2000) observe that the FAMA/FRENCH (1992, 1993) approach performs best in predicting the return on REITs headquartered in the United States.[178]

However, the theoretical justification has been more complex in comparison to that of the CAPM for example. Furthermore, several researchers have questioned the validity of the FAMA/FRENCH (1992, 1993) three-factor model. Some authors find only weak evidence of a significant relationship between the book-to-market equity ratio and security returns.[179] BLACK (1993, p. 9f) suggests that the small company effect might be a sample period phenomenon as a significant relationship has been observed in certain periods only.[180] As seen before, this argument seems to be valid in the case of REITs as well. Accordingly, JAGANNATHAN/WANG (1993, p. 2) do not observe a necessity of employing a three-factor model but propose the use of the CAPM.

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[177] Comparing factor models encompassing macroeconomic factors, technical factors, fundamental factors and statistical factors, CHAN/KARCESKI/LAKONISHOK (1998, p. 182) find that fundamental factors chosen from the FAMA/FRENCH (1992, 1993) model do provide a good explanatory power.

[178] PETERSON/HSIEH (1997, p. 342f) deliver evidence of a statistically significant relationship between US-American REIT returns and all three factors included in the FAMA/FRENCH (1992, 1993) model.

[179] BREEN/KORAJCZYK (1995), p. 2; KOTHARI/SHANKEN/SLOAN (1995), p. 186. Specifically, a survivorship bias has been observed with the data used by FAMA/FRENCH (1992). [JAGANNATHAN/McGRATTAN (1995), p. 7.] BREEN/KORAJCZYK (1995, p. 2) adjust the data for this bias and find a much weaker relationship between security returns and the book-to-equity market ratio.

[180] According to BLACK (1993, p. 9f), the small company effect has been absent during the time period between 1981 and 1990 for example. JAGANNATHAN/McGRATTAN (1995, p. 8) question the importance of the size effect, considering the relatively low value of small firms as a group used in the studies that test for a size effect. Unlike FAMA/FRENCH (1993), the authors assume that the CAPM is still valid if a large collection of assets is present. [JAGANNATHAN/McGRATTAN (1995), p. 8.]

#### 7.3.2.4 Structure of analysis and results

REITs belonging to the sample were categorised according to three groups associated with each of the four variables introduced above. In total, the categorisation led to a selection of 54 different portfolios. Value-weighted returns were calculated for each portfolio on a monthly basis between July of year *t* and the end of June of year *t+1*.[181] In June of year *t+1*, the portfolios were reformed. This calculation was carried out over the longest monthly time series available in this study; i.e., from January 1995 until December 2009 a sample of 50 REITs with each firm domiciled in the United States was collected. Additionally, data on 96 REITs that are all headquartered in the United States over the sub-period between 2005 and 2009 were considered.[182]

The risk factor in returns related to the size of REITs is called small minus big (SMB). The SMB factor was calculated by subtracting the simple average return on the nine portfolios including high capitalisation REITs ($H_s/L_{bme}$, $H_s/M_{bme}$, $H_s/H_{bme}$, $H_s/L_l$, $H_s/M_l$, $H_s/H_l$, $H_s/L_d$, $H_s/M_d$, $H_s/H_d$) from the mean return on the nine portfolios including low capitalisation REITs ($L_s/L_{bme}$, $L_s/M_{bme}$, $L_s/H_{bme}$, $L_s/L_l$, $L_s/M_l$, $L_s/H_l$, $L_s/L_d$, $L_s/M_d$, $L_s/H_d$).

The risk factor in returns concerning the book-to-market equity of REITs is called high minus low (HML). The HML factor was estimated by subtracting the simple average return on the nine portfolios encompassing REITs with a low book-to-market equity ratio ($L_s/L_{bme}$, $M_s/L_{bme}$, $H_s/L_{bme}$, $L_{bme}/L_l$, $L_{bme}/M_l$, $L_{bme}/H_l$, $L_{bme}/L_d$, $L_{bme}/M_d$, $L_{bme}/H_d$) from the average return on the nine portfolios including REITs possessing a high book-to-market equity ratio ($L_s/H_{bme}$, $M_s/H_{bme}$, $H_s/H_{bme}$, $H_{bme}/L_l$, $H_{bme}/M_l$, $H_{bme}/H_l$, $H_{bme}/L_d$, $H_{bme}/M_d$, $H_{bme}/H_d$).

The risk factor in returns associated with the leverage component of REITs is called debt-to-total assets (DTA). This factor was estimated by subtracting the simple average return on the nine portfolios including REITs with a low DTA ratio ($L_s/L_l$,

[181] The portfolios are calculated in July of year *t* to ensure the availability of the book value of equity in year *t-1*.

[182] In contrast, the number of firms domiciled in other countries had been relatively low, being 31 companies domiciled in a single country at maximum. Considering the requirement to calculate 54 different portfolios, only REITs domiciled in the United States are employed. The underlying data represent REIT stock data that have been adjusted according to the explanations in Section 6.2.

$M_s/L_l$, $H_s/L_l$, $L_{bme}/L_l$, $M_{bme}/L_l$, $H_{bme}/L_l$, $L_l/L_d$, $L_l/M_d$, $L_l/H_d$) from the average return on the nine portfolios including REITs with a high DTA ratio ($L_s/H_l$, $M_s/H_l$, $H_s/H_l$, $L_{bme}/H_l$, $M_{bme}/H_l$, $H_{bme}/H_l$, $H_l/L_d$, $H_l/M_d$, $H_l/H_d$).

Furthermore, the risk factor in returns corresponding to the dividend yield (DY) of REITs was calculated by subtracting the simple average return on the nine portfolios including REITs with a low dividend yield ($L_s/L_d$, $M_s/L_d$, $H_s/L_d$, $L_{bme}/L_d$, $M_{bme}/L_d$, $H_{bme}/L_d$, $L_l/L_d$, $M_l/L_d$, $H_l/L_d$) from the average return on the nine portfolios including REITs with a high dividend yield ($L_s/H_d$, $M_s/H_d$, $H_s/H_d$, $L_{bme}/H_d$, $M_{bme}/H_d$, $H_{bme}/H_d$, $L_l/H_d$, $M_l/H_d$, $H_l/H_d$).[183]

The model was tested for multicollinearity, with the independent variables being orthogonalised if necessary.

In the multi-factor model employed in this study, the factor sensitivities were calculated similarly to those included in the CAPM. Accordingly, the historical monthly excess returns attached to each REIT were regressed against fundamental factors by means of the following model:

$$E(r_i) - r_f = \lambda_i + \beta_{i,1} \times HML + \beta_{i,2} \times SMB + \beta_{i,3} \times DTA + \beta_{i,4} \times DY + \varepsilon_i \quad \textbf{(7.9)}$$

where

| | |
|---|---|
| $E(r_i)$ = | expected rate of return on a security $i$ |
| $r_f$ = | return of a risk-free investment |
| $HML$ = | total return on the HML portfolio |
| $SMB$ = | total return on the SMB portfolio |
| $DTA$ = | total return on the DTA portfolio |
| $DY$ = | total return on the DY portfolio |
| $\beta_{i,1}, \ldots, \beta_{i,4}$ = | sensitivity of the return on security $i$ to the characteristics of a factor $1, \ldots, 4$ |
| $\varepsilon_i$ = | company-specific interfering variable |

[183] The decision on the form of the subtraction is based on recent findings. For example, the portfolios comprising high capitalised REITs are subtracted from the portfolios including small capitalised REITs, as small companies tend to possess higher returns.

Following the recommendations of FAMA/FRENCH (1992, p. 5), a one-month treasury bill was collected with data covering a time period between 2005 and 2009. For the time period between 1995 and 2009, data from a three-month treasury bill were obtained as an approximation of the one-month treasury bill, which was not available.[184]

The results of analysing the two time periods are illustrated in Figure 7.20.

***Figure 7.20: Summary of the results of the four-factor model.***

| | 1995-2009 | | 2005-2009 | |
|---|---|---|---|---|
| **Total number of REITs considered** | 50 | | 96 | |
| **Total number of REITs exhibiting at least one significant coefficient** | 29 | | 61 | |
| **Mean coefficient of determination ($R^2$)** | 0.283 | | 0.336 | |
| **Adjusted coefficient of determination ($R^2_{adj}$)** | 0.265 | | 0.281 | |
| | **Number of significant coefficients** | | **Number of significant coefficients** | |
| ***Factors*** | + | - | + | - |
| **SMB** | 16 | 0 | 23 | 0 |
| **DTA** | 0 | 26 | 42 | 0 |
| **HML** | 4 | 10 | 1 | 27 |
| **DY** | 9 | 1 | 14 | 0 |

*Source: Own calculations based on the total sample (50/96 of 218 REITs)*

[184] To express the annualised data obtained with the treasury bills in monthly rates, the following formula has been employed:

$$r_{fm} = (1 + r_{fa})^{\frac{1}{12}} - 1$$

with $r_{fm}$ representing the monthly rate and $r_{fa}$ representing the annual rate. [Adapted from ACKER/DUCK (2006, p. 10).]

Overall, the model delivers considerable power, with the simple coefficient of determination being higher in the time period from 2005 until 2009. Given the finding that the adjusted coefficient of determination is relatively similar to the simple coefficient of determination, it could be argued that the inclusion of the four independent variables is rather justified. Additionally, an orthogonalisation of independent variables was not necessary, as the independent variables exhibited variance inflation factors below the critical levels. However, it should be noted that a survivorship bias might be present with the sample employed in this study.

Notably, the results of the regression document a comparatively large fraction of statistically significant coefficients relevant to SMB. Accordingly, the significance of the size effect introduced earlier is confirmed in this work. The size effect, in terms of its significant connections as a share of the total number of REITs exhibiting a significant relationship during a certain time period, has been less pronounced in recent years. Correspondingly, the factor analysis in the preceding chapter points to a decrease in the relative share of the size factor when considering all factors over five-year time horizons, beginning in 1985 and ending in 2009.

Similarly, a significant relationship between excess stock returns and the debt-to-total assets ratio was identified for a large share of the sampled REITs. Considering the analyses in the preceding chapter, REIT returns might be susceptible to the leverage ratio on the basis of interest rates that reflect the cost of financing on the one hand and current economic conditions on the other hand. In addition, the results of the factor analysis revealed an increasing presence of a leverage factor in past years. These findings provide some evidence regarding the recent assumption that the leverage component possessed higher explanatory power in recent years, possibly because of the more sophisticated use of financing instruments by REITs noted previously.

In addition, the book-to-market equity factor exhibits a significant relationship with stock returns in the case of several REITs included in the sample. However, an overweighting of negative relationships is detected. In the context of general stocks, a high book-to-market equity ratio implies that the share is inexpensive in comparison to the underlying book value.[185] Nevertheless, this view might not be adopted with REITs: given evidence that unsecuritised real estate returns follow the development of securitised property returns with a time lag, a high book-to-market equity ratio might be a result of the fact that the stock market has already anticipated a fall in real estate prices, whereas the real estate assets, which are supposed to comprise a large share of the total assets owned by a REIT, have not yet been adjusted to market conditions by means of appraisals. Considering that properties are valued at annual or even longer time intervals, a response of REIT assets to underlying market conditions might occur with a time lag.

For the dividend yield, a comparatively small number of statistically significant relationships was observed. Given the distribution requirement, a consistently high dividend yield was identified across several REITs. Considering that a REIT typically delivers a high dividend yield, investors might not pay attention to differences in the measure between REITs. However, the coefficients are largely documenting a positive relationship between the dividend yield of REITs and REIT stock returns.

### 7.3.3 Final recommendation

Two approaches to derive the cost of equity have been proposed thus far. Particular attention has been devoted to the CAPM and a four-factor model founded on the considerations by FAMA/FRENCH (1992, 1993). In addition, the analyses in the recent chapter identified further explanatory variables affecting REIT returns. In this regard, an equation comprising the factors considered in the analyses in Chapter Six, which is denominated as a multi-factor model, could also deliver an estimation of the cost of equity.

The results of the three approaches are summarised in Figure 7.21 while paying specific attention to the explanatory power of the models. In particular, the CAPM and the multi-factor model have been re-estimated with the dataset already used for the derivation and the calculation of the four-factor model. Choosing monthly data, adjusted according to the explanations in Chapter Six, 50 US-domiciled REITs over

[185] PINTO et al. (2010), p. 66.

a time period from 1995 to 2009 and a sample of 96 US-REITs from 2005 until 2009 are available.[186] Concerning the time period from 1995 to 2009, the four-factor model delivered the highest explanatory power in terms of both the simple and the adjusted coefficient of determination. Notably, the CAPM provided a very low explanatory power, irrespective of using listed real estate or general stock market returns to estimate the market risk premium.

With regard to the time period from 2005 until 2009, the multi-factor model delivers the highest simple and the largest adjusted coefficient of determination. Although 21 regressors are included in the multi-factor model, the four-factor model exhibits only a marginally lower explanatory power in terms of the adjusted coefficient of determination. In addition, the relatively large difference between the simple and the adjusted coefficient of determination points to an increased number of insignificant variables having been entered into the multi-factor model. Indeed, some regressors covered in the model did not show a significant connection with any REIT sampled during the two time periods under consideration. To reduce the complexity, Figure 7.21 lists the four variables that exhibit the highest explanatory power measured in terms of the number of significant relationships. Remarkably, the leading indicator explains a large fraction of the changes in REIT prices.

The results examined in the previous chapter already indicate a high explanatory power and considerable forecasting ability attached to the leading indicator variable. Similarly, the general stock market returns variable exhibited a significant impact on REIT returns in several cases. For example, the stock market variable possesses the second-highest number of significant relationships with REIT returns over the time period between 1995 and 2009. In addition, the beta associated with the general stock market return showed acceptable stability over time; at least when the results of the previously conducted portfolio approach are considered.

Taking the preceding arguments into account, it is suggested that the cost of equity be calculated using a combined six-factor model. Specifically, the formula should comprise the explanatory variables included in the four-factor model, together with the leading indicator and the general stock market variable. However, the application of the six-factor model is suggested only for REITs domiciled in the United States.

[186] To ensure consistency between the models, the rate on a one-month treasury bill has been subtracted from both the explanatory and the dependent variables.

***Figure 7.21: Comparison of the explanatory power of selected models regarding the estimation of the cost of equity.***

| | **Four-factor model** | | **CAPM (stock market)** | | **CAPM (listed real estate market)** | | **Multi-factor model** | |
|---|---|---|---|---|---|---|---|---|
| | **1995-2009** | **2005-2009** | **1995-2009** | **2005-2009** | **1995-2009** | **2005-2009** | **1995-2009** | **2005-2009** |
| **Total number of REITs considered** | 50 | 96 | 50 | 96 | 50 | 96 | 50 | 96 |
| **Total number of REITs exhibiting a significant relationship** | 29 | 61 | 27 | 70 | 14 | 67 | 31 | 31 |
| **Share of significant relationships as of the total number considered** | 58.00% | 63.54% | 54.00% | 72.92% | 28.00% | 69.79% | 62.00% | 32.29% |
| **Mean coefficient of determination ($R^2$)** | 0.283 | 0.336 | 0.047 | 0.122 | 0.069 | 0.154 | 0.251 | 0.581 |
| **Adjusted coefficient of determination ($R^2_{adj}$)** | 0.265 | 0.281 | 0.042 | 0.106 | 0.064 | 0.139 | 0.157 | 0.366 |

| | | + | - | + | - | | + | - | + | - | | + | - | + | - | | + | - | | + | - |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of significant coefficients** | **HML** | 4 | 10 | 1 | 27 | **MRPG** | 26 | 1 | 70 | 0 | **MRPR** | 11 | 3 | 65 | 2 | **LI** | 18 | 2 | **LI** | 19 | 1 |
| | **SMB** | 16 | 0 | 23 | 0 | | | | | | | | | | | **MRPG** | 14 | 0 | **RS** | 14 | 1 |
| | **DTA** | 0 | 26 | 42 | 0 | | | | | | | | | | | **RS** | 6 | 4 | **UN** | 1 | 13 |
| | **DY** | 9 | 1 | 14 | 0 | | | | | | | | | | | **CC** | 8 | 1 | **LT** | 11 | 2 |

*Source: Own calculations based on the total sample (50/96 of 218 REITs)*

*Notes: HML=book-to-market equity factor; SMB=size factor; DTA=leverage factor; DY=dividend yield factor; MRPG=market risk premium using general stock market returns; MRPR=market risk premium using listed real estate market returns; LI=leading indicator; RS=retail sales; CC= consumer climate; UN=unemployment rate; LT=long-term interest rate*

A major reason for this recommendation relates to the observation that the formation of four-factor portfolios is rather restricted to REIT regimes consisting of a sufficient number of REITs. Furthermore, the analyses in the recent chapter point to the observation that the explanatory power of variables may show disparities depending on the country of origin. As an alternative, the application of the CAPM is suggested with a general stock market index acting as the market portfolio. Furthermore, to reduce the complexity of the valuation tool, it is recommended to discount the cash flows of operating activities and those of investing activities at the same rate.

## 7.4 Implicit cash flow calculation scheme

Subsequent to the explicit planning period, the REIT could be either liquidated (this involves abandonment of the business activities) or it may continue to exist. The liquidation of a REIT is not unlikely. REITs have often been liquidated as a consequence of insolvencies or takeovers, for example. However, while it appears to be impossible to anticipate the date of the liquidation of a firm, the valuation tool devotes particular attention to the going-concern scenario of REITs.

In the following sections, important parameters used in the calculation of the terminal value are discussed first (7.4.1). Taking these parameters into account, the weight of the terminal value is analysed (7.4.2). Finally, an approach to calculate the value of the implicit planning period is suggested (7.4.3).

### 7.4.1 Considerations regarding the parameters of the terminal value calculation

The calculation of the value attached to the implicit planning period can be accomplished by means of the terminal value calculation introduced in Chapter Three. More precisely, the terminal value is derived by dividing the normalised free cash flow pertaining to the first year of the implicit planning period by the difference of an appropriate discount rate and the nominal annual growth rate of the FCF. In the following section, the nominal annual growth rate of the FCF (7.4.1.1) and the discount rate (7.4.1.2) are considered in greater detail.[187]

#### 7.4.1.1 Nominal annual growth rate of the free cash flow

As documented above, the growth rate may have a relatively large impact on the size of the terminal value. The real estate holding, management and operating business typically includes the generation of contractually agreed revenues that are probably linked to the consumer price index. Unless a REIT is in the stage of assembling its real estate portfolio at the beginning of the implicit planning period, an approach employing the expected change in the annual CPI might deliver a good long-term approximation of the growth rate.[188] Apart from this, the existence of contractually agreed lease payments potentially reduces the volatility of the rental revenues stream. Given recent findings that point to a large share of revenues being derived from real estate holding, management and operating activities, a reduction in volatility probably lowers the fluctuations of future growth rates achieved by the REIT and thus enhances the degree of conformity between realised rates and the constant growth rate estimation. In contrast, REITs that exhibit a relatively large turnover of their real estate holdings might show fluctuations in total revenues.

As discussed previously, the factors influencing growth rates can be multifaceted. Concerning the real estate holding, management and operating business, the life cycle stage of the company or the regional and sectoral allocations of the real estate portfolio might have a notable impact on the growth rate.

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[187] Furthermore, it has been contended that the proposal to employ a normalised free cash flow in the terminal value calculation may not square with the use of a FCF forecast pertaining to the last year of the explicit planning period, which is increased by the growth rate. However, as particular attention has been devoted to the forecast of individual cash flow items, no explicit adjustment is carried out in this work. [See, for example, LODERER (2005, p. 613-626) for an overview regarding normalised cash flows.]

[188] However, it should be noted that the growth rate is multiplied by the FCF. In contrast, the indexation to inflation rates is rather observable with the rental revenues item. As a consequence, the inflation rate may represent a less adequate approximation of the growth rate when using FCFs instead of rental revenues.

Regarding the life cycle stage of the REIT, companies that are currently setting up their portfolio are potentially confronted with higher growth rates of their cash flows.

In terms of the regional portfolio allocation, REITs primarily investing in less mature real estate markets might receive rental payments growing at higher rates in comparison to firms that are mainly exposed to property holdings in more mature property markets. A lack of investable real estate assets in the target investment markets of a REIT might force the management to expand the real estate portfolio by developing properties, ideally leading to a future step-up in rental revenues. Both scenarios can ultimately result in a higher growth rate of the FCFs, because the REIT might be able to sharply increase its rental revenues due to shortage in the supply of quality real estate assets in the respective markets.

Finally, the sectoral real estate allocation of a REIT may also have an impact on the growth rate. Depending on the real estate sector under consideration, step-ups in rental revenues can occur at different intervals, ideally in parallel with the ability of the REIT to raise rents considerably, whereas Figure 7.8 indicates that the difference in the share of both G & A and property operating expenses depends on the property type classification.

Based on the preceding assumptions about the factors influencing the growth rate, the sampled REITs were clustered according to the stage in their life cycle and the sectoral real estate portfolio allocation (Figure 7.22).

Considering annual data between 1999 and 2008, mean growth rates were calculated for each cluster, where possible.

Unfortunately, the assumption regarding the target investment markets made above could not be verified or rejected, given the limited availability of data. A classification according to investment markets was not conducted, as the sample consisting of 50 firms is largely confined to REITs domiciled in the United States.

The cash flows from investing activities, which have been calculated according to Formula 7.5, show large variations between years. In this regard, the dataset reveals that REITs do not purchase or sell properties in some years, but carry out many property transactions in other years. Accordingly, the growth rate shows high volatility. Notably, classifying the sample depending on the time over which stock market data are available shows that younger firms exhibit much higher growth rates in the FCFs from investing activities. Presumably, younger companies are still assembling their real estate portfolios and are thus characterised by higher growth rates.

***Figure 7.22: Historical growth rates of free cash flows.***

| *Arithmetic mean values (1999-2008)* | Number of sampled firms | FCFs from operating activities | FCFs from investing activities |
|---|---|---|---|
| **Total** | **50** | **12.89%** | **83.19%** |
| **Apartments** | 11 | 7.23% | 90.45% |
| **Community centres** | 4 | 18.34% | -8.17% |
| **Free standing** | 3 | 11.42% | 37.02% |
| **Health care** | 4 | 12.50% | -48.83% |
| **Industrial** | 3 | **19.20%** | -197.83% |
| **Land lease** | --- | --- | --- |
| **Lodging and resorts** | 3 | 17.46% | 646.74% |
| **Merchandise centres** | 3 | 9.21% | 28.02% |
| **Neighborhood centres** | 1 | 11.07% | -73.13% |
| **Offices** | 12 | 17.68% | -144.56% |
| **Self-storage** | 2 | 2.92% | 359.62% |
| **Specialty** | --- | --- | --- |
| **Diversified** | 4 | 10.14% | **734.78%** |
| | | | |
| **High age (24-31 yrs.)** | 12 | 9.65% | 3.94% |
| **Upper-middle age (16-23 yrs.)** | 13 | 10.97% | -26.83% |
| **Lower-middle age (15-16 yrs.)** | 13 | 10.75% | 44.16% |
| **Low age (10-15 yrs.)** | 12 | **20.52%** | **323.89%** |
| | | | |
| **High market capitalisation** | 12 | **15.80%** | -141.97% |
| **Upper-middle market capitalisation** | 13 | 12.91% | 119.49% |
| **Lower-middle market capitalisation** | 13 | 14.97% | 51.93% |
| **Low market capitalisation** | 12 | 7.68% | **302.87%** |

*Source: Own calculations based on the total sample (50 of 218 REITs)*

The growth rate of the FCFs from operating activities with young firms exceeds that of old firms.[189] However, measuring the stage of a firm in its life cycle in terms of market capitalisation leads to differing results. It should be noted that the classification based on market capitalisation has been performed over a different time interval, namely from 2004 until 2008. Overall, the growth rates of the FCFs from operating activities are much lower than those corresponding to the FCFs from investing activities, but they still exhibit an average value over the total sample of 12.89%. In comparison, the arithmetic mean of the annual change of the consumer price index in the United States is 2.53% when measured over the same (1999-2008) time period.

#### 7.4.1.2 Discount rate

The inclusion of a discount rate in the calculation of the value of both the explicit and the implicit planning period highlights the importance of this variable. The estimation of the discount rate can be accomplished using the approaches previously recommended. Specifically, the six-factor model has been applied to a sample of 46 REITs domiciled in the United States, whereas the CAPM has been employed to derive the cost of equity for a sample including 46 US-American, two Australian and one Canadian REIT(s) (see Figure 7.23).[190]

The risk-free rate used with both models to calculate the cost of equity relates to the yield on a long-term government bond rate as of the 31st of December, 2009. In terms of the calculation of the factor returns, the numbers outlined in Figure 7.16 have been used as market risk premiums. To obtain long-term risk premiums concerning the remaining independent variables, the longest time series available have

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[189] The dataset used to calculate Figure 7.22 has been sorted according to the age of the sampled firms, approximated through the availability of stock market data. No distinct clusters could have been created depending on the number of years as some REITs differ in their stock market availability for few months only. For example, some REITs with a 15-year track record have been allocated to the "Lower-middle age" group while others, which exhibited only a few months less of stock market data were allocated to the "Low age" group.

[190] Specifically, the 46 US-American REITs represent an intersection of the sample used to test beta stability (Section 7.3.1.3.2) on the one hand and the sample used in the estimation of the multi-factor model (Section 7.3.2.4) on the other hand

been chosen.[191]

As expected, the six-factor model delivers a much higher explanatory power than the CAPM. However, the mean costs of equity are relatively low with both models, particularly due to the following reasons: first, the value of the government bond rate, used as the risk-free rate approximation, is relatively low (Australia: 5.65%, Canada: 3.60%, United States: 3.59%) in a long-term comparison. Second, several REITs exhibited negative coefficients concerning the six-factor model or relatively low coefficients with regard to the CAPM. Moreover, given the restricted availability of data regarding the calculated factors, the mean risk premiums of HML, SMB, DTA and DY have negative signs contributing to a further reduction in the discount rate.[192] Although the negative coefficients are (partly) supposed to become positive over the long term, it is suggested to use the CAPM with those REITs that have been assigned a cost of equity through the six-factor model that falls below the interest rate on the risk-free investment.[193]

[191] Specifically, a mean average risk premium of the leading indicator has been calculated from data collected between 1983 and 2009. The corresponding mean returns for the remaining four factors have been obtained from 1997 to 2009. As with the four-factor model calculated earlier, a one-month treasury bill rate issued by the Canadian government has been obtained. Given data limitations, three-month treasury bill rates have been employed as an approximation for firms domiciled in Australia or in the United States.

[192] Specifically, the HML variable has an annual mean excess return of –1.18%, the SMB factor has a value of –2.45%, the DTA variable has a mean return over the return on a government bond of –3.44% and a DY factor of –1.22%.

[193] Similar to the calculation of growth rates, the discount rates on the sampled REITs were classified according to the stage in their life cycle and with regard to their sectoral portfolio classification. However, as no distinct differences were identified, the results are not reported.

***Figure 7.23: Summary of the results of the cost of equity calculations.***

| *2005-2009* | | Six-factor model | | | CAPM (general stock market returns) | |
|---|---|---|---|---|---|---|
| Total number of REITs considered | | 46 | | | 49 | |
| Total number of REITs exhibiting a significant relationship | | 37 | | | 36 | |
| Share of significant relationships as of the total number of REITs considered | | 80.43% | | | 73.47% | |
| Mean coefficient of determination ($R^2$) | | 0.356 | | | 0.176 | |
| Adjusted coefficient of determination ($R^2_{adj}$) | | 0.283 | | | 0.162 | |
| Mean cost of equity ($c_e$) | | 3.79% | | | 4.00% | |
| Number of significant coefficients | | + | - | | + | - |
| | HML | 0 | 8 | MRPG | 36 | 0 |
| | SMB | 6 | 0 | | | |
| | DTA | 17 | 1 | | | |
| | DY | 4 | 0 | | | |
| | MRPG | 11 | 0 | | | |
| | LI | 5 | 1 | | | |

*Source: Own calculations based on the total sample (46/49 of 218 REITs)*
*Notes: HML=book-to-market equity factor; SMB=size factor; DTA=leverage factor; DY=dividend yield factor; MRPG=market risk premium using general stock market returns; LI=leading indicator. The mean value of the cost of equity associated with the six-factor model includes positive discount rates only.*

### 7.4.2 Considerations regarding the weight of the terminal value

Depending on the nature of the business activities under consideration, the terminal value may account for 60 to 70% of the total firm value. Specifically, certain sectors (such as the high technology sector) employ investments in fixed assets and working capital that exceed current cash flows, potentially leading to higher cash flows in subsequent years. Consequently, the share of the value generated in the implicit planning period could be relatively high.[194] Extending this line of argument to REITs, firms that participate in real estate development or trading activities to a considerable extent or that are still in the stage of assembling their portfolio might have a high share of the firm value attached to the terminal value. In contrast, KOCH (2005, p. 100) recommends the consideration of valuation tools in which the terminal value accounts for a relatively low share of the total value. The author makes this case on the fact that the assumptions of calculating a terminal value are simplified in comparison to those made for estimating the value belonging to the explicit planning period.

The following sample calculation contributes to the identification of the weight of the implicit planning period and its influencing factors while capitalising on the findings obtained in the previous sections. Figure 7.24 summarises the results of the application of a simple discounted cash flow calculation, assuming FCFs growing at a rate of four percent.

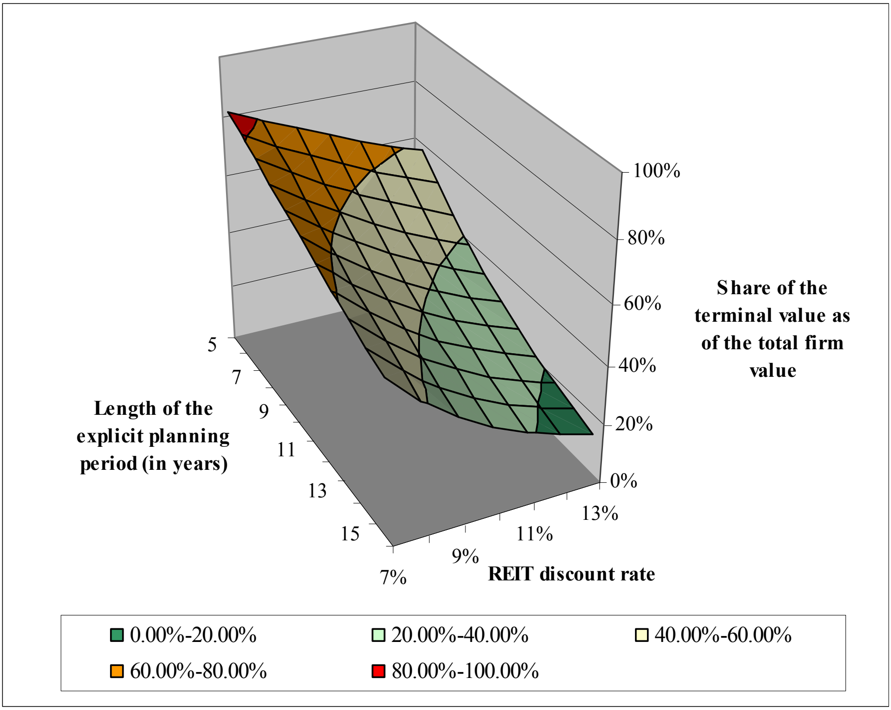
For example, a range between seven and 13% of the discount rate helps to illustrate the effect of a variation in the required rates of return on the weight of the value of the implicit planning period. As a comparison, scientific real estate research has suggested REIT discount rates of between ten and twelve percent.[195] Concerning the length of the explicit planning period, a range between five and 15 years was chosen to investigate the impact of a change in the duration on the weight of the terminal value.

Specifically, the weight of the terminal value is supposed to decline, either through the application of a higher discount rate in the course of an increase of the length of

[194] COPELAND/KOLLER/MURRIN (2000), p. 268.
[195] BLOCK (2006), p. 222; BRUEGGEMAN/FISHER (2005), p. 264f.

the explicit planning period or by a combination of both adjustments.[196] However, the increase in forecasting length leads to enhanced difficulty and uncertainty regarding the calculation of the value assigned to the explicit planning period. Ideally, the explicit planning period should last until the variability in the earnings stream of a company stops with a normalised growth expected in the following years.[197]

***Figure 7.24: The weight of the terminal value depends on both the length of the explicit planning period and the discount rate.***




*Source: Own calculations*

The data summarised in Figure 7.24 reveal that a discount rate of 9% in connection with an explicit planning period of ten years would result in a terminal value that accounts for 51.02% of the total value. Considering that the complexity of the calcu-

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[196] Apart from this, an increase in the growth rate leads to a rise in the terminal value as a share of the total firm value.
[197] KOCH (2005), p. 100.

lation rises as the length of the explicit planning period increases, the choice of a forecasting period of ten years appears to be reasonable. Despite some of the recent findings, the discount rate of REITs might have a value of 9% or higher over the long term, thus resulting in an acceptable terminal value as a share of the total firm value.

### 7.4.3 Final recommendation

The previous analyses of the parameters concerning the terminal value calculation have been carried out in the context of both operating and investing activities performed by a REIT. The results of these examinations indicate that both types of activities exhibited growth rates that clearly exceed those of the consumer price index. In particular, the cash flows from investing activities show high volatility when using annual time intervals in the analysis. However, it should be noted that the lack of long-term data impedes the calculation of the long-term growth rate of REITs. High growth rates probably result from the relatively long time span needed to establish the real estate portfolio of the REIT. Potentially, the growth rate declines as the firm size increases.

Given the recent considerations, an H model should be applied, which has been mentioned during the classification of corporate valuation methodologies. The H model assumes one phase during the implicit planning period that is characterised by a relatively high growth rate, whereas a stable long-term growth rate is used during a second phase. Expressed as a formula, the H model can be calculated in the following form:

$$TV = \frac{FCF_{T+1}}{\left(c_{eul} - g_s\right)} \times \left[\left(1 + g_s\right) + h \times \left(g_i - g_s\right)\right] \qquad \textbf{(7.10)}^{198}$$

198 FULLER/HSIA (1984), p. 52.

where

| | |
|---|---|
| $TV =$ | terminal value |
| $FCF_{T+1} =$ | normalised FCF in the first year of the implicit planning period pertaining to both operating and investing activities |
| $h =$ | midpoint in the initial high growth period (high growth period/2) |
| $g_i =$ | nominal annual growth rate in the initial high growth period |
| $g_s =$ | nominal annual growth rate in the stable growth period |

In this regard, $g_i$ could equal the average growth rate on operating activities (12.89%) that has been listed in Figure 7.22 and presumably represents a more reasonable forecast of the future cash flows in comparison to the growth rate on investing activities. Considering that the sampled REITs were based on published stock market data for a period between ten and 31 years, a duration of the initial high growth period of between five and 15 years (depending on the firm) could be chosen. In contrast, the rate attached to the stable growth period $g_s$ might have a value close to that based on inflation rate expectations. Nevertheless, both types of growth rates could be adjusted according to the prospects of the user of the valuation tool.

# 8 Determination of the value components imputable to financing activities

Following the previous explanations, the valuation of financing activities is separated from the valuation of both operating and investing activities. Accordingly, the following sections deliver further explanations to the research sub-question of how a new REIT valuation approach can be structured. In accordance with the valuation methodology relying on the APV concept, debt-related cash flows are supposed to be forecast irrespective of the temporary development pertaining to the total REIT value. This assumption is denominated as an autonomous financing policy with the absolute future amount of debt being fixed.[1]

Considering that REITs are tax-exempt at the corporate level, the use of debt financing is supposed to lack positive effects on the firm value. The meaningfulness of the utilisation of debt by REITs is further challenged when considering agency or bankruptcy costs, which potentially induce a negative impact of debt financing on the company value. Nevertheless, the recent explanations reveal that REITs employ higher average debt-to-total assets ratios compared to firms belonging to other industries.

In this context, four theories of capital structure have emerged, which potentially deliver an explanation regarding the use of leverage by REITs.

First, the trade-off theory claims that the optimal capital structure is achieved in cases where the benefits of obtaining an additional amount of debt equal the marginal costs. In this sense, the tax advantage of using leverage is typically confronted with bankruptcy and agency costs.[2] REITs that are acting according to the trade-off theory should employ a relatively low leverage ratio due to the absence of potential tax savings and the presence of bankruptcy and agency costs. This assumption is contested by relatively high leverage ratios that have been observed with REITs. Furthermore, the argument that REITs are at a disadvantage, as they have to com-

[1] DRUKARCZYK (2003), p. 291.

[2] See HIRSHLEIFER (1970), KRAUS/LITZENBERGER (1973) and ROBICHEK/MYERS (1965) that constitute major contributions regarding the so-called static trade-off theory. Within the framework of static trade-off theory, the leverage of a company is derived on the basis of a single-period comparison of benefits and drawbacks. [MURRAY/GOYAL (2007), p. 7-11.]

pete with taxable firms that can afford to pay higher interest rates on debt due to tax savings, has been disputed.[3] When comparing REITs to taxable real estate corporations, BARCLAY/HEITZMAN/SMITH (2008, p. 23) did not confirm the assumption that taxes significantly influence the decision to employ leverage. Although scientific evidence is limited, the prevalence of studies has rejected the trade-off theory when analysing REITs.[4]

The trade-off theory has been complemented by the consideration of MYERS (1984), i.e., that firms gradually move towards a target leverage ratio while showing temporary deviations from this objective.[5] In the context of the trade-off theory, research regarding stocks has shown that firms aim at reaching a certain debt ratio,[6] whereas a scarce amount of scientific examinations concentrating on REITs have delivered inconclusive results[7].

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[3] Specifically, JAFFE (1991, p. 401) did not share the assumption of HOWE/SHILLING (1988, p. 983f), i.e., that REITs exhibit a disadvantage due to a missing tax shield. Instead, JAFFE (1991, p. 404) supposed that the individual investor receives the same tax reduction effect if he/she leverages his/her personal investment. Extending this argument, MARIS/ELAYAN (1990, p. 30) found evidence that REITs possess a bimodal distribution of capital structure, which probably points to the specialisation of the capital structure to appeal different investor clienteles. MARIS/ELAYAN (1990, p. 25) described this phenomenon as the so-called leverage clientele effect. In this context, KIM/LEWELLEN/McCONNELL (1979, p. 88) argued that investors possessing a higher tax rate than a corporation will tend to use leverage personally, while investors exhibiting a lower tax rate than that of a firm will extract a higher return if the company uses leverage. The authors concluded that investors with a high tax burden prefer the holding of shares issued by unlevered firms, whereas investors in low tax brackets desire to hold stock in companies that employ leverage. [KIM/LEWELLEN/McCONNELL (1979), p. 88.] As REITs are typically confronted with very low or even zero tax rates, the leverage clientele effect would claim that the investors, if eligible, utilise debt by themselves.

[4] Several assumptions have been attached to the trade-off theory and tested with REITs. These relate to the relationship between the leverage ratio and explanatory variables such as the firm size, the profitability, the share of tangible to total assets, the market-to-book value ratio and the operating risk. FENG/GHOSH/SIRMANS (2007, p. 103) rejected the validity of the trade-off theory with REITs. MORRI/BERETTA (2008, p. 23-26 & 30) observed little evidence in accordance with the trade-off model but noticed that the pecking order theory provides a superior explanation regarding the capital structure observed with REITs. Both CHIKOLWA (2009, p. 3), when studying Australian REITs, and BOUDRY/KALLBERG/LIU (2010, p. 91), who analysed a sample of REITs domiciled in the United States did not confirm the validity of the trade-off theory.

[5] The target adjustment behaviour described by MYERS (1984) was first implemented by BRENNAN/SCHWARTZ (1984) and KANE/MARCUS/McDONALD (1984). These publications rely on the assumption that the company continues its business for more than a single period and thus have been denominated as the dynamic trade-off theory. [MURRAY/GOYAL (2007), p. 11-13.]

[6] See, for example, FLANNERY/RANGAN (2006, p. 499f) or HOVAKIMIAN/OPLER/TITMAN (2001, p. 22).

[7] Analysing REITs headquartered in the United States, OOI/ONG/LI (2010, p. 158) delivered evidence that a target debt ratio is existent although REITs may deviate from the target depending on market conditions. In contrast, GENTRY/MAYER (2002, p. 2f) found that the capital structure of a REIT re-

Second, the pecking order theory[8] claims that firms prefer to issue debt instead of equity. This propensity relies on the assumption that equity issuances are supposed to be more costly than debt issuances due to the existence of information asymmetries between new investors and management.[9] The hypothesis that REITs follow the pecking order theory has been confirmed with a relatively large number of studies[10] and rejected by few scientific researchers[11].

Third, the market timing theory proposes that the management of a firm intends to conduct an equity issuance at the time it is convinced that the stock market overvalues the company. Consequently, the theory claims that the current capital structure equals the cumulative outcome concerning past endeavours to time the equity market.[12] Although research testing the validity of the theory with REITs is limited, the bulk of studies confirm the existence of the market timing hypothesis.[13]

Fourth, the signalling theory states that the use of a relatively high amount of debt, expressed as a share of the total assets, signals management expectations in terms of promising firm prospects.[14] A positive market reaction following the announcement of a debt issuance, which provides an indication of the validity of the theory for REITs, has been reported in a few studies.[15]

In summary, the validity of any of the four theories for REITs should be subjected to further scientific research. In this regard, it should be noted that research on theories

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sponds rather slowly towards changes in equity market valuations. In addition, FENG/GHOSH/SIRMANS (2007, p. 90) identified a continuous growth in leverage ratios, which does not affirm the supposition of a target capital structure.

[8] See MYERS (1984) and MYERS/MAJLUF (1984) for an explanation regarding this model.

[9] JUNG/KIM/STULZ (1996), p. 160; MYERS (1983), p. 581.

[10] See GHOSH/NAG/SIRMANS (1999, p. 189), HOWTON/HOWTON/McWILLIAMS (2003, p. 155) and KAWAGUCHI/SA-AADU/SHILLING (2005, p. 13), who confirmed the validity of the pecking order theory with REITs headquartered in the United States. In addition CHIKOLWA (2009, p. 3), who studied Australian REITs, and BOND/SCOTT (2006, p. 22), who analysed UK property companies, approved the validity of the pecking order theory.

[11] See BOUDRY/KALLBERG/LIU (2010, p. 91) for example.

[12] See BAKER/GREENWOOD/WURGLER (2003) for further explanations.

[13] Focusing on REITs headquartered in the United States, BOUDRY/KALLBERG/LIU (2010, p. 91), GENTRY/MAYER (2002, p. 3f) and OOI/ONG/LI (2010, p. 132) delivered evidence for the adaptability of the market timing theory. In contrast, FENG/GHOSH/SIRMANS (2007, p. 103) rejected the validity of the theory with REITs domiciled in the United States.

[14] Adapted from ROSS (1977). In contrast, firms of a lower quality cannot employ additional leverage due to an insufficient profitability. [ROSS (1977), p. 34-38.]

[15] See, for example, ELAYAN/MEYER/LI (2004), p. 60), FRANCIS/LYS/VINCENT (2004, p. 15) or HOWE/SHILLING (1988, p. 983).

to explain the capital structure of REITs is still rare. Despite these limitations, three arguments may provide a contribution to explain the capital structure of REITs.

First, the ability of REITs to collateralise real estate assets probably delivers one explanation for the use of a relatively large share of debt to total assets. Consistent with the assumptions of both the pecking order and trade-off theories, MYERS (1977, p. 170f) argued that companies possessing a relatively large share of tangible to total assets might exhibit a higher level of debt compared to firms primarily owning growth opportunities.[16] Though the positive correlation between the debt-to-total assets ratio and the tangible-to-total assets ratio has been found with studies analysing real estate securities[17], research covering REITs is scarce but delivers evidence of both positive[18] and negative[19] connections.

Second, the requirement to pay out the bulk of earnings, thus lowering the discretionary cash flows, provides limitations regarding the choice between different funding sources. In this sense, FENG/GHOSH/SIRMANS (2007, p. 97) argued that the alternative between the use of debt or equity might depend on existing regulatory and market structures.

Third, recent examinations have revealed that REITs explore a variety of debt financing sources. In this regard, the firm potentially tries to identify instruments that allow the use of leverage at favourable costs of debt. Thus, the owned real estate assets probably act as collateral. This assumption will be subject to further investigation in the present work.

Similar to the methodology for the valuation of operating activities, several components of debt financing are evaluated concerning the importance of their inclusion within the valuation tool. Specifically, the impact of flotation costs (8.1), the influ-

[16] This assumption has been approved by several studies analysing non-real estate stocks [see, for example, BRADLEY/JARRELL/KIM (1984, p. 874) or RAJAN/ZINGALES (1995, p. 1454)].

[17] See OOI (1999, p. 474f) for evidence of the connection when studying UK property companies and ALLEN (1995, p. 421f), who documented a significant positive relationship between leverage and the ratio of real estate-to-total assets when analysing RELPs domiciled in the United States.

[18] Examining REITs headquartered in the United States, MORRI/BERETTA (2008, p. 21-25) documented a significant positive relationship between leverage and the ratio of net fixed-to-total assets.

[19] FENG/GHOSH/SIRMANS (2007, p. 103) observed a significant negative relationship between leverage and the ratio of real estate investments-to-total assets. EROL (2008, p. 19) found a significant negative relationship between the leverage ratio and the ratio of fixed-to-total assets when analysing Turkish REITs. With regard to Australian REITs, CHIKOLWA (2009, p. 14) documented a negative but insignificant relationship between leverage and the ratio of the book value of properties-to-total assets.

ence of an interest rate disparity (8.2), the weight of bankruptcy costs (8.3), the effect of agency costs (8.4) and the importance of taxes (8.5) are analysed in the following sections.

## 8.1 Considerations regarding the value impact associated with flotation costs

The recent explanations regarding REITs have documented the use of debt financing instruments. The issuance of debt instruments incurs flotation costs. Typically, flotation costs comprise fees charged by investment bankers, lawyers, printers and other service providers.[20]

If a REIT issues a debt instrument, the resulting flotation costs can be included in the cash flow calculation associated with financing activities. Specifically, the flotation costs charged for the issuance of debt will be deducted from positive cash flows without the need to discount this type of expense to the present. The subtraction of flotation costs relates to the fact that this type of expense usually has to be paid at the time of the issuance of the respective debt instrument. However, the analysis of REIT financial reports reveals that the size of flotation costs is published infrequently. Given the reduced use of public bond financing of REITs, no approximation of flotation costs is suggested.

## 8.2 Calculation of the net present value of an interest rate disparity

Following the previous considerations, savings regarding the costs of financing potentially represent a main motivation for REITs to employ debt financing. In particular, REITs might be able to borrow at interest rates below those that are available marketwide.[21] A major reason for this interest rate disparity may be due to the possi-

[20] ROSS/WESTERFIELD/JAFFE (2002), p. 479.

[21] In comparison to firms, STIGLITZ (1969, p. 784) claimed that individuals are charged higher borrowing rates as they exhibit a larger probability of default. Concerning REITs, WILKES/SHAPIRO (2004, p. 18) argued that large companies are able to borrow debt at rates that are 150 to 200 basis points below those offered to conventional real estate borrowers.

bility of collateralising real estate assets.[22] This argument is strengthened by the finding that borrowing costs typically account for a relatively large fraction of the overall expenses charged to REITs.[23] Accordingly, a reduction in borrowing costs, without a decrease in the amount of debt, can lead to a notable increase in cash flows and finally induce a positive impact on firm value.

To address the possibility of a positive or a negative net present value component arising from an interest rate disparity, the following calculation is suggested:

$$NPV_{id} = AB - PV_{ip} - PV_{dr} \qquad \textbf{(8.1)}$$ [24]

where

$NPV_{id}$ = net present value of an interest rate disparity
$AB$ = amount borrowed
$PV_{ip}$ = present value of interest payments
$PV_{dr}$ = present value of debt repayment

The amount borrowed equals the gross proceeds of the debt, i.e., optional flotation costs and the actual volume of debt obtained by the REIT. $PV_{ip}$ relates to the future interest payments made by a REIT, which are discounted to the present at the marketwide interest rate $i_m$. $PV_{dr}$ entails the repayment of debt at the end of the forecasting period, which is transferred to the present at the rate $i_m$.

To derive the net present value of an interest rate disparity, the estimation of the three items on the right-hand side of Equation 8.1, including their treatment after the explicit planning period, is described in the following sections.

### 8.2.1 Amount borrowed

Following the previous considerations, the valuation tool relies on the assumption of an autonomous financing policy. Given that the volume of debt remains constant

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[22] This reasoning complies with the assumption by SCOTT (1977, p. 12), i.e., that firms may be able to borrow at relatively low interest rates if they hold collateralised debt.

[23] Following OOI/ONG/LI (2010, p. 131), interest expenses may account for a share between 30% and 70% of the overall expenses a REIT has to carry.

[24] Adapted from ROSS/WESTERFIELD/JAFFE (2002, p. 480f).

over the explicit forecasting period, the estimation of the amount borrowed used in the computation of $NPV_{id}$ requires careful consideration.

As documented earlier, REITs may employ a variety of financing sources, such as bank loans, public bonds and asset-backed securities. This diversity potentially increases complexity when trying to determine the amount borrowed. Instead of partitioning the amount borrowed by the type of financing, the item under review can be approximated by the total book value of debt[25] collected from the financial statements that have been published prior to the key valuation date. This approximation reflects the amount of debt financing at a specific point in time without accounting for temporary variations in the amount borrowed, thus possibly leading to distortions regarding the calculation of $NPV_{id}$. However, several circumstances might contribute to a disparity of considerable magnitude between the total book value of debt at the key valuation date and the amount borrowed in subsequent periods. For example, OOI/ONG/LI (2010, p. 137f) observed that the issuance of debt by REITs exhibits a strong negative correlation with the magnitude of borrowing costs.[26] Likewise, the amount borrowed might be higher for younger REITs, compared to more mature REITs, as the former are confronted with a relatively large number of restrictions regarding the issuance of equity.[27]

Despite potential temporary variations in the amount borrowed, REITs might aim at a relatively stable leverage ratio over the long term. This assumption is backed by the following observations. First, numerous country-specific REIT laws confine the magnitude of the leverage employed by REITs. Second, long-term data on the sampled REITs indicate that the leverage ratio does not exhibit large-scale volatility.[28] These findings may increase the likelihood of a comparatively stable connection between the amount borrowed and the total value of assets. To reduce the possibility of using an unrepresentative measure of the amount borrowed, the item should be approximated by multiplying the total book value of assets with a normalised leverage ratio.

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[25] Similarly to the previous study of leverage ratios pertaining to the sampled REITs, the book value of debt equals the sum of the debt in current liabilities and the long-term debt.

[26] Specifically, REITs tend to issue debt when the risk premium for long-term debt is low. [OOI/ONG/LI (2010), p. 145.]

[27] Adapted from ERTUGRUL/GIAMBONA (2010, p. 21).

[28] As an exception, Figure 2.10 documents a rise in the leverage ratio of Australian firms between 1990 and 1997.

The normalised leverage ratio is obtained from the previous summary of mean leverage ratios corresponding to the sample of REITs employed in this study (see Figure 2.9).[29] Concerning REITs domiciled in the United States, the mean leverage ratio is attained according to both the country of headquarters and the property type. In contrast, the reduced availability of REITs headquartered outside the United States leads to the recommendation to obtain the leverage ratio according to the country of origin only. The issue that some countries lack a long-term track record might be mitigated by the possibility that even mean values relying on short-term data could provide a reasonable target estimation.[30]

### 8.2.2 Present value of interest payments

Having extracted a normalised amount borrowed, the present value of interest payments $PV_{ip}$ made by the REIT has to be derived. Basically, $PV_{ip}$ can be calculated by means of the following formula:

$$PV_{ip} = \frac{i_{REIT} \times AB}{i_m} \times \left[1 - \left(\frac{1}{1+i_m}\right)^n\right] \qquad \textbf{(8.2)}^{31}$$

where

$i_{REIT}$ = total annual cost of debt charged to the REIT

$n$ = length of the explicit planning period

[29] This approach complies with the recommendation by SHYAM-SUNDER/MYERS (1999, p. 226), i.e., to employ historical mean values of the leverage ratio as target leverage ratios. As an alternative approach to obtaining a target leverage ratio, HOVAKIMIAN/OPLER/TITMAN (2001, p. 5-8) suggested the estimation of the ratio by using a regression model with the leverage ratio acting as the dependent variable and several trade-off variables representing the regressors. However, the choice of explanatory variables with REITs has not been subject to a sufficient array of research. OOI/ONG/LI (2010, p. 144 & 151-153) delivered evidence of notable deviations between the target debt ratio estimated by means of a regression model and the actual debt ratio of REITs domiciled in the United States but used explanatory variables that differ from the regressors employed by HOVAKIMIAN/OPLER/TITMAN (2001, p. 7f).

[30] On the one hand, JALILVAND/HARRIS (1984, p. 134) investigated general stocks and argued that their results remained constant, as the leverage ratios had been relatively stable. Similarly, the results did not change when the authors employed a three-year moving average ratio in comparison to a calculation of the mean based on long-term data. [JALILVAND/HARRIS (1984), p. 134.] On the other hand, OOI/ONG/LI (2010, p. 136f) reported notable fluctuations in the magnitude of debt issuances of REITs especially in the nineties, which has contributed to alterations in the leverage ratio.

[31] Adapted from ROSS/WESTERFIELD/JAFFE (2002, p. 480f).

Whereas the amount borrowed and the length of the explicit planning period have already been determined, both the marketwide interest rate $i_m$ and the REIT-specific borrowing rate $i_{REIT}$ have yet to be identified. In this context, it is important to note that the interest cost charged to the REIT is discounted at a marketwide interest rate for borrowing. Assuming that the magnitude of $i_m$ exceeds that of $i_{REIT}$, $PV_{ip}$ is reduced, thus increasing $NPV_{id}$.
The marketwide interest rate represents the rate of financing that is commonly available to market participants. The use of a commonly available mortgage rate is suggested as an approximation of $i_m$.

The analysis of annual reports has indicated that the overall cost of borrowing can be retrieved from the financial statements of several REITs. If $i_{REIT}$ is not publicly available, the rate can be calculated by dividing the total interest payments on the debt by the book value of the total debt.[32] However, the cost of borrowing that is charged to a REIT might be subject to variation based on various influencing factors.
With regard to firm size, MORRI/CRISTANZIANI (2009, p. 331) claimed that large REITs are able to borrow capital at lower interest rates compared to small REITs.[33] Consequently, the growth in firm size over the explicit planning period might result in a reduction of $i_{REIT}$.
Similarly, the receipt of a credit rating or alterations regarding the type of financing[34] may lead to changes concerning the overall cost of debt.
Given the published research reviewed above, changes in $i_{REIT}$ are probably connected with the development of interest rates, such as LIBOR. However, the recent analyses have indicated that the LIBOR is subject to volatility. Furthermore, difficulties have been cited within the scientific literature when trying to predict interest rates.[35]

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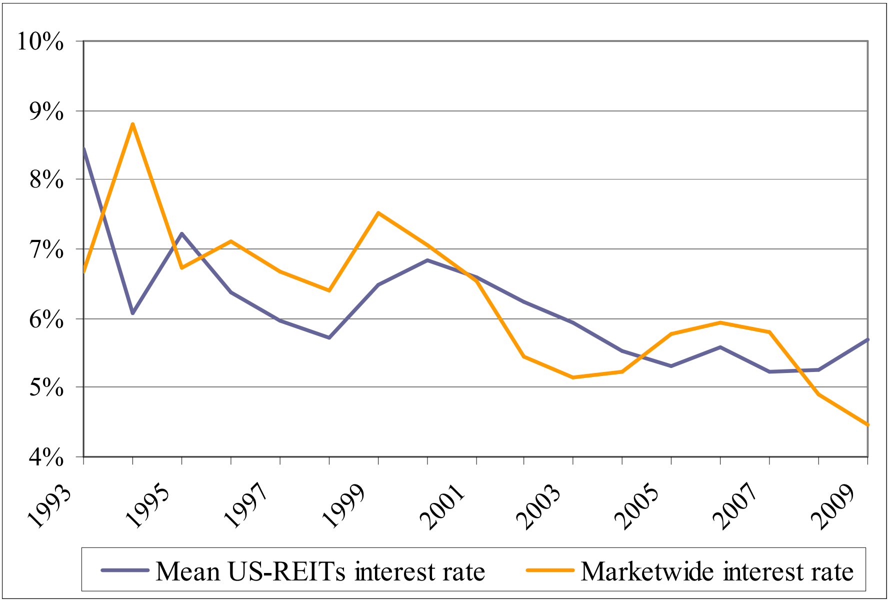
[32] MORRI/CRISTANZIANI (2009), p. 329.
[33] The authors measured the size as the logarithm naturalis of the book value of total assets and the market leverage ratio as the total book value of debt divided by the sum of the equity market value and the total book value of debt. [MORRI/CRISTANZIANI (2009), p. 328f.]
[34] For example, the interest rates pertaining to public bond financing may differ from those charged on bank loans.
[35] See, for example, BALI/HEIDARI/WU (2009, p. 517). The volatility of LIBOR has been partly observed during the analyses of short-term interest rates in Chapter 6.

Given the impediments associated with the estimation of a future interest rate, a reasonable forecast of $i_{REIT}$ that takes potential variations into account seems to be impossible. However, as an approximation, a mean interest rate comprising data over five years preceding the key valuation date is calculated and employed in the valuation tool.

Figure 8.1 reveals that REITs have been able to obtain financing at costs below those charged to the market, when applying a 15-year mortgage interest rate as an approximation of the marketwide interest rate. However, this capability has not been observed with every year considered in Figure 8.1.[36]

***Figure 8.1: Marketwide interest rates in comparison to REIT interest rates. (1993-2009; year-end values)***




*Source: Own calculations based on the total sample (50 of 218 REITs) and data retrieved from Bloomberg*

[36] A sample of 50 REITs with each firm domiciled in the United States and representing a company belonging to the total sample described before has been used to calculate interest rates through dividing the total interest payments on debt by the book value of the total debt.

### 8.2.3 Present value of the debt repayment

To complete the calculation of the net present value of an interest rate disparity, the present value of the debt repayment $PV_{dr}$ needs to be estimated.

Conceivably, debt can be repaid both during and at the end of the explicit planning period. The supposition of debt repayments occurring during the forecasting horizon will reduce debt exposure over time in the valuation framework. Instead, contingent growth in total assets in connection with a target leverage ratio will deliver evidence for the assumption of a progression of $AB$ during the explicit forecasting period. Similarly, the inclusion of interim debt repayments in the calculation of the net present value of debt repayments would increase the complexity of the calculation.

Given these considerations, debt is supposed to be repaid at the end of the explicit planning period. Consequently, $PV_{dr}$ is determined by means of the following formula:

$$PV_{dr} = \frac{AB}{\left(1+i_m\right)^n} \qquad \textbf{(8.3)}$$ [37]

### 8.2.4 Net present value of an interest rate disparity pertaining to the implicit planning period

The preceding calculations were carried out assuming that the amount borrowed by the REIT will be repaid at the end of the explicit planning period. However, it is likely that the REIT will continue to employ leverage after the explicit planning period as well.

Accordingly, the items included on the right-hand side of Equation 8.1 are examined regarding their impact on the net present value of an interest rate disparity when the number of years of the implicit planning period converges to infinity. Specifically, $AB$ could equal the amount at the beginning of the explicit planning period, thus assuming that the debt position of the company remains constant over both the explicit and the implicit planning periods. As the length of the planning period $n$ converges to infinity, Formula 8.2, which is used to calculate the present value of inter-

[37] Adapted from ROSS/WESTERFIELD/JAFFE (2002, p. 480f).

est payments, is reduced to the multiplication of $i_{REIT}$ with the amount borrowed and the result divided by the marketwide interest rate. The present value of the debt repayment, which can be calculated through Formula 8.3, approaches zero as the denominator converges to infinity. Taking into consideration that the value of an interest rate disparity pertaining to the implicit planning period has to be discounted to the present, the following formula can be used to calculate the net present value:

$$NPV_{idip} = \frac{AB - \dfrac{i_{REIT} \times AB}{i_m}}{(1+i_m)^n} \qquad \textbf{(8.4)}$$

where

$NPV_{idip}$ = net present value of an interest rate disparity pertaining to the implicit planning period

Finally, $NPV_{idip}$ will be added to the net present value of an interest rate disparity $NPV_{id}$, which has been estimated by means of Equation 8.1.

## 8.3 Calculation of the value impact associated with bankruptcy costs

Following the explanations by MODIGLIANI/MILLER (1958), the authors did not explicitly consider the costs of bankruptcy[38].[39] However, ROBICHEK/MYERS

[38] HAUGEN/SENBET (1978, p. 384) argued that the bankruptcy of a firm materialises in the case that fixed obligations towards creditors cannot be met. However, SCOTT (1981, p. 342) claimed that the failure of a company to fulfil its financial obligations does not automatically result in the bankruptcy of a firm. For example, the bankruptcy filing might be avoided if an agreement with creditors is reached outside of court. [SCOTT (1981), p. 342.] The term bankruptcy relates to proceedings in accordance with bankruptcy law in a scenario where a firm is not able to meet its obligations and cannot achieve a settlement with creditors outside of court [adapted from WARNER (1977a, p. 241)]. Although the term failure has been used interchangeably with the term bankruptcy, a failure of a firm represents a necessary but not a sufficient condition of bankruptcy. [KARELS/PRAKASH (1987), p. 575.] The bankruptcy filing typically involves the reorganisation or the liquidation of the firm. Assuming a reorganisation of the company, the firm operations are continued with the incumbent management. The reorganisation may comprise a proposal of the management regarding the settlement with creditors and the suspension of dividend payments until the obligations, specified by the reorganisation plan, are met. The liquidation of the company typically involves the appointment of a trustee who initiates the termination of the business

(1966, p. 16) hypothesised that benefits from the tax shield effect of leverage might be offset through contingent costs of bankruptcy. To determine an optimised capital structure, several authors suggest comparing the advantages of debt to the disadvantage due to the threat of bankruptcy.[40] However, the significance of bankruptcy costs has been subject to scientific debate. For example, ignoring the threat of bankruptcy in a corporate valuation model has been suggested.[41] Considering these arguments, the following sections provide recommendations regarding the estimation of the size of contingent bankruptcy costs pertaining to REITs and render an evaluation of whether or not this cost component should be captured in the valuation tool.

Principally, the value impact associated with the costs of bankruptcy may be considered through the estimation of expected bankruptcy costs. The present value of expected bankruptcy costs can be derived by means of the following formula:

$$PV_{ebc} = \pi_d \times PV_{bc} \qquad \textbf{(8.5)}$$[42]

where

$PV_{ebc}$ = present value of expected bankruptcy costs
$\pi_d$ = probability of default
$PV_{bc}$ = present value of bankruptcy costs

To approach the estimation and evaluation of expected bankruptcy costs with Real Estate Investment Trusts, an initial procedure for estimating the costs of bankruptcy

activities and the subsequent liquidation of the assets. The assets are either sold piecemeal or as a whole by means of a going-concern sale. Proceeds from the liquidation net of ex post bankruptcy fees are distributed to creditors according to their priority status. [COUWENBERG (2001), p. 5-7; WHITE (1983), p. 478f.] Although the reorganisation or the liquidation of a company is commonly regulated by law, it should be noted that there exist differences by country-specific legislation [see, for example, DJANKOV et al. (2008) for an overview].

39 Nevertheless, MODIGLIANI/MILLER (1958, p. 274) noted the possibility of a liquidation or a reorganisation of a firm.

40 See HIRSHLEIFER (1970, p. 264) or KRAUS/LITZENBERGER (1973, p. 915).

41 ALTMAN (1984a), p. 1069. Assuming that capital markets are functioning well, HAUGEN/SENBET (1988, p. 35) argued that the costs of bankruptcy share an insignificant role in the valuation of a firm with exposure to debt. The authors contended that costs, which originally incurred due to the bankruptcy process, are rather associated with the liquidation of assets, which should be considered separately. [HAUGEN/SENBET (1978), p. 384.]

42 DAMODARAN (2002), p. 401.

is derived (8.3.1). Subsequently, a method to derive the probability of a bankruptcy is proposed (8.3.2).

### 8.3.1 Determination of the costs of bankruptcy

The process of determining the costs of bankruptcy for Real Estate Investment Trusts is twofold.

First, scientific studies regarding the magnitude of bankruptcy costs are analysed (8.3.1.1). Attention is paid to the bankruptcy regimes persistent in the countries that are considered in the REIT sample previously described. Given the absence of studies on bankruptcy costs associated with REITs, the analysis should provide an indication regarding the scope of fees attached to a bankruptcy proceeding.

Second, the transferability of the preceding results to REITs is critically examined (8.3.1.2). This examination should result in a proposal concerning the estimation of contingent bankruptcy costs with regard to Real Estate Investment Trusts.

#### 8.3.1.1 Examination of scientific studies regarding bankruptcy costs

WHITE (1983, p. 477) stated that bankruptcy costs "[…] are the deadweight economic costs of firms going bankrupt […]". Bankruptcy costs are typically distinguished into direct and indirect fees.[43]

The direct costs of bankruptcy represent explicit costs paid by the debtor and typically comprise fees charged by lawyers, accountants and other professionals as well as filing fees. Similarly, the value attached to the time management expenses for administering the bankruptcy process is included in the direct costs of bankruptcy.[44]

Scientific evidence reveals that bankruptcy procedures together with judicial efficiency demonstrate large variations between countries.[45] In this regard, the efficiency of a bankruptcy code is dependent on the ability of the system to reduce

[43] See, for example, ALTMAN (1984a, p. 1067f). However, eventual losses due to a liquidation of assets are not considered [see, for example, ANG/CHUA/McCONNELL (1982), p. 219-220)].
[44] ALTMAN (1984a), p. 1068-1073; LoPUCKI/DOHERTY (2008), p. 1002; WARNER (1977b), p. 338.
[45] See, for example, WANG (2006, p. 28).

costs.[46] Analysing a case study on bankruptcy proceedings in 88 countries, DJANKOV et al. (2008, p. 18) observed average direct costs of bankruptcy of 13.5%, expressed as a share of the estate. The authors claimed that firms declaring bankruptcy in high-income countries, such as Australia, Belgium, Canada, France, Japan, the Netherlands, New Zealand, Singapore and the United States, require less time to resolve a bankruptcy proceeding compared to firms filing for bankruptcy in lower- and middle-income countries, such as South Africa and Turkey.[47] In addition, the authors, together with other scientific researchers,[48] deliver evidence that the length of the bankruptcy proceeding is positively associated with the costs.[49] In this sense, LoPUCKI/DOHERTY (2008, p. 1003) observed that long proceedings are almost twice as expensive in terms of direct bankruptcy costs compared to short proceedings.[50]

The bulk of scientific studies, summarised in Figure 8.2[51], have focused on the size of direct bankruptcy costs associated with firms domiciled in the United States[52]. Summarising the results of the examinations, the direct costs of bankruptcy are typically expressed as a share of firm size exhibiting mean values in a range between

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[46] Adapted from KAISER (1996, p. 68).

[47] DJANKOV et al. (2008, p. 4) found that per capita income and legal origins represent the most compelling determinants of efficiency of the debt enforcement procedure. In detail, the countries classified as high-income nations are associated with an average cost of bankruptcy of 9%, whereas the lower- and middle-income countries outline a cost of 16%. The costs are expressed as a share of the estate measured at the time of entry into the bankruptcy proceeding. However, it should be noted that the publication is based on a case study regarding a hotel business without a complex capital structure and no reliance on data concerning actual bankruptcy filings. [DJANKOV et al. (2008), p. 16-46.]

[48] See, for example, LoPUCKI/DOHERTY (2004, p. 128) or LoPUCKI/DOHERTY (2008, p. 1003).

[49] DJANKOV et al. (2008, p. 18) observed that a time of 2.64 years is needed on average to resolve a bankruptcy. Specifically, firms headquartered in high-income countries require 1.51 years on average to resolve a bankruptcy filing, whereas bankruptcy proceedings passed by firms domiciled in the lower- and middle-income groups persist 3.45 years on average. The time relates to the duration from the moment of default of the company until the date when the decision is made of whether the hotel business is sold or reorganised. [DJANKOV et al. (2008), p. 7 & 46.]

[50] LoPUCKI/DOHERTY (2008, p. 987) studied 74 public companies from the United States. Short proceedings are classified as those with a time period of 136 days, whereas long proceedings are declared as having a time span of 672 days. Specifically, a doubling in time leads to an increase in fees by 38%. [LoPUCKI/DOHERTY (2008), p. 1003f.]

[51] Unlike the studies included in Figure 8.2, the results obtained by DJANKOV et al. (2008) show a reduced comparability as they do not rely on actual data but on a case study and are therefore excluded from the table.

[52] In the United States, two important bankruptcy procedures, i.e., cash auction procedures according to Chapter 7 and negotiation procedures covered by Chapter 11, can be distinguished [see BRIS/WELCH/ZHU (2006, p. 1254-1278) for further information].

0.9% and 16.9%. The mean value calculated from the findings of all publications is at 5.0%, with a median value of 3.9%. However, the comparability of the results is reduced, as the definition of direct bankruptcy costs and the type of reference figure both differ among studies.

Considering that the examinations included in Figure 8.2 investigated samples with an overall mean firm value of 172.7 million USD, a larger company size, which was observed in the previously introduced REIT sample, is probably connected with lower costs of bankruptcy. This assumption is based on the finding that the ratio of the direct bankruptcy costs to the value of the company is inversely related to firm size.[53]

Furthermore, Figure 8.2 considers only one examination, covering sparse bankruptcy data beyond 2000. Given past reforms in bankruptcy law[54], the costs of bankruptcy estimated by the studies cited above might have changed.

In addition, a reduction in the length of a bankruptcy proceeding might contribute to a decrease in costs. Taking into consideration the results published in several studies[55], 1.96 years might be expected to be the average time for a bankruptcy proceed-

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[53] The so-called scale effect has been documented by LoPUCKI/DOHERTY (2004, p. 125f) and WARNER (1977b, p. 337) with firms headquartered in the United States, with an analysis of Australian firms conducted by ROBERTSON/TREES (1985, p. 56), by MARTEL (1994, p. 12f) covering Canadian firms, through COUWENBERG/DE JONG (2008, p. 119) with Dutch firms and by BRADBURY/LLOYD (1994, p. 109f) with companies domiciled in New Zealand. In contrast, LUBBEN (2000, p. 535f) found evidence of a positive relationship between direct bankruptcy costs and firm size when analysing companies headquartered in the United States.

[54] For example, the Bankruptcy Abuse Prevention and Consumer Protection Act was passed in 2005. This Act included significant changes made to Chapter 11 filings. [BAK/GOLMANT/WOODS (2008), p. 11-23.]

[55] ANG/CHUA/McCONNELL (1982, p. 221) observed that more than 80% of the bankruptcy filings had been resolved during a period of two years. BETKER (1995, p. 5f) found that the average time from the first default of a single debt contract until plan confirmation is 16 months. BRIS/WELCH/ZHU (2006, p. 1270) observed an average time of approximately 2.27 years to resolve Chapter 11 filings. CAMPBELL (1997, p. 27) documented that the average time needed to resolve Chapter 11 filings is 1.17 years. With regard to Chapter 11 filings, FRANKS/TOROUS (1989, p. 753) measured an average time of 3.67 years. TASHJIAN/LEASE/McCONNELL (1996, p. 141f) found that 21.6 months are spent on average between the announcement of the initial structuring attempt and the resolution of the financial distress. WEISS (1990, p. 288) calculated an average time between bankruptcy petition and resolution of 2.5 years.

ing[56]. Further, the results point to the observation that the duration of a bankruptcy proceeding has decreased over time.[57]

In addition, few studies have focused on the identification of direct bankruptcy costs of firms that are subject to bankruptcy legislation outside the United States. The results of the studies covering direct bankruptcy costs in countries other than the United States are included in Appendix 8.1.

In summary, the direct costs of bankruptcy with companies headquartered in Australia[58] account for a mean share of 2.5% of the firm value, up to 8% of the estate.[59] Direct bankruptcy costs pertaining to companies headquartered in Belgium[60] represented a mean share of 4% of the estate.[61]

Given that Canadian reorganisation procedures share various characteristics with the Chapter 11 filings present in the United States,[62] there exists some evidence that direct bankruptcy costs account for an average share of 4% of the estate.[63]

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[56] The average length of 1.96 years equals the mean value of the results obtained with the studies on firms headquartered in the United States cited earlier. The study of ANG/CHUA/McCONNELL (1982) is not considered as no exact length of time is defined. Besides this, it has to be taken into account that the definition of the length of the bankruptcy proceeding may differ between the studies.

[57] Analysing Chapter 11 filings in the United States, LoPUCKI/DOHERTY (2004, p. 138) documented a significant change in the size of direct bankruptcy costs between a sub-period from 1981 and 1988 and another time span from 1998 and 2002. The authors explain this finding through the reduced length of a bankruptcy process.

[58] Three major types of bankruptcy proceedings, namely the voluntary administration, the liquidation and the receivership, are governed by the Australian Corporations Act and are prevalent in Australia. [HENSHER/JONES/GREENE (2007), p. 92.]

[59] DJANKOV et al. (2008), p. 46; PHAM/CHOW (1989), p. 84-87. In addition, ROBERTSON/TREES (1985, p. 54) observed that the fees account for 38.8% of the liquidation proceeds on average. However, the relevance of bankruptcy costs might be overstated as the sampled firms exhibit an average amount of assets of 69,279 AUD while a scale effect has been observed with Australian firms. In addition, the reference figure employed by ROBERTSON/TREES (1985) is different from those considered with studies cited before. Dividing the mean value of administrative costs of bankruptcy mentioned by ROBERTSON/TREES (1985, p. 54) by the average amount of total assets yields an average value of 7.8%. Concerning the length of the bankruptcy proceedings in Australia, ROBERTSON/TREES (1985, p. 53) observed a mean duration of 26.4 months. DJANKOV et al. (2008, p. 46) even observed a time of 0.58 years needed to resolve a bankruptcy proceeding.

[60] The Belgian bankruptcy legislation was reformed in 1997 and includes a reorganisation procedure similar to the Chapter 11 filing in the United States. Besides this, a firm may file for a liquidation under Belgian bankruptcy legislation. [DEWAELHEYNS/VAN HULLE (2008), p. 411f.]

[61] DJANKOV et al. (2008), p. 46.

[62] With regard to the Canadian Bankruptcy and Insolvency Act, a proposal is filed by the bankrupt debtor with the reorganisation process being supervised by a licensed trustee. [FISHER/MARTEL (1999), p. 236-240.]

[63] In contrast, FISHER/MARTEL (1999, p. 243-248) found that direct bankruptcy costs account for a mean value of 22.5% and a median value of 5.7%, both expressed as a share of the book value of assets. The differing results might be partly explained by a scale effect, which has been observed by MARTEL

Analysing the direct bankruptcy costs of companies headquartered in France,[64] DJANKOV et al. (2008) documented a mean share that amounts to 9% of the estate.[65] With regard to Japan,[66] the costs of bankruptcy are assumed to be relatively low with large companies. A major reason for this assumption relates to the existence of banking relationships built up by Japanese firms together with mutual insurance systems between companies belonging to the same sector. In this sense, several Japanese banks hold equity stakes or have appointed bank employees in the debtor firms. Furthermore, a reorganisation of a company domiciled in Japan means that the estimated costs of the proceeding have to be paid ex ante. These characteristics probably contribute to a reduction in bankruptcy costs by raising the efficiency of the proceeding.[67] As a consequence, there exists evidence that bankruptcy filings of Japanese firms require less amount of time and incur fewer costs compared to bankruptcy proceedings in other countries.[68] Further evidence regarding this assumption is provided by DJANKOV et al. (2008, p. 46), who observed a mean share

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(1994, p. 12f) with Canadian firms. Furthermore, the size of the median value, which is much lower than that of the mean value, points to distortions by outliers. FISHER/MARTEL (2003, p. 15) concluded that a reorganisation of Canadian firms takes a mean time of 1,116 days whereas a liquidation requires a mean time of 819 days, which is similar to the data obtained with US-American firms. MARTEL (1994, p. 12) observed an average time spent on a bankruptcy proceeding of 818 days. The author analysed a sample of 417 commercial bankruptcies and 393 commercial reorganisation proposals declared over a time period between 1977 and 1987. [MARTEL (1994), p. 6.] DJANKOV et al. (2008, p. 46) observed an average time needed to resolve a bankruptcy proceeding of 0.75 years.

64 The French bankruptcy law provides the possibilities of either reorganising or liquidating a firm. [COUWENBERG (2001), p. 9; DAVYDENKO/FRANKS (2008), p. 569.]

65 DAVYDENKO/FRANKS (2008, p. 581) documented that a reorganisation in France persists over a time span of 3.05 years on average. In contrast, DJANKOV et al. (2008, p. 46) documented an average length of 1.89 years. Accordingly, the discrepancy in the findings on the direct costs of bankruptcy associated with firms headquartered in France and companies domiciled in the United States cannot be explained through differences in the length of the bankruptcy proceeding.

66 In Japan, the Corporate Reorganisation Law and the Civil Rehabilitation Law can be distinguished as formal bankruptcy procedures. Corporate Reorganisation Law is roughly similar to the Chapter 11 proceeding in the United States. Civil Rehabilitation Law offers the possibility for a firm to choose between a reorganisation and a rehabilitation. [XU (2004), p. 6-12.]

67 ALLEN/MIZUNO (1989), p. 578; HELWEGE/PACKER (2003), p. 99-103; HOSHI/KASHYAP/SCHARFSTEIN (1990), p. 68. In this regard, the bank as the lender might be well informed about the current condition of the company, thus being confronted with less information asymmetries. [HOSHI/KASHYAP/SCHARFSTEIN (1990), p. 69.]

68 HELWEGE/PACKER (2003), p. 99. Indeed, the time needed to resolve a bankruptcy proceeding seems to be relatively low based on an international comparison. In Japan, the average time from filing until bankruptcy petition requires 1.9 years based on the Corporate Reorgansation Law and 0.6 years based on the Civil Rehabilitation Law with an average of 1.2 years for the whole sample. [XU (2004), p. 21f.] DJANKOV et al. (2008, p. 46) found an even lower time of 0.58 years needed to resolve a bankruptcy proceeding.

of 1% when expressing direct bankruptcy costs of Japanese companies as a share of the estate. With regard to bankrupt firms in the Netherlands,[69] the mean share of bankruptcy costs ranges from 4% of the estate to 10.7% of the book value of total assets.[70] Studies on firms that filed for bankruptcy in New Zealand[71] documented a mean share of direct bankruptcy costs between 4% of the estate and 4.4% of the total firm assets.[72] With regard to companies headquartered in Singapore,[73] DJANKOV et al. (2008, p. 46) documented that direct bankruptcy costs account for 1% of the estate. Examining South African[74] firms, direct bankruptcy costs exhibit an average share of between 1% and 19% of the total book value of assets.[75]
Evidence indicates that companies filing for bankruptcy in Turkey are confronted with direct bankruptcy costs accounting for 7% of the estate.[76]

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[69] When firms or individuals declare financial distress, the Dutch Bankruptcy Act provides three procedures, namely bankruptcy, fresh start procedure and suspension of payments. In a bankruptcy proceeding, a court appoints a trustee who analyses the reasons of the bankruptcy filing and balances the possibilities of continuing the business activities. The fresh start procedure was introduced to support natural people in financial distress. The suspension of payments represents a type of formal reorganisation but is rarely used in the Netherlands. [COUWENBERG/DE JONG (2008), p. 112; VAN DIJCK/GRAMATIKOV (2009), p. 14.]

[70] COUWENBERG/DE JONG (2008), p. 113-116; DJANKOV et al. (2008), p. 46.
Analysing Dutch companies, VAN DIJCK/GRAMATIKOV (1999, p. 17) observed a mean time of 497 days required for a liquidation. Comparably, COUWENBERG/DE JONG (2008, p. 114-117) found an average duration of the bankruptcy procedure of 25 months, whereas DJANKOV et al. (2008, p. 46) observed a mean length of 1.42 years.

[71] According to the bankruptcy regulations in New Zealand, firms either opt for a receivership or a liquidation. [BRADBURY/LLOYD (1994), p. 105.]

[72] BRADBURY/LLOYD (1994), p. 105-108; DJANKOV et al. (2008), p. 46. Analysing prepackaged bankruptcies with firms headquartered in New Zealand, BRADBURY/LLOYD (1994, p. 106) reported that the duration of a receivership has a mean value of 42.6 months. DJANKOV et al. (2008, p. 46) noted an average length needed to resolve a bankruptcy proceeding of 0.67 years.

[73] In Singapore, the Companies Act governs the bankruptcy of companies. [SINGAM (1985), p. 451.]

[74] The Companies Act, which concerns bankruptcy filings by corporates in South Africa, distinguishes between three categories. Most commonly, the firm is liquidated either voluntarily by the company itself or after the decision-making of the court. Alternatively, a firm is reorganised based on a court sanctioning, which might lead to a merger or a takeover. In relatively few cases, the operations of the company are continued but with a judicial manager. [GITLIN/DeSIENO (1997), p. 284-289.]

[75] NEGASH (2001), p. 39. Calculating the mean value of the results, the administrative costs of bankruptcy amount to 4.69% of the total book value of assets. Similarly, DJANKOV et al. (2008, p. 46) documented that direct bankruptcy costs with firms headquartered in South Africa amount to 18% of the estate. In addition, the authors noted that the average time needed to resolve the bankruptcy proceeding is 1.92 years. [DJANKOV et al. (2008), p. 46.]

[76] DJANKOV et al. (2008), p. 46. Furthermore, DJANKOV et al. (2008, p. 46) documented a comparatively long average duration of a bankruptcy proceeding of 5.88 years.

***Figure 8.2: Overview of major results of studies examining direct bankruptcy costs with firms filing for bankruptcy in the United States.***

| Author(s) | Year of publi-cation | Country | Analysed time horizon | Number of firms | Firm industry(ies) | Firm size | | Magnitude of direct bankruptcy costs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean value in mln. US-Dollars | Unit | Mean share | Median share | Reference figure |
| ALTMAN | 1984 | United States | 1970-1978 | 19 | retail and industrial | 141.78 | market value of equity plus book value of debt plus market value of debt plus the value of capitalised leases at the fiscal year-end prior to the bankruptcy filing date | 4.6% | 3.2% | market value of equity plus book value of debt plus market value of debt plus the value of capitalised leases at the fiscal year-end prior to the bankruptcy filing date |
| ANG/ CHUA/ McCONNELL | 1982 | United States | 1963-1978 | 86 | machine tool manufac-turers, construction firms, retail and wholesale furni-ture outlets, restaurants, hair styling salons, plum-bing supply distributors | 0.62 | total assets | 7.5% | 1.7% | total payments from liquidation of assets |
| BETKER | 1995 | United States | 1986-1993 | 49[1] | N/A | 476.00 | total book value of assets at the fiscal year-end prior to the bankruptcy filing date | 2.9% | 2.6% | total book value of assets at the fiscal year-end prior to the bankruptcy filing date |
| BETKER | 1997 | United States | 1986-1993 | 48[1]/ 75[2]/ 29[3] | N/A | 0.50[1]/ 0.89[2]/ 0.42[3] | total book value of assets at the fiscal year-end prior to the bankruptcy filing date | 2.85%[1]/ 3.93%[2]/ 2.51%[3] | 2.38%[1]/ 3.37%[2]/ 1.98%[3] | total book value of assets at the fiscal year-end prior to the bankruptcy filing date |
| BRIS/ WELCH/ ZHU | 2006 | United States | 1995-2001 | 225[2]/ 61[4] | N/A | 19.80[2]/ 0.50[4] | pre-bankruptcy assets | 16.9%[2]/ 8.1%[4] | 1.9%[2]/ 2.5%[4] | pre-bankruptcy assets |
| CAMPBELL | 1997 | United States | 1987-1992 | 36[2] | N/A | 1.69 | total book value of assets at the bankruptcy filing date | 8.5% | 5.3% | total book value of assets at the bankruptcy filing date |
| LoPUCKI/ DOHERTY | 2004 | United States | 1980-1993 | 49[2] | N/A | 561.34 | total book value of assets at the fiscal year-end prior to the bankruptcy filing date | 1.0% | N/A | total book value of assets at the fiscal year-end prior to the bankruptcy filing date |
| LUBBEN | 2000 | United States | 1994 | 22[2] | N/A | 50.00 | total assets | 0.9% | 0.4% | total assets |
| TASHJIAN/ LEASE/ McCONNELL | 1996 | United States | 1986-1993 | 49[1] | N/A | 570.00 | total book value of assets at the fiscal year-end prior to the bankruptcy filing date | 1.9% | 1.5% | total book value of assets at the fiscal year-end prior to the bankruptcy filing date |
| WARNER | 1977 | United States | 1933-1955 | 11[5] | railroad firms | 50.00 | total market value of the firm computed as the sum of each equity and debt issue | 4.0% | N/A | total market value of the firm computed as the sum of each equity and debt issue |
| WEISS | 1990 | United States | 1979-1986 | 35[2]/ 2[4] | manufacturers, construction firms, oil/gas firms, retail firms | 227.69[2&4] | pre-bankruptcy assets | 3.1%[2&4] | 2.6%2[&4] | book value of debt plus the market value of equity |

*Source: Own considerations based on scientific research on bankruptcy costs*
*Notes: The footnotes indicate the type of filing. If only one type of filing is identified in the column "Number of firms", the results of all other columns are associated with this single type. Unfortunately, some studies did not provide precise information regarding the reference figure or the date of measurement of certain figures. Moreover some information is not available and thus denoted as "N/A".*
*[1] Prepackaged bankruptcies; [2] Chapter 11 filings; [3] Exchange offers; [4] Chapter 7 filings; [5] Section 77 filings*

Obviously, there is insufficient evidence regarding the size of direct bankruptcy costs outside the United States. Taking the recent findings into consideration, the direct costs of bankruptcy are supposed to stay within a range between 1% and 9%, based on firm size. Exceptions in the present REIT sample might include companies headquartered in Turkey and South Africa. These companies probably observe bankruptcy costs of more than 15% and up to 20% because of a lower judicial efficiency. However, it should be considered that these estimates relate to direct bankruptcy costs, which ought to be complemented by an estimation of indirect bankruptcy costs.

Indirect bankruptcy costs may include lost sales and missing profits, as potential customers suspect the default of the company or because the management capabilities are tied into the bankruptcy proceeding. Further, indirect costs include the consequences of key personnel moving to other companies and higher financing costs or even the inability to obtain debt financing.[77]

Indirect fees constitute lost opportunities that are difficult or even impossible to quantify.[78] Accordingly, although rare, the empirical evidence regarding this type of costs is listed in Appendix 8.2. Several authors claimed that the time needed to resolve a bankruptcy represents a noisy approximation of indirect bankruptcy costs.[79] OPLER/TITMAN (1994, p. 1015) found that indirect bankruptcy costs are significant and positive.

Quantitative evidence on these assumptions is provided through the investigation of Australian firms by PHAM/CHOW (1989, p. 87), who indicated that indirect bankruptcy costs account for 84.3% of the sum of both direct and indirect costs of bankruptcy average. Furthermore, PHAM/CHOW (1989, p. 84-87) found that the ratio of

[77] ALTMAN (1984a), p. 1071; HAUGEN/SENBET (1988), p. 31; WARNER (1977b), p. 338; WEISS (1990), p. 288f. The agency costs arising from the possibility that the bankruptcy trustee does not act in the interests of the claimholders but in charge of a court might represent another component of indirect costs. [WARNER (1977b), p. 337.]
[78] WARNER (1977b), p. 339.
[79] FRANKS/TOROUS (1989), p. 748; THORBURN (2000), p. 359.

indirect bankruptcy costs to the firm value stays in a range between 2.5% and 31.1%, with a mean value of 13.4%.[80]
Investigating firms that filed for bankruptcy in the United States, ALTMAN (1984a, p. 1073f) observed that the indirect costs of bankruptcy equal a share of 6.5% of the firm value, on average, with a median value of 2.6%.[81] Interestingly, the average ratio of indirect fees to the sum of both direct and indirect bankruptcy costs is 47.4%. Likewise, MAKSIMOVIC/PHILLIPS (1998, p. 1501-1529) observed an insignificant share of indirect bankruptcy costs. Both findings challenge the assumption made by BAXTER (1967, p. 399), i.e., that earnings losses represent the most important component of bankruptcy costs.
KWANSA/CHO (1995, p. 345) found that the indirect costs of bankruptcy account for 7.72% of the firm value at the fiscal year-end prior to the bankruptcy filing date. The authors discovered that the ratio of indirect bankruptcy costs to the firm value varies between 0.03% and 123.5%.[82]

Adding up direct and indirect costs, PHAM/CHOW (1989, p. 87) documented an average share of 15.9% of the firm value at the fiscal year-end prior to the bankruptcy filing date. The sum of both cost components ranged between 0.8% and 33.0%.[83] ALTMAN (1984a, p. 1087) found that the bankruptcy costs comprising both direct and indirect expenses exhibit a mean value of 11.1%, a median value of 7.8% and remain within a range of 0.4% to 33.8%.
Considering the previous results, the sum of both direct and indirect costs of bankruptcy is likely to exhibit a share of the firm value in a range between 5% and 15% at the fiscal year-end prior to the bankruptcy filing date. In contrast, a higher amount of direct bankruptcy costs and lengthy bankruptcy proceedings, which potentially

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[80] Indirect costs of bankruptcy have been estimated by means of the methodology suggested by ALTMAN (1984a). [PHAM/CHOW (1989), p. 77-84.]
[81] In this study, the share of indirect bankruptcy costs to the firm value varied between 0% and 25.3%. [ALTMAN (1984a), p. 1073f.] ALTMAN (1984a, p. 1073) estimated the indirect cost of bankruptcy by a foregone profits and sales proceeding. HAUGEN/SENBET (1988, p. 31) criticised the methodology used by ALTMAN (1984a) as being a calculation of an aggregated deviation of realised profits from expected profits instead of an approximation of indirect costs of bankruptcy.
[82] The comparability of the study by KWANSA/CHO (1995, p. 342) to other studies might be reduced as the authors analysed ten restaurant companies that filed for bankruptcy in the United States. The indirect costs of bankruptcy are derived by subtracting expected profits from actual profits prior to the date of bankruptcy filing. [KWANSA/CHO (1995), p. 343-345.]
[83] PHAM/CHOW (1989), p. 87.

increase indirect fees, lead to the assumption that the total costs of bankruptcy in South Africa and in Turkey are likely greater than 15%.
However, the results point to great variations in the size of total bankruptcy costs. In addition, many countries have reformed their bankruptcy legislation in recent years. Given the different time spans considered by the studies examined previously, the burden associated with these fees might have changed due to a reformation of the bankruptcy legislation.[84]

### 8.3.1.2 Derivation of a bankruptcy costs estimate regarding REITs

The previous analysis reveals that total bankruptcy costs may account for a significant share of the assets owned by a firm. Accordingly, it should be questioned to what extent REITs are potentially beset with direct and indirect costs of bankruptcy. For this purpose, the bankruptcy costs pertaining to REITs are considered in a first instance (8.3.1.2.1), with empirical evidence concerning companies belonging to the real estate sector provided in a second instance (8.3.1.2.2).

#### 8.3.1.2.1 Considerations regarding bankruptcy costs attached to REITs

The magnitude of bankruptcy costs attached to Real Estate Investment Trusts is potentially affected by a choice of determinants discussed in the following.
Considering the liquidation of assets that are traded in illiquid secondary markets, the liquidation costs are supposed to be comparatively high. In contrast, property assets comparable to those owned by a REIT are typically traded in relatively liquid real estate markets.[85] As a consequence, the properties of a REIT are probably liquidated without suffering from a high discount to the book value.[86] This assumption is

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[84] See DEWAELHEYNS/VAN HULLE (2008, p. 409) and WANG (2006, p. 8). In contrast, benefits associated with financial distress could also occur. WRUCK (1990, p. 433) claimed that financial distress contributes to the removal of incumbent managers for the benefit of appointing a management with a superior ability. In addition, a financial distress situation may lead to an organisational restructuring together with a reassessment of the strategy of the company, which creates value to the claimants. [WRUCK (1990), p. 434f.] However the quantification of these advantages seems to be difficult to accomplish.
[85] ALDERSON/BETKER (1995), p. 46; CAPOZZA/SEGUIN (1999b), p. 7.
[86] Specifically, GIAMBONA/HARDING/SIRMANS (2008, p. 115-120) concluded that the liquidity of a certain property type is affected by structural attributes such as zoning, the physical flexibility, the lease

confirmed by DE JONG (2002, p. 35-49), who provided evidence that the share of the assets pledged as collateral is negatively associated with the costs of bankruptcy to bondholders.[87] Likewise, ALDERSON/BETKER (1995, p. 49f) delivered evidence that companies exhibiting a significant amount of real estate holdings tend to suffer from fewer losses in the case of a liquidation compared to firms owning relatively few real estate assets.[88]

However, the direct and indirect costs of bankruptcy, as previously considered, do not account for a potential shortfall in the value realised from the liquidation of assets. Nevertheless, THORBURN (2000, p. 349-356) hypothesised that companies with a relatively high proportion of tangible assets possess higher asset liquidity and are less difficult to value than firms exhibiting a low share of tangible assets. The author contended that the enhanced asset liquidity together with the eased valuation of assets translate into relatively low direct bankruptcy costs.[89] However, THORBURN (2000, p. 358f) could not verify this assumption based on a sample of Swedish firms. Overall, there exists no sufficient evidence that a relatively high fraction of real estate assets contributes to a reduction in direct or indirect bankruptcy costs.

As previously explained, many countries have introduced formal proceedings regarding both the liquidation and the reorganisation of companies. Given a relatively frequent application of reorganisation proceedings, the relevance of asset liquidity might be alleviated. Despite this, the low liquidation costs probably constitute one reason for the relatively high leverage ratios of REITs previously documented. This assumption is based on the arguments of several scientific researchers, who have

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maturity and the recovery rate. The recovery rate relates to the share of the face value attached to a claim by a creditor, which is paid back through the debtor. [FRANKS/TOROUS (1994), p. 358.]

[87] In this regard, companies with a relatively large amount of secured debt are associated with higher recovery rates in a bankruptcy situation. [BRIS/WELCH/ZHU (2006), p. 1290; THORBURN (2000), p. 360-363.] In addition, DAVYDENKO/FRANKS (2008, p. 585) showed that recovery rates tend to be positively associated with the size of collateral assets.

[88] ALDERSON/BETKER (1995, p. 49f) compared the bankruptcy filings by the firms called American Healthcare Management and Maxicare. American Healthcare Management acted as an owner of hospital buildings and land. Maxicare operated as a health care maintenance organisation, which possessed a relatively small fraction of tangible assets. Specifically, American Healthcare Management lost 12% of its going-concern value by means of a liquidation, whereas Maxicare suffered from a loss of 76%. Furthermore, in an analysis of 88 firms, the authors observed that the mean liquidation costs amounted to a share of 36.5% of the going-concern value. In addition, the results point to differences in the size of the liquidation costs dependent upon the industry classification of the company. [ALDERSON/BETKER (1995), p. 49-52.]

[89] THORBURN (2000), p. 349-356.

claimed that companies that are exposed to relatively low liquidation costs tend to use a comparably high leverage ratio.[90]

As documented before, REITs employ secured debt through collateralising real estate assets. Evidence suggests that firms being financed by debt provided by a relatively large number of secured creditors typically spend more time resolving a bankruptcy.[91] Indeed, it has been documented that the share of unsecured debt has been increased by numerous REITs over recent years. Similarly, the share of unsecured debt to total debt shows large variations among REITs. However, within a liquidation proceeding, unsecured creditors might be able to convert their debt holdings to a secured status to reduce their risk.[92] As a consequence, the operations of the REIT are possibly prolonged, which may increase the costs of bankruptcy.

XU (2004, p. 24) contended that corporate public bonds associated with a diffuse set of bondholders may exacerbate the challenge of reaching a consent thus increasing the duration of a bankruptcy proceeding. Given a potential connection between the length and the costs of a bankruptcy proceeding, the issuance of public bonds might lead to an escalation of the direct or indirect costs of bankruptcy. Thus, the reported use of corporate public bonds by REITs potentially influences the magnitude of the size of bankruptcy costs.

As previously explained, the sampled REITs possess an average market capitalisation of 2.36 billion USD and a mean leverage ratio of 27.98%.[93] In contrast, the average firm sizes used within the studies on bankruptcy costs considered before tended to be relatively low. Taking into account the scientific evidence regarding the scale effect, the costs of bankruptcy associated with a REIT might be lower compared to the estimates made in the previous section.

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[90] See, for example, HARRIS/RAVIV (1990, p. 335) and TITMAN (1984, p. 150).
[91] BRIS/WELCH/ZHU (2006), p. 1271.
[92] Adapted from WHITE (1983, p. 478f).
[93] The market capitalisation was derived on 31st of December 2009 from the sample including 218 REITs. Those figures, which have not been denominated in USD, have been converted by using the respective currency exchange rate on the 31st of December 2009. The leverage ratio is expressed as an arithmetic mean considering annual values between 2004 and 2008.

A critical component of indirect bankruptcy costs is missing profits, as clients of the firm fear that the default of the company is likely. However, this cost component might be reduced in the case of REITs. In this regard, the tenants are perceived as customers who pay rents in return for the use of a leasable area within a property. Assuming that a default of a REIT is imminent, the tenant may not immediately leave the property for at least two reasons. First, the tenant has signed a leasing contract, probably with a break option, which must not square with the time when the default of a REIT is likely. Second, critical advantages of the property to the tenant, such as the quality of the rental area, the location of the building or the leasing conditions, are not automatically impaired through a change in ownership. In addition, the property management might be carried out through a company independent from the REIT as the landlord. The property management company typically represents the first point-of-contact to the tenants and probably does not leave the property when there is a change in ownership. Accordingly, tenant support possibly remains constant, despite a change in ownership.

As mentioned previously, the results of various scientific examinations indicate that the magnitude of bankruptcy costs may be affected by the bankruptcy code prevailing in a certain country. As the present study considers REITs domiciled in several countries, there might exist differences in the actual size of the bankruptcy costs due to country-specific bankruptcy legislation. Particularly, characteristics such as close banking relationships might contribute to exceptionally low direct bankruptcy costs in the case of Japanese REITs. On the contrary, REITs that are forced to file for bankruptcy in Turkey or in South Africa might be beset with comparatively high costs contingent upon the time needed to resolve the bankruptcy.

Overall, the considerations regarding direct bankruptcy costs associated with REITs do not immediately point to differences in the size of bankruptcy fees between REITs and other companies. With regard to indirect bankruptcy costs, the recent argument proposes a lower burden for REITs due to a reduced susceptibility to earning losses. To back or to disprove these findings by means of empirical evidence, the following section presents the results of studies on bankruptcy costs pertaining to REITs and other companies focused on the real estate holding, management and operating business.

#### 8.3.1.2.2 Empirical evidence regarding bankruptcy costs of REITs

Recent review of the scientific literature on bankruptcy costs has indicated that almost no attention has been paid to the industry classification of a bankrupt firm.[94] Accordingly, there is no direct evidence regarding the question of whether the bankruptcy costs associated with REITs are equal to or are different from fees charged to companies assigned to other industries. For this purpose, two datasets are analysed in the following.

First, the sample used by PHAM/CHOW (1989) has been used to compare the size of bankruptcy costs between real estate firms and non-real estate firms.

Second, data on real estate firms that filed for bankruptcy in the United States have been collected and analysed thereafter.

The data gathered by PHAM/CHOW (1989) include five real estate firms that are listed in Figure 8.3.

However, it should be noted that the representativeness of the sample for the purposes of this study is partly reduced, as the firms are rather focused on the real estate development business and filed for bankruptcy in Australia between 1977 and 1979. In addition, the sizes of the real estate firms, measured in terms of assets at the bankruptcy filing date, have a mean value of 4.67 million AUD only. In contrast, the remaining firms of the sample collected by PHAM/CHOW (1989) possess a mean value of 105.17 million AUD. Focusing on the scale effect observed with Australian firms, the ratio of bankruptcy costs to the firm value should be higher with the sample of real estate firms compared to the non-real estate firms under consideration. However, the data reveal that the ratio of direct bankruptcy costs-to-total assets at the bankruptcy filing date is lower with real estate firms (mean value of 3.52%) in comparison to non-real estate firms (mean value of 5.37%).

On the contrary, real estate companies exhibit a higher ratio of indirect costs-to-assets at the bankruptcy filing date (mean value of 27.03%) compared to firms assigned to other industries (mean value of 14.53%). Given that companies focused on the real estate development business generate a major share of their income from the

[94] In this regard, the review of the studies has revealed that the bulk of examinations do not include information about the industry classification of the sampled firms.

***Figure 8.3: Estimation of bankruptcy costs pertaining to real estate companies.***

| | Name of real estate company | Type of real estate company | Assets at the bankruptcy filing date (in millions of Australian Dollars) | Year of bank-ruptcy filing | Direct bankruptcy costs (in th. of Australian Dollars) | Ratio of direct bankrupty costs-to-assets at the bankruptcy filing date | Indirect bankruptcy costs (in th. of Australian Dollars) | Ratio of indirect bankrupty costs-to-assets at the bankruptcy filing date | Ratio of total bankrupty costs-to-assets at the bankruptcy filing date |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Contour Development | Real estate development | 6.32 | 1977 | 227.5 | 3.60% | 1,089.3 | 17.24% | 20.84% |
| 2 | Curry and Mooney | Real estate development | 5.75 | 1978 | 63.3 | 1.10% | 1,938.5 | 33.71% | 34.81% |
| 3 | Hollandia | N/A | 8.97 | 1979 | 235.9 | 2.63% | 4,177.5 | 46.57% | 49.20% |
| 4 | KVE Industries | N/A | 1.68 | 1979 | 57.0 | 3.39% | 528.5 | 31.46% | 34.85% |
| 5 | M.G. Securities | N/A | 0.62 | 1977 | 42.6 | 6.87% | 38.2 | 6.16% | 13.03% |
| **Summary statistics: real estate firms** | | | | | | | | | |
| **Mean** | | | **4.67** | | **125.3** | **3.52%** | **1,554.4** | 27.03% | 30.55% |
| **Median** | | | **5.75** | | **63.3** | **3.39%** | 1,089.3 | 31.46% | 34.81% |
| **Summary statistics: firms belonging to other industries (finance, retail, manufacturing)** | | | | | | | | | |
| **Mean** | | | 105.17 | | 1,190.8 | 5.37% | 5,058.7 | **14.53%** | **19.90%** |
| **Median** | | | 25.06 | | 704.4 | 4.40% | **450.2** | **14.69%** | **24.23%** |

*Source: Own calculations based on data included in the study by PHAM/CHOW (1989)*
*Note: The cells highlighted in red colour indicate the lower value when summary statistics of real estate firms are compared to firms belonging to other industries.*

sale of finished properties, an imminent inability to meet the creditor's claims potentially leads to a termination of the real estate development project, with the company realising much lower profits.
The high share of indirect costs associated with the real estate firms contributes to a higher average share of total bankruptcy costs (mean value of 30.55%) to firm assets compared to the ratio obtained with non-property companies (mean value of 19.90%).

Almost all of the scientific examinations considered until now have analysed the bankruptcy costs of firms with their businesses having little similarity to the main activities conducted by REITs. Given this limitation, bankruptcy data have been collected on companies with operations demonstrating a relatively high concurrence to the main business activity followed by REITs.
With regard to Figure 8.4, data on a sample of 20 companies that filed for bankruptcy in the United States have been compiled.[95] The sample includes ten companies focusing their operations on the property development business and ten firms concentrating their activities on the holding, management and operations of real estate assets. The companies filed for bankruptcy between 1986 and 2002 and exhibited a relatively large average firm size of 1,183 million USD.[96] Specifically, the real estate development-focused companies have an average firm size of 1,454 million USD, while the firms capitalising on the real estate holding, management and operating business possess a mean size of 912 million USD. The average length of bankruptcy proceedings, measured from filing to sale, is 1.44 years for the whole sample. Interestingly, the real estate development-focused companies required a mean time of 1.63 years to resolve a bankruptcy, whereas companies centred on non-real estate development activities needed 1.25 years on average.[97]

[95] Data concerning the bankruptcy proceedings were obtained from the Bankruptcy Research Database compiled by Lynn M. LoPUCKI.
[96] The firm size is approximated through the total assets measured at the fiscal year-end prior to the bankruptcy filing date and is expressed in current USD. The bankruptcy filing dates are divided relatively equally across both real estate development companies and companies focusing on the holding, management and operations of real estate assets. Accordingly, potential differences in the time spent on resolving a bankruptcy proceeding might not depend on changes in bankruptcy legislation.
[97] Data on the length of the bankruptcy proceeding are available in days and converted into years by dividing the number of days by 365.

***Figure 8.4: Estimation of direct bankruptcy costs pertaining to real estate companies.***

| | Name of real estate company | Type of real estate company | Assets at the bankruptcy filing date (in millions of current US-Dollars) | Time from filing to disposition (in years[1]) | Ratio of direct bankruptcy costs to the total assets at the bankruptcy filing date |
|---|---|---|---|---|---|
| 1 | American Continental Corporation | Real estate development | 9,008 | 1.63 | 0.68% |
| 2 | Baldwin Builders/ Baldwin Building Contractors, L.P. | Real estate development | 509 | 2.07 | 2.25% |
| 3 | Bay Financial Corporation | Real estate development | 467 | 1.35 | 1.80% |
| 4 | Calton, Inc. | Real estate development | 299 | 0.16 | 0.59% |
| 5 | Centennial Group, Inc. | Real estate development | 347 | 2.22 | 2.69% |
| 6 | Cenvill Development Corporation | Real estate development | 388 | 1.46 | 2.02% |
| 7 | General Development Corporation | Real estate development | 1,445 | 1.98 | 1.49% |
| 8 | Leisure Technology, Inc. | Real estate development | 353 | 1.78 | 2.35% |
| 9 | McLean Industries, Inc. | Real estate development | 1,183 | 2.48 | 1.83% |
| 10 | Radice Corporation | Real estate development | 542 | 1.13 | 1.54% |
| 11 | Koger Properties, Inc. | Real estate holding & trading | 1,006 | 2.21 | 0.99% |
| 12 | Koll Real Estate Group, Inc. | Real estate holding & development | 369 | 0.10 | 0.41% |
| 13 | Southmark Corporation | Real estate holding & development | 1,615 | 1.02 | 0.97% |
| 14 | Fairfield Communities, Inc. | Real estate operating | 1,541 | 1.87 | 1.41% |
| 15 | Sunterra Corporation | Real estate operating | 1,343 | 2.06 | 1.57% |
| 16 | Forum Group, Inc. | Real estate operating | 835 | 1.13 | 1.31% |
| 17 | Commonwealth Equity Trust | Real estate investment fund | 421 | 1.02 | 1.58% |
| 18 | Residential Resources | REIT | 442 | 1.39 | 1.87% |
| 19 | Pinnacle Holdings | REIT | 1,252 | 0.39 | 0.60% |
| 20 | Alexanders | REIT | 293 | 1.35 | 2.14% |
| **Summary statistics** | | | | | |
| **Mean** | | **Total** | 1,183 | 1.44 | 1.50% |
| | | **Real estate development companies** | 1,454 | 1.63 | 1.72% |
| | | **Non-real estate development companies** | 912 | 1.25 | 1.28% |
| **Median** | | **Total** | 526 | 1.43 | 1.55% |
| | | **Real estate development companies** | 488 | 1.71 | 1.82% |
| | | **Non-real estate development companies** | 921 | 1.24 | 1.36% |

*Source: Own calculations based on data retrieved from REIT annual reports and the database compiled by Lynn M. LoPUCKI*
[1]*It is assumed that a year consists of 365 days.*

As no data on the bankruptcy fees charged to the 20 companies have been available, the regression model suggested by LoPUCKI/DOHERTY (2004, p. 120) was employed to estimate the size of direct bankruptcy costs. This regression model includes the firm size and the length of the proceeding as the two variables, which are expected to offer the highest explanatory power. If available, the number of professional firms employed in the bankruptcy case and a variable indicating the court location are also included in the model.[98] The results are summarised in Figure 8.4.

In comparison to firms focused on real estate development activities, the companies relying on the real estate holding, management and operating business exhibit a lower firm size and need less time to resolve a bankruptcy proceeding. Obviously, the time savings accomplished by the firms concerned with the real estate holding, management and operating business

contribute to the lower estimate of direct bankruptcy costs as a share of total assets (1.28%).

Summarising both datasets, a relatively low size of direct bankruptcy costs is observed with real estate firms measured against non-real estate firms as well as when firms focused on the real estate holding, management and operating business are compared to companies devoted to real estate development activities.

Considering that the firms capitalising on the real estate holding, management and operating business might sell parts or all of their property assets in relatively liquid markets to serve the claims of creditors, the complexity

and the length of the bankruptcy proceedings might be reduced. Despite data limitations, there is some evidence that companies focused on the real estate holding, management and operating business require a relatively short time span to resolve a bankruptcy proceeding.

Although the results point to differences in the size of both direct and indirect costs of bankruptcy by the industry classification of the company,the evidence is still rare. Accordingly, the issue of bankruptcy costs not only for REITs but also for other companies, especially outside the United States, needs further investigation. Despite these limitations, Figure 8.5 shows bankruptcy costs estimates, which are recom-

[98] See LoPUCKI/DOHERTY (2004, p. 119-136) for further information.

mended for use with REITs. The data represent rough estimates on the basis of all findings obtained earlier.[99]

***Figure 8.5: Overall estimates regarding bankruptcy costs of REITs.***

| | Direct bankruptcy costs | Indirect bankruptcy costs | Total bankruptcy costs |
|---|---|---|---|
| Australia | 3% | 6% | 9% |
| Belgium | 3% | 5% | 8% |
| Canada | 3% | 5% | 8% |
| France | 3% | 5% | 8% |
| Japan | 2% | 5% | 7% |
| Netherlands | 3% | 5% | 8% |
| New Zealand | 3% | 5% | 8% |
| Singapore | 3% | 5% | 8% |
| South Africa | 8% | 10% | 18% |
| Turkey | 8% | 11% | 19% |
| USA | 3% | 5% | 8% |

*Source: Own calculations based on scientific research on bankruptcy costs*
*Note: The percentages reflect bankruptcy costs as a share of the total book value of assets.*

### 8.3.2 Estimation of the probability of bankruptcy

Having calculated an estimation regarding the costs of bankruptcy, the consideration of the value of expected bankruptcy costs in the valuation tool requires the determination of the probability of bankruptcy.

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[99] Apart from the considerations made regarding the country-specific bankruptcy costs, one percent has been added to the indirect bankruptcy cost figures of both Turkey and Australia as REITs domiciled in these countries show a comparatively high exposure to real estate development and trading activities that are associated with an increased risk profile.

To accomplish this task, the methods suggested for the calculation of the probability of bankruptcy are critically evaluated initially (8.3.2.1). Subsequently, the approach to estimate the probability of bankruptcy associated with REITs is explained (8.3.2.2).

#### 8.3.2.1 Considerations regarding the models proposed to calculate the probability of bankruptcy

Several scientific researchers have investigated the possibility of predicting the bankruptcy of a firm. As a result of these investigations, various bankruptcy prediction models have been proposed that are partially applicable to the estimation of the probability of bankruptcy as well.

To address the issue of calculating a probability of bankruptcy, an overview regarding bankruptcy prediction models, as suggested by scientific research, is initially provided (8.3.2.1.1). Subsequently, the surveyed models are also subjected to a critical evaluation with regard to the ability of calculating a probability of bankruptcy (8.3.2.1.2).

##### 8.3.2.1.1 Overview

Bankruptcy prediction models seek to distinguish between firms that file for bankruptcy and those that remain solvent over a certain time span.[100]

For this purpose, both models, derived on the basis of relationships between empirical data and models founded on explicit theoretical considerations, have been developed.

With regard to models based on empirical data, the prediction of whether or not a firm files for bankruptcy has typically been accomplished by means of the following approach.

First, data are collected in paired samples over a certain time period, i.e., one sample including firms that filed for bankruptcy and a second sample of companies that did not enter into a bankruptcy proceeding over the period of consideration. Second,

[100] SCOTT (1981), p. 317f.

financial ratios[101] are selected and typically calculated for up to five years prior to the bankruptcy filing date using data included in the financial statements of the sampled firms. In addition, BEAVER (1966, p. 74) noted the possibility that the numerical value of a ratio, which is used to predict a bankruptcy, leads to different probabilities of bankruptcy by industry. As a consequence, several scientists have proposed the application of industry-relative ratios in the formulation of a bankruptcy prediction model.[102] Third, a formula is derived that includes either a single financial ratio[103] or a combination of financial ratios.[104] This formula should help to discriminate between firms that have filed for bankruptcy and companies that have remained viable.[105] Many studies have derived this formula by means of multiple discriminant analysis, with some examinations using logit analysis,[106] neural network analysis[107] or a stochastic modelling approach founded on the gambler's ruin model[108]. Fourth, the proposed formula has often been tested in terms of its accuracy in classifying a firm either as a bankrupt or a non-bankrupt entity by using a sample of companies that is independent of the sample utilised to derive the model.[109]

Extending the empirically derived models explained previously, capital markets-based models have been proposed. These models aim to infer probabilities of bank-

[101] A financial ratio equals the quotient of two numbers that both include items obtained from the financial statements. [BEAVER (1966), p. 71f.]

[102] See, for example, IZAN (1984) or PLATT/PLATT (1990).

[103] See, for example BEAVER (1966) or DEAKIN (1972).

[104] See, for example, ALTMAN (1968), ALTMAN/HALDEMAN/NARAYANAN (1977), BLUM (1974) or DEAKIN (1972).

[105] SCOTT (1981), p. 320.

[106] See, for example, MARTIN (1977), OHLSON (1980), PLATT/PLATT (1990) or SHUMWAY (2001). Also called binary logit models, a moral hazard approach including both market and accounting variables has been introduced as well [see, for example, SHUMWAY (2001) for further information].

[107] Neural network analyses seek to discover hidden correlations between the predictive variables that are expressed in new explanatory variables and included in the prediction function [see COATS/FANT (1993), KARELS/PRAKASH (1987) or POMPE/BILDERBEEK (2005)].

[108] With regard to Gambler's ruin models, a gambler uses an arbitrary amount of money and wins a unit with a probability of $p$ but loses a unit with a probability of $1-p$. The game is continued until all money previously owned by the gambler is lost. In this model, the company is viewed as the gambler with a bankruptcy potentially occurring when the net worth of the firm falls to zero. [SCOTT (1981), p. 322f.]

[109] The classification accuracy is typically expressed through the calculation of both Type I and Type II errors. A Type I error reflects firms that have been classified through the prediction model as viable but filed for bankruptcy in reality. A Type II error relates to companies that have been classified by the model as failed but have actually not been subject to a bankruptcy filing. [ALTMAN (1968), p. 599.]

ruptcy from past data regarding bond defaults that are distinguished by maturity and credit grade.[110]

Moreover, a variety of models have been suggested based on explicit theoretical considerations. Particularly, single-period models[111], gambler's ruin models[112], models assuming perfect access to external capital[113], models presupposing imperfect access to external capital[114] and models founded on implied default probabilities[115] can be distinguished.

### 8.3.2.1.2 Critical review

The preceding overview corroborates that a large variety of bankruptcy prediction models have been recommended. Contemporaneously, no uniform bankruptcy prediction model that can be also used for the estimation of default probabilities has evolved over the past decades. In this context, the previously introduced models are subject to the following critical evaluation, with supplementary attention paid to their ability to derive bankruptcy probability estimates for REITs.

A comparison of academic studies on bankruptcy prediction reveals that the variables selected for inclusion in the prediction model differ heavily across the individ-

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110 Capital markets-based models include the mortality rate model and the aging analysis. The mortality rate model has been suggested by ALTMAN (1989) for the purpose of measuring default risk. ALTMAN (1989, p. 910) defined mortality as the life expectancy of a bond measured in periods of time subsequent to the bond issuance. The aging approach has been proposed by ASQUITH/MULLINS/WOLFF (1989, p. 925 & 931) based on the finding of a positive relationship between bond ages and default rates.

111 With regard to single-period models, the securities of a firm traded in the current period will be subject to liquidation in the subsequent period if the liquidation value falls below the amount of creditor claims. [SCOTT (1981), p. 325.]

112 Gambler's ruin models, which have also been introduced as empirically derived models, are also classified as a form of theoretically derived models. [SCOTT (1981), p. 322-324.]

113 Models assuming perfect access to capital markets presuppose that firms have an infinite life and are able to meet losses through the issuance of debt or equity. Likewise, efficient markets are assumed with an absence of flotation costs. In this framework, the solvency of a firm is established to the extent that the market value of the equity remains positive [see SCOTT (1977) for an overview].

114 SCOTT (1981, p. 332-341) developed a model with imperfect access to capital markets based on the notions of both the gambler's ruin models and the models with perfect access to capital markets. In this environment, access to external capital might be restricted, flotation costs are potentially incurred when selling securities or a personal tax system probably incentivises the use of internal funds. [SCOTT (1981), p. 332.]

115 Implied default probabilities have been imputed from the term structure of yield spreads between risk-free and risky corporate securities [see IBEN/LITTERMAN (1991) regarding further information].

ual examinations. In particular, the 36 studies summarised in Appendices 8.3 and 8.4 have proposed a total of 173 different variables, primarily selected due to a certain statistical relationship observed by the authors.[116] The large number of variables is reduced to 23 when considering only those figures that exhibited a significant relationship in more than one study. Interestingly, the variables utilised by ALTMAN (1968) appear the most frequently across all studies, with each of the individual ratios being included in 9 to 13 other studies. However, this finding does not directly point to a superiority of the ALTMAN (1968) model in terms of its predictive ability. Instead, the approach constitutes a pioneering work regarding bankruptcy prediction models that employ a set of variables and thus has been cited by many comparable studies published thereafter.

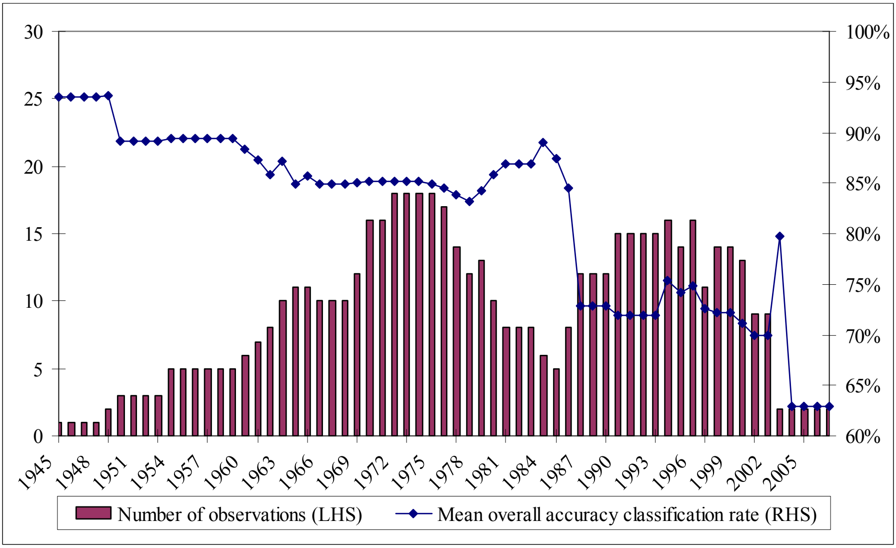
Accordingly, it seems helpful to analyse the predictive ability of bankruptcy prediction models in more detail.
For example, negligible differences in accuracy classification rates of the ALTMAN (1968) model and of an extended version of the discriminant model have been ascertained.[117] Similarly, the confrontation of the classification accuracy rates of preceding works, including one study that relies on discriminant analysis and another using a logit analysis, leads to controversial results. Furthermore, it has been observed that even after a re-estimation of the coefficients associated with the ALTMAN (1968) model and its extension, their applicability to data collected from other time horizons is subject to restrictions.[118] The models relying on neural network analyses

[116] Similarly, SCOTT (1981, p. 325) claimed that the models using a combination of several ratios might suffer from statistical overfitting. The author views the existence of many divergent models as one indication of statistical overfitting. [SCOTT (1981), p. 325.]
[117] Specifically, the ZETA™ approach suggested by ALTMAN/HALDEMAN/NARAYANAN (1977, p. 34f) has been compared with the model proposed by ALTMAN (1968). As a result of the analysis, the former model yields higher accuracy classification rates for two to five years prior to the bankruptcy filing date, whereas both models deliver similar results when examining the year preceding the filing date. [ALTMAN (2000), p. 41.]
[118] Comparing the classification accuracy rates of the model based on logit analysis suggested by OHLSON (1980) with the respective rates when applying the model by ALTMAN (1968), BEGLEY/MING/WATTS (1996, p. 268-271) claim the choice of the former model. Specifically, BEGLEY/MING/WATTS (1996, p. 267f) collected a sample for a time period between 1980 and 1991 including 3,300 non-bankrupt and 165 bankrupt firms domiciled in the United States. [BEGLEY/MING/WATTS (1996), p. 268-271.] In contrast, MARTIN (1977, p. 266f) finds that a dichotomous classification between viable firms and failed companies is performed equally well with both discriminant and logit analysis.

have partially, though not consistently, delivered higher accuracy classification rates compared to approaches using discriminant or logit analyses, but at the expense of a higher complexity.[119] Likewise, approaches developed on the basis of the gambler's ruin model have been subject to difficulties in empirical testing.[120]

With regard to the sample of 36 publications on bankruptcy prediction, as previously introduced, a total of 48 bankruptcy prediction models,[121] with a mean accuracy classification rate of 79.9%, have been proposed. Figure 8.6 reveals that a relatively

***Figure 8.6: Mean overall accuracy classification rates realised by bankruptcy prediction models.***




*Source: Own calculations based on scientific research on bankruptcy prediction models*

[119] In terms of classification accuracy, COATS/FANT (1993, p. 150-152) observe a superiority of a model employing a neural network approach over a model using discriminant analysis. BORITZ/KENNEDY (1995, p. 503 & 511f) argue that the performance of approaches relying on neural network analyses is not always superior when compared to models using discriminant, logit and probit analyses but varies with Type I and Type II classification accuracy rates.

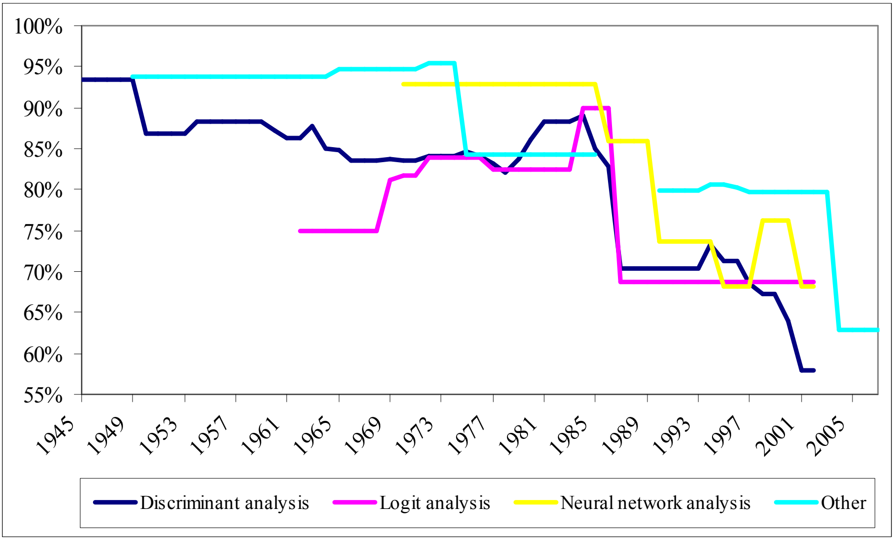
[120] See SCOTT (1981, p. 323f) for further information.

[121] Although 36 publications have been investigated, 48 prediction models are extracted when considering the following rules. First, only those scientific examinations that are listed in Appendices 8.3 and 8.4 are included that displayed an overall accuracy classification rate. Second, if a scientific study includes the calculation of more than one model, the classification rates pertaining to each model have been considered.

large amount of data collected for the 48 models relate to the time horizon between 1972 and 1975.[122]

As indicated by Appendices 8.3 and 8.4, these data have been primarily used in forming and validating models founded on discriminant and, to a minor extent, logit analyses. The preferable use of discriminant analysis conforms to the finding presented in Figure 8.7, i.e., higher accuracy classification rates pertaining to discriminant analysis compared to logit analysis.

***Figure 8.7: Mean overall accuracy classification rates realised by bankruptcy prediction models based on the type of analysis.***




*Source: Own calculations based on scientific research on bankruptcy prediction models*

However, as can be observed from Figure 8.6, the annual mean accuracy classification rates concerning the 48 models declined between 1945 and 2007.[123] This find-

[122] Following the red bar chart in Figure 8.6, 18 different bankruptcy prediction models considered a data sample with regard to a single year during the time period from 1972 until 1975.

[123] The annual average classification rates were derived by means of the following procedure. For each of the 48 models, the overall average classification rate was listed in each year of the overall sample used by the respective study. Subsequently, the mean classification rates of all available data pertaining to the 48 models were calculated on an annual basis between 1945 and 2007. Following the red bar chart in Figure 8.6, each year between one and 18 studies was, respectively were used to calculate the average annual classification rate. However, it should be considered that the classification rate employed in calculating

ing might result from the fact that a variety of scientific studies have applied or modified prediction models that were proposed prior to the 1990s, instead of suggesting new approaches, which accommodate the prevailing situation. Figure 8.7 indicates that the application of models using neural network and certain other types of analyses (i.e., linear programming) has been confined to more recent years, probably taking into account weaknesses associated with discriminant analysis. However, there is limited evidence regarding higher accuracy rates of neural network and other types of analyses compared to discriminant analysis.

Moreover, the magnitude of the probability of a bankruptcy might be associated with country-specific features. However, the examination of this relationship is hampered through the absence of bankruptcy data and the relatively low number of scientific studies on the probability of bankruptcy in countries besides the United States.[124] Nevertheless, a comparison of existing studies according to the domicile of the sampled firms reveals that examinations regarding companies headquartered in the United States yielded the highest accuracy classification rates in almost every year under consideration.[125] Scientific studies analysing firms that are domiciled outside the United States have often proposed unique models, which did not consistently deliver superior classification rates when compared to the results of applying the ALTMAN (1968) model. Consequently, it is probably reasonable to surrender the benefits of the slightly higher classification accuracy potentially offered by a country-specific model for the benefit of reduced outlay when using a single bankruptcy prediction model on a sample of firms domiciled in more than one country.

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the graph is associated with the overall sample of the study, which may lead to biased results if the overall sample had been divided into a sample used to estimate the model and a sample employed for calculating classification rates. Given that many studies did not clearly document the time span used to derive classification rates, the overall sample period is presented as an approximation.

[124] ALTMAN (1984b), p. 185; ALTMAN/NARAYANAN (1997), p. 2.

[125] Only three prediction models relying on non-US data deliver a higher classification accuracy rate than the mean accuracy rate of the studies focusing on companies domiciled in the United States. However, the studies analysing firms headquartered in Singapore [TA/SEAH (1988)] and in Turkey [UĞURLU/AKSOY (2006) and UNAL (1988)] may be biased due to relatively low sample sizes, whereas the two studies focusing on firms in Turkey calculated classification rates on the sample they already used to derive the model.

Besides the criticism regarding the properties of the statistical methodologies used to derive a prediction function[126] and the application of accounting data[127], the following arguments are mentioned as further explanations of the recent findings regarding the predictive ability of several models.

The paired sampling method, employed by many of the reviewed studies on bankruptcy prediction, has been subject to criticism. Denominated as a choice-based sample bias, scientific examinations have identified failed and non-failed firms as distinct categories, with the companies from each group being selected separately. As can be observed from Appendices 8.3 and 8.4, numerous models have used a share of failed firms, accounting for 40% to 50% of the total sample, which can be classified as non-random and thus potentially leading to estimation biases. Additionally, a sample selection bias may occur. In this context, it is assumed that the probability of failure differs between a sample of firms with complete data and a sample of companies subject to incomplete data. The estimated prediction model might be biased if the sample is collected subject to the condition that the firms offer complete data.[128]

Moreover, the use of financial variables by many bankruptcy prediction models has been questioned. JOHNSON (1970, p. 1166-1168) criticised that financial ratios cannot predict a bankruptcy but are able to discriminate between failed and non-failed firms ex post.[129] Comparing within-sample classification rates with out-of-sample classification rates of various scientific examinations, PLATT/PLATT (1990, p. 33f) concluded that the instability of financial variables over time reduces

[126] See, for example, ALTMAN/SAUNDERS (1998, p. 1724), COATS/FANT (1993, p. 142) and KARELS/PRAKASH (1987, p. 573) regarding linear discriminant analysis and to ALTMAN/MARCO/VARETTO (1994, p. 507 & 515) regarding the neural network analysis.

[127] See, for example, ALTMAN/SAUNDERS (1998, p. 1724) or HILLEGEIST et al. (2004, p. 6).

[128] ZMIJEWSKI (1984), p. 59-74. However, the impact on accuracy classification rates has not been addressed by a sufficient number of examinations. To investigate the sampling biases in more detail, ZMIJEWSKI (1984, p. 63f) collected a sample of 81 firms that filed for bankruptcy in the United States and were listed on the American and New York Stock Exchange between 1972 and 1978. The author found evidence regarding both a choice-based sample bias and a sample selection bias but did not observe a change in classification rates pertaining to the models when these biases were present. [ZMIJEWSKI (1984), p. 77-80.]

[129] Similarly, the author claimed that financial ratios cannot consider intervening economic processes to predict a failure and may show a reduced comparability between firms because of a lack of a standard ratio comparison. [JOHNSON (1970), p. 1166f.]

their predictive ability.[130] This conclusion may deliver one explanation for the decreasing mean classification rate previously identified. Alternatively, the use of industry-related variables potentially mitigates the issue of the instability of explanatory variables.[131]

Empirically derived models have been criticised as being founded on a statistical search for financial indicators rather than on a well-developed, explicit theory. Though no commonly accepted approach based on explicit theoretical considerations has been established, the theoretically derived models have also been largely associated with difficulties in their applicability to a sample of firms due to restrictive assumptions.[132]

In summary, there probably exists no model that is able to correctly predict a bankruptcy irrespective of the time horizon or certain features of the sampled firms, such as the industry classification or the country of origin. However, a relatively large body of research has investigated the model proposed by ALTMAN (1968). In addition, the model remains relatively simple in its application for bankruptcy prediction and probability estimation and has been adjusted to account for the industry classification of the sampled firms. Accordingly, the ALTMAN (1968) model may provide indicative estimates regarding the probability of bankruptcy.

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[130] Based on this assumption, PLATT/PLATT (1991, p. 1193) compared the stability of a model using industry-relative variables against a model utilising unadjusted variables and observed that the former approach exhibits a higher parameter stability. Likewise, the probability of a bankruptcy might change over time. For example, DEWAELHEYNS/VAN HULLE (2008, p. 422f) documented that the reformation of the Belgium bankruptcy legislation led to a reduction in failure rates of small firms.

[131] PLATT/PLATT (1990), p. 35f. The industry-related variable was derived by dividing a financial ratio subject to a firm through the industry mean value of the respective variable at a certain point in time. [PLATT/PLATT (1990), p. 34.] IZAN (1984, p. 317f) revealed that the results of the discriminant function show large variations depending on the industry classification of the sample, whereas SHIRATA (1998, p. 8) did not observe this connection. In contrast, PLATT/PLATT (1990, p. 41-46) provided evidence that the overall as well as the Type I and Type II classification accuracy rates associated with industry-relative variables are higher than the respective rates using unadjusted variables.

[132] SCOTT (1981), p. 317. SCOTT (1981, p. 326) criticised that single-period models cannot explain the predictive ability of empirical models. Founded on the option pricing theory, the bankruptcy prediction approach introduced by HILLEGEIST et al. (2004, p. 7) is based on certain assumptions that potentially do not hold in practice. [HILLEGEIST et al. (2004), p. 6.] Further, ALTMAN/SAUNDERS (1998, p. 1725) argued that the assumptions made by the models focusing on the imputation of implied default probabilities are debatable. Despite the difficulties regarding the applicability of the model assuming perfect access to capital markets, the approach seems to be theoretically plausible as bankruptcy is described through negative earnings and firms are able to raise capital externally. [SCOTT (1981), p. 331.]

#### 8.3.2.2 Recommendation regarding the procedure for estimating the probability of bankruptcy

In the following, a discussion of the potential susceptibility of REITs to bankruptcy precedes the recommendation of a procedure for estimating the probability of bankruptcy.

On the one hand, several arguments contribute to the expectation of a relatively high probability of bankruptcy of REITs compared to firms in other industries.
In an inter-industry comparison, the previous explanations document a comparatively high operating expense ratio associated with REITs. Consequently, a reduction in rental revenues can result in an increased probability that the REIT fails to meet its obligations.
With regard to the examined publications on bankruptcy prediction, a positive connection between the debt-to-total assets ratio and the probability of bankruptcy is observed.[133] This relationship potentially increases the threat of a REIT bankruptcy, as the previous explanations document that historical debt-to-total asset ratios for REITs have been higher than those of many firms operating in other sectors.
EL HENNAWY/MORRIS (1983, p. 209) claimed that companies demonstrate a higher vulnerability to enter into bankruptcy during an economic recession. In this regard, cycles associated with rents and property prices have been partially observed in the earlier analysis, including appraisal-based direct real estate investment returns.[134] Considering the bottom side of the rental cycle, the REIT might be forced to close leasing contracts at rental rates below those received previously, possibly leading to reductions in the rental revenues item. Likewise, if a downward-sloping economic cycle translates into a higher bankruptcy probability for firms, REITs may suffer from reductions in rental revenues due to tenant defaults. Additionally, a fall in real estate prices conceivably results in an increase of the probability of bankruptcy. In this scenario, portfolio re-valuations potentially induce downward adjustments of property values and thus an increase in the leverage ratio. If the rise in the leverage ratio provokes a breach of a certain threshold included in the financing

[133] See, for example, PLATT/PLATT (1990, p. 43f) or SHUMWAY (2001, p. 119f).
[134] See PHYRR/ROULAC/BORN (1999) regarding a review of scientific studies investigating real estate cycles and SAGALYN (1990), who addressed the linkage between REITs and the business cycle.

contract, a REIT might be forced to contribute additional capital. Given the distribution requirements of REITs, possibly in combination with deteriorating capital market conditions that exacerbate the problem of raising capital through equity issuances, for example, capital might be difficult to obtain, thus potentially causing liquidity problems. Reconsidering the risk and return profiles of several business activities carried out by REITs, firms that are engaged in the real estate development or trading businesses might suffer from a higher probability of bankruptcy.[135]

On the other hand, the following considerations rather lead to the view that REITs are confronted with a lower likelihood of being forced to enter into bankruptcy in comparison to firms in other industries.
According to the findings by ALTMAN/KARLIN (2008, p. 12), 14 REITs experienced corporate bond defaults over the time period from 1970 to 2007. Interestingly, twelve of the defaults, which are supposed to primarily relate to Mortgage-REITs, occurred in the period between 1970 and 1989. Concerning the time span beginning in 1990 and ending in 2007, only two REITs defaulted on corporate bonds. In contrast, the mean number of defaults distinguished by industry classification between 1990 and 2007 is 69.07, with a median value of 46.50.[136] Compared to the category of real estate and construction companies, which experienced 39 defaults between 1990 and 2007, the REIT business seems to default less often. However, it should be

[135] Besides this, several authors observed that bankrupt firms, which went through a reorganisation, are associated with a comparatively high probability of filing for bankruptcy again [see, for example, HOTCHKISS (1995, p. 3) and LoPUCKI/WHITFORD (1993, p. 611)]. However, given the missing empirical evidence regarding REITs together with an increase in complexity of the probability estimation when including a possibility of re-entering a bankruptcy filing, this observation is not considered in this study.
[136] Apart from REITs, auto and motor carriers, conglomerates, energy companies, financial services firms, leisure and entertainment companies, general manufacturing companies, health care firms, real estate and construction companies, retailing firms, communications firms, transportation companies, utilities companies and miscellaneous industries have been considered. [ALTMAN/KARLIN (2008), p. 12.] Specifically, the REIT Pinnacle Holdings filed for Chapter 11 on May 21, 2002. However the company focused on the renting of space to wireless communication services. It is likely that the dependence of the REIT earnings on the development of the technology sector has been a major cause of the bankruptcy filing. In 1992, a second REIT called Alexander's Inc., focused on investments in retail properties in the New York region, filed for Chapter 11. Not considered by ALTMAN/KARLIN (2008, p. 12), the REIT called Residential Resources filed for bankruptcy in 1989. The REIT had obtained a high leverage ratio with an excessive share of floating rate short-term debt. After an increase in short-term interest rates, Residential Resources was not capable of meeting the margin calls on its borrowings and filed for bankruptcy. [ASNESS/SMIRLOCK (1991), p. 1174.]

noted that no information regarding the number of bond issuances per sector, which would offer the possibility to calculate relative values, is available.
Furthermore, STIGLITZ (1972, p. 480) noted that instead of filing for bankruptcy, which involves a variety of costs previously analysed, firms may prefer to be taken over or merged. Indeed, the process of collecting the total REIT sample previously described led to the exclusion of several REITs that were either acquired or that merged with another firm. Nevertheless, a REIT that is confronted with an imminent bankruptcy filing probably cannot independently decide upon a merger or an acquisition but rather requires the consent of the firm that it would merge with or that would acquire the REIT.

In summary, scarce empirical evidence points to a relatively low probability of bankruptcy for REITs in an inter-industry comparison. However, this reduction might be partly a result of the legal restrictions regarding the business activities carried out by a REIT. Given the possibility of variations in the composition of the business activities and corresponding assets, it is recommended to estimate the probability of bankruptcy for each individual firm instead of using an industry-specific reference value.
Based on the preceding considerations, two procedures for estimating the probability of bankruptcy are recommended. First, in case a credit rating of a REIT is available, an approximation of the probability of bankruptcy is founded upon historical corporate bond default rates (8.3.2.2.1). Second, if no credit rating pertaining to a REIT is accessible, the model suggested by ALTMAN (1968) is chosen and modified by using industry-relative ratios (8.3.2.2.2).

#### 8.3.2.2.1 Estimation of the probability of bankruptcy based on corporate bond defaults

A simple procedure for estimating the probability of bankruptcy utilises historical data on corporate bond defaults.
Specifically, survival rates of corporate bonds associated with several time periods

after issuance have been analysed by various scientists[137] and can serve as approximations of bankruptcy probabilities.[138] Figure 8.8 summarises the examination by ALTMAN/KARLIN (2008, p. 25), who used 1,990 corporate bonds rated by Standard & Poor's at issuance to derive probabilities of default in function of credit ratings.[139] To prepare an application of this procedure for REITs, the sample of 218

***Figure 8.8: Probabilities of default according to credit ratings provided by Standard & Poor's.***

| Credit rating awarded by Standard & Poor's | Probability of default |
|---|---|
| AAA | 0.07% |
| AA | 0.51% |
| A | 0.66% |
| BBB | 7.54% |
| BB | 19.63% |
| B | 36.80% |
| CCC | 59.02% |

*Source: ALTMAN/KARLIN (2008, p. 25)*

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137 See, for example, ALTMAN (1989) or ALTMAN/KARLIN (2008).
138 Denominated as the mortality rate concept, the total value of defaulting debt of a year *t* is divided by the population of bonds at the beginning of year *t*. Contemporaneously, a cumulative mortality rate is calculated through subtracting the product of annual survival rates over a certain time horizon from one. [ALTMAN (1989), p. 912.]
139 Figure 8.8 documents the cumulative mortality rates ten years after issuance [see ALTMAN/KARLIN (2008, p. 24f) for further explanations].

firms previously introduced was employed to analyse REIT credit ratings. If available, the credit ratings pertaining to REITs were retrieved from three major credit rating agencies, namely, Standard & Poor's, Moody's and Fitch.

According to Figure 8.9, 83 companies have been rated by at least one of the three agencies.[140] Although the bulk of rated firms are domiciled in the United States (57 REITs), Japan (92.31%) and Singapore (66.67%) exhibit the highest percentages of rated companies as a share of the total country-specific sample.

***Figure 8.9: Credit ratings of Real Estate Investment Trusts.***

| | Total | Australia | Canada | France | Japan | Singapore | United States |
|---|---|---|---|---|---|---|---|
| **Total number of REITs with credit rating** | **83** | 6 | 1 | 3 | 12 | 4 | 57 |
| **Share of REITs with credit rating to the total country-specific sample** | **37.90%** | 19.35% | 5.00% | 27.27% | 92.31% | 66.67% | 55.34% |
| **Number of REITs rated by Standard & Poor's** | **67** | 4 | 1 | 3 | 7 | 0 | 52 |
| **Number of REITs rated by Moody's** | **71** | 4 | 0 | 2 | 11 | 4 | 50 |
| **Number of REITs rated by Fitch** | **36** | 1 | 0 | 0 | 0 | 0 | 35 |

*Source: Own calculations based on the total sample (83 of 218 REITs) while using data retrieved from Standard Poor's, Moody's and Fitch*

In accordance with the sample used by ALTMAN/KARLIN (2008, p. 25), the credit ratings by Standard & Poor's were preferably used if REITs had obtained ratings by more than one agency. With regard to the 16 REITs that had not been rated by Standard & Poor's, the rating by one of the two remaining agencies was utilised as an

[140] Figure 8.9 does not include the countries Belgium, the Netherlands, New Zealand, South Africa and Turkey as the REITs domiciled in any of these countries have not been rated. Furthermore, it should be noted that the ratings had been prepared in the period between 1998 and 2010. In this regard, ratings that were published several years ago but have not been modified to capture current conditions might be less representative.

approximation.[141] Consequently, the final sample consisted of 67 credit ratings provided by Standard & Poor's, 14 ratings provided by Moody's and two ratings awarded by Fitch. Given the different rating classification symbols adopted by Moody's and Standard & Poor's, the comparison published by CANTOR/PACKER (1997, p. 1398) was consulted to convert the ratings awarded by Moody's into the notation employed by Standard & Poor's.

With regard to Figure 8.10, each of the 83 firms obtained a rating in a range between AA- and B-. Despite the recent findings indicating that a comparatively small number of REITs filed for bankruptcy in the past, 16 firms received a rating below investment grade.[142] However, given the limited historical data regarding bond defaults of REITs in combination with few bond issuances, no unambiguous evidence is available. Although the restrictive legislation regarding REITs might lead to an alignment of business activities with similar risk profiles, the credit ratings show large variations. These disparities are also evident when transferring the ratings into bankruptcy probabilities on the basis of the results by ALTMAN/KARLIN (2008, p. 25). In particular, a range of bankruptcy probabilities between 0.51% and 36.80% was obtained.[143] Consequently, it is recommended to consider the impact of expected bankruptcy costs, especially with REITs possessing a credit rating below investment grade. In contrast, all Japanese REITs obtained investment grade ratings. This finding leads to the assumption that in comparison to firms domiciled in other countries, Japanese firms exhibit a lower bankruptcy risk, mainly due to their close banking relationships and the equity nature of main bank lending.[144]

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[141] It has not been necessary to choose between a rating either from Moody's or awarded by Fitch as each of the 16 firms has been rated by a single agency only.

[142] See CANTOR/PACKER (1997, p. 1397f) for explanations regarding the meaning of individual rating symbols.

[143] Given the missing evidence on default probabilities, the algebraic signs in front of the ratings (i.e., BB+) are omitted.

[144] SUZUKI/WRIGHT (1985), p. 108. SUZUKI/WRIGHT (1985, p. 105) delivered evidence that the bankruptcy risk of Japanese firms is dependent on social importance indicators such as sales volume and the number of employees together with main bank relationship variables such as the size of the main loan granted by the main bank and the share of the loan in comparison to the common stock holdings of a company. The authors considered a sample of 18 firms listed on Japanese stock exchanges that declared bankruptcy during the period between 1974 and 1978 together with a sample of 34 firms, which faced financial difficulties but received a rescue financing from private banks. [SUZUKI/WRIGHT (1985), p. 103.]

***Figure 8.10: Number of REITs categorised by credit rating.***

| *Credit rating* / *Country of origin* | AA- | A+ | A | A- | BBB+ | BBB | BBB- | BB+ | BB | BB- | B+ | B | B- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | | | | 4 | 1 | 1 | | | | | | | |
| Canada | | | | | | | | | 1 | | | | |
| France | | | 1 | | 1 | | | 1 | | | | | |
| Japan | 1 | 1 | 5 | 2 | 2 | | | 1 | | | | | |
| Singapore | | | 1 | | 2 | 1 | | | | | | | |
| United States | | | | 3 | 7 | 20 | 14 | 4 | 3 | 3 | 1 | | 2 |
| **Total** | **1** | **1** | **7** | **9** | **13** | **22** | **14** | **6** | **4** | **3** | **1** | | **2** |

*Source: Own calculations based on the total sample (83 of 218 REITs) while using data retrieved from Standard Poor's, Moody's and Fitch*

Given the REIT credit ratings, the probability of bankruptcy is derived on the basis of historical corporate bond default rates. However, this procedure is carried out subject to the availability of a credit rating. If a credit rating is not accessible for a certain REIT, the probability of bankruptcy will be derived by the approach proposed in the following section.

#### 8.3.2.2.2 Estimation of the probability of bankruptcy based on an extension of the ALTMAN (1968) model

As documented above, the bankruptcy prediction model proposed by ALTMAN (1968) has been subject to extensive academic scrutiny. However, the application of the approach has been rather confined to manufacturing firms.[145] In addition, the previous examinations point to a reduced predictive ability of studies that have applied the ALTMAN (1968) model in recent years. Although the criticism regarding the paired sampling approach, the use of accounting data and of financial ratios was not addressed by ALTMAN (2005), the author modified the ALTMAN (1968) model to allow for its application to firms of all industries through a function that has been re-estimated based on more recent data. Specifically, ALTMAN (2005, p. 313) derived the following equation on the basis of firms headquartered in the United States:

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[145] ALTMAN (1968), p. 609; ALTMAN (2005), p. 313.

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25 \qquad \textbf{(8.6)}$$ [146]

where

$Z''$ = overall score
$X_1$ = working capital-to-total assets
$X_2$ = retained earnings-to-total assets
$X_3$ = EBIT-to-total assets
$X_4$ = book value of equity-to-total liabilities

Basically, the function consists of four explanatory variables.
First, the working capital[147]-to-total assets ratio expresses the net liquid assets owned by the firm in relation to total capitalisation.[148]
Second, the retained earnings[149]-to-total assets ratio embodies the cumulative profitability attached to a company over time. Additionally, the ratio should incorporate the impact of firm age on bankruptcy, as young firms are supposed to have collected fewer retained earnings compared to old companies.[150]
Third, the EBIT-to-total assets ratio constitutes a productivity measure in the absence of taxes and leverage. The variable is included in the prediction function as the viability of the firm is assumed to be associated with its earnings power.[151]
Fourth, the ratio of the book value of equity-to-total liabilities[152] indicates the extent to which the assets of the firm can decline in value until the liabilities exceed the equity.[153]

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[146] ALTMAN (2005), p. 313.
[147] In this context, the working capital figure is defined as the difference between current assets and current liabilities. [ALTMAN (1968), p. 594f.]
[148] ALTMAN (1968), p. 594f.
[149] Also called earned surplus, retained earnings represent the total amount of reinvested earnings and/or losses that a firm has compiled over its lifetime. [ALTMAN (1968), p. 595.]
[150] ALTMAN (1968), p. 595.
[151] ALTMAN (1968), p. 595.
[152] The total liabilities are calculated as the book value of both current and long-term debt. [ALTMAN (1968), p. 595.]
[153] ALTMAN (1968), p. 595. ALTMAN (2000, p. 25) suggested the use of the book value of equity as a substitute for the market value of equity to ensure the application of the model with private firms as well. Although the REITs listed on the stock exchange exhibit a market value of equity, the use of the book value of equity is suggested in this study as this measure has been included in the function used to calculate the Z"-Score, which has been employed to derive Figure 8.11.

The four variables are collected from the financial statements of the respective REIT immediately prior to the key valuation date and entered into Equation 8.6 to receive a Z"-Score. Figure 8.11 illustrates the size of the Z"-Score according to the credit rating. This classification has been derived from a sample including more than 750 rated firms headquartered in the United States. Considering that the approach suggested in this section could be used with REITs exhibiting no credit rating, it should be noted that the estimation of Z"-Scores does not rely on data obtained regarding firms domiciled outside the United States.[154]

Accordingly, a credit rating for a single REIT is derived on the basis of the calculated Z"-Score. The recent considerations point to the possibility of differences between bankruptcy probabilities of REITs and those of firms belonging to other industries. Hence, the credit rating based on the Z"-Score will be adjusted to account for the industry classification. Analogous to ALTMAN (2005, p. 314), the calculated credit rating is probably modified after a comparison to an industry rating.

For each full-letter grade difference between the industry grade and the rating obtained from the Z"-Score, the latter grade is adjusted up or down by one unit.[155] In case this difference amounts to a full rating class but less than two rating classes, the grade is adjusted by two units,[156] and so forth. Given that ALTMAN (2005) does not include an industry rating for REITs or real estate firms, the modal value of the sample of 83 REITs exhibiting credit ratings is used. Accordingly, most REITs obtained a credit rating of BBB.[157] Despite limited evidence, REITs belonging to the Japanese regime are found to have a credit rating with a modal value of A and can be separated from the remaining sample. In contrast, the modal value of the remaining sample does not change when excluding Japanese REITs. After the optional adjustment, the credit rating is transferred to a probability of bankruptcy by means of the methodology explained in the preceding section.

[154] See ALTMAN (2005, p. 313f) for further information.

[155] Accordingly, given a REIT industry rating of BBB, a REIT possessing a rating of A, A- or BBB+ is modified by one notch down.

[156] ALTMAN (2005), p. 314.

[157] Specifically, 22 out of 83 REITs received the rating BBB. As credit ratings are measured on an ordinal scale, the modus, as an applicable measure of central tendency, represents the most frequent value. [ECKEY/KOSFELD/TÜRCK (2005), p. 55f.]

***Figure 8.11: Size of Z''-Scores based on the credit ratings (Standard & Poor's notation).***

| Credit rating (Standard & Poor's notation) | Z''-Score |
|---|---|
| AAA | >8.15 |
| AA+ | >7.60 & ≤8.15 |
| AA | >7.30 & ≤7.60 |
| AA- | >7.00 & ≤7.30 |
| A+ | >6.85 & ≤7.00 |
| A | >6.65 & ≤6.85 |
| A- | >6.40 & ≤6.65 |
| BBB+ | >6.25 & ≤6.40 |
| BBB | >5.85 & ≤6.25 |
| BBB- | >5.65 & ≤5.85 |
| BB+ | >5.25 & ≤5.65 |
| BB | >4.95 & ≤5.25 |
| BB- | >4.75 & ≤4.95 |
| B+ | >4.50 & ≤4.75 |
| B | >4.15 & ≤4.50 |
| B- | >3.75 & ≤4.15 |
| CCC+ | >3.20 & ≤3.75 |
| CCC | >2.50 & ≤3.20 |
| CCC- | >1.75 & ≤2.50 |
| D | ≤1.75 |

*Adapted from ALTMAN (2005), p. 313f.*

## 8.4 Considerations regarding the value impact associated with agency costs

Several publications propose the consideration of the impact associated with agency costs[158] on firm value.[159] Apart from bankruptcy costs, agency costs are depicted as a trade-off for the potential tax benefits of leverage.[160] In this study, agency costs potentially represent a further disadvantage attached to the use of leverage, which cannot be offset by tax savings, as these are rather absent from REITs. Accordingly, this type of cost might exert a notable impact on firm value.

In the context of the agency theory[161], two types of conflicts have been distinguished that probably affect the size of agency costs.[162]

The first conflict type can arise between the management of a firm and the equity-holders. Given that the management owns less than 100% of the equity claims on the corporation, shareholders, who participate proportionally in the profits but are exposed to limited liabilities, hold the remaining fraction. Agency costs are incurred if management pursues non-pecuniary benefits completely for its own utility but bears only a fraction of the associated costs. These costs are avoided if management holds all equity claims. Alternatively, the use of debt potentially mitigates agency costs by means of reducing the FCF. Given the necessity of servicing debt, management will be disciplined to operate efficiently.[163] In this regard, the pecking order model and the signalling effect explained previously deliver further arguments for

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[158] The agency relationship relates to a contract that includes a person, characterised as the agent, who exhibits some authority to make decisions on behalf of one or more people called principal(s). Agency costs comprise bonding expenditures by the agent, monitoring costs incurred at the level of the principal and residual loss. Residual loss equals the difference between decisions made by the agent and decisions that are deemed to be optimal in terms of the principal's welfare. [JENSEN/MECKLING (1976), p. 308.]

[159] See, for example, MEGGINSON/SMART (2008, p. 515) or VAN HORNE/WACHOWICZ (2008, p. 463f).

[160] MEGGINSON/SMART (2008), p. 515.

[161] Following JENSEN (1994, p. 13), "Agency theory postulates that because people are, in the end, self-interested they will have conflicts of interests over at least some issues any time they attempt to engage in cooperative endeavours." This type of cooperation may include interaction in corporations that is part of the present examination. [JENSEN (1994), p. 13.]

[162] See JENSEN/MECKLING (1976).

[163] JENSEN (1986), p. 323-325; JENSEN/MECKLING (1976), p. 333f; MALONEY/McCORMICK/ MITCHELL (1993), p. 215. In this regard, FRIDAY/SIRMANS/CONOVER (1999, p. 75) found some evidence that a higher leverage ratio of REITs tends to limit agency costs.

the use of debt and for the benefit of narrowed agency costs. In summary, the utilisation of debt can mitigate a reduction in firm value due to agency costs.

A second type of conflict relates to the relationship between equity- and debtholders. If the company is partially financed by debt, creditors are exposed to the firm's business and operating risks. However, as management and external shareholders make the investment and operating decisions, they might be inclined to pursue activities to expropriate wealth from creditors. For example, the firm may make risky investments that deliver above-average returns, which are typically captured by equity- instead of debtholders. As a consequence, bondholders seek to prevent these activities by introducing covenants, which incur costs attached to their negotiation and enforcement. As a result, this type of conflict probably leads to an increase in the total present value of agency costs.[164]

In the case of REITs, several arguments lead to the conclusion of a diminished impact of the present value of agency costs on the firm value.

Generally, the restrictions regarding the assets held and the income generated by REITs may contribute to a lowering of agency costs. Specifically, these limitations narrow the possibility that the REIT can engage in other activities that might not be beneficial to equity- or bondholders.[165] In this regard, several REIT regimes have confined the possibility for REITs to engage in property development and trading activities. In contrast, specific attention should be devoted to regimes that do not confine these activities, such as the Australian REIT legislation.

REITs experience a diminution in discretionary cash flows due to the common requirement to distribute the bulk of their earnings to shareholders.[166] Likewise, the

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[164] JENSEN/MECKLING (1976), p. 334; MEGGINSON/SMART (2008), p 508. The explained participation in risky investments is called the asset substitution effect. Further sources of conflict arise due to dividend payments, claim dilution or underinvestment. In terms of dividend payments, the value of bonds is lowered if the bonds are priced based on the assumption that the company continues its dividend policy, whereas the dividend rate is actually increased at the expense of reduced investments. The claim dilution corresponds to the situation in which bonds are priced based on the premise that no further debt is issued while in reality the value of creditor claims is reduced by issuing additional debt of equal or even a higher priority. Underinvestment relates to the situation in which a firm rejects projects with a positive net present value as the profits would be captured by bondholders only. [MYERS (1977), p. 148f; SMITH/ WARNER (1979), p. 118f.]

[165] However, GHOSH/SIRMANS (2006), p. 328) noted that the specialisation on the real estate business might contribute to an entrenchment of the REIT management including the defense of takeovers. This behaviour might increase agency costs as the authors assume a positive relationship between the probability of takeover and the degree of firm monitoring. [GHOSH/SIRMANS (2006), p. 334.]

[166] FENG/GHOSH/SIRMANS (2007), p. 85.

shortened possibility for using earnings to pursue new activities potentially represents one reason for the funding activities of REITs on capital markets, which has been documented earlier. Financing activities on the capital markets, including analyst coverage[167] and the receipt of credit ratings might lead to a further decrease in agency costs.

Additionally, STULZ (1990, p. 23f) found that a reduction in the volatility of cash flows facilitates the ability of shareholders to monitor the activities of management. Considering that the primary cash flow component for REITs consists of rental revenues, which are typically fixed through leasing contracts, cash flow volatility can be reduced, thus contributing to a reduction in agency costs.

With regard to the assets held by a REIT, TITMAN/WESSELS (1988, p. 3) argued that the issuance of debt secured by properties decreases agency costs. A major reason for this reduction relates to the possibility granted to external parties to benchmark the REIT properties against comparable buildings that are traded in direct real estate markets. Similarly, information asymmetries are probably lowered as managers obtain debt restricted to use for specific projects, thus mitigating the possibility that the REIT invests sub-optimally at the expense of bondholders. Given the close bank relationships of Japanese firms documented above, the monitoring function in Japan should presumably contribute to a reduction in agency costs.[168]

Additionally, the amount of accounting discretion is assumed to be lower with REITs compared to companies in other industries.[169]

In contrast, the following reasoning rather dilutes the persuasiveness attached to the preceding arguments.

In their analysis of REITs headquartered in the United States, BRADLEY/CAPOZZA/SEGUIN (1998, p. 564-566) observed that cash flows available for distribution amount to two times the payout required by legislation, on average. Consequently,

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[167] In this sense, DEVOS/ONG/SPIELER (2007, p. 353f) provided evidence that a higher degree of monitoring through analyst coverage associated with REITs contributes to an increase in REIT value. In contrast, LEWIS/SPRINGER/ANDERSON (2003, p. 77) did not find evidence that debt provides a disciplining tool when analysing REITs domiciled in the United States.

[168] CAPOZZA/SEGUIN (1999b), p. 7; MORRI/BERETTA (2008), p. 25.

[169] CAPOZZA/SEGUIN (1999b), p. 8; MORRI/BERETTA (2008), p. 14. For example, HOLMSTROM (1989, p. 309) argued that agency costs of innovation projects, included in the financial statements in the research and development expenditures item, are relatively high. In contrast, REITs do not significantly pursue innovation projects.

the availability of discretionary cash flows might not be conspicuously diminished by the necessity of distributing cash flows.

HAN (2006, p. 474) asserted that real estate transactions carried out by REITs are difficult to monitor, as the underlying assets are beset with illiquidity and heterogeneity. Taking this argument into consideration, the possibility of benchmarking properties, thus reducing agency costs, might be limited but is still more pronounced than the possibility for firms exhibiting a higher share of intangible assets, such as companies in the technology sector. However, this possibility might also be affected by the regional or sectoral portfolio allocation. For example, a REIT investing in specialty real estate or in markets with a relatively small amount of investable real estate assets might not possess the possibility to benchmark its properties.

SHOME/SINGH (1995, p. 7) argued that large blockholders can mitigate agency costs by means of monitoring the activities of a firm. Given that the legislation in several countries[170] prohibits large block holdings by REIT shareholders, managers might be less pressed to reveal information about the company.[171]

Furthermore, the previous explanations document that REITs may be advised by an external contractor. If REITs retain outside management, agency costs can rise, as the problem of aligning interests between management and shareholders is exacerbated.[172] Given the recent evidence regarding the management and advisor structure, REITs that originated in Japan are probably burdened with additional agency costs.

Finally, quantifying agency costs seems to be difficult to accomplish.[173] Likewise, very few approaches have been proposed regarding the quantification of agency costs.[174] Given the scarcity of studies concerning the quantification of agency costs together with the recent arguments, which rather point to a reduced impact of agency costs with REITs, this type of cost is not considered in the valuation tool.

[170] A legislation that rather limits the possibility of blockholdings is present in 15 of the 27 REIT regimes.
[171] Adapted from MORRI/BERETTA (2008, p. 26).
[172] In this regard, CANNON/VOGT (1995, p. 314) confirmed the assumption that self-administered REITs are less exposed to agency problems than REITs advised by an independent contractor.
[173] Adapted from DEPKEN/NGUYEN/SARKAR (2006, p. 3f).
[174] McKNIGHT/WEIR (2009), p. 140.

## 8.5 Considerations regarding the value impact associated with taxation

In the context of corporate valuation, taxes relate to the income streams obtained from the company or to the discount rate. In this context, taxes on a company level and taxes on a shareholder level are distinguished.[175] REITs tend to largely avoid paying taxes due to the distribution of a high share of income to shareholders. Consequently, the value effect from the tax shield regarding interest payments is supposed to be largely narrowed. Furthermore, the tax shield due to capital gains taxes occurs in irregular intervals only as the sale of properties is usually not the main business activity of a REIT.

Given these considerations, the impact of taxes on the value of a REIT is assumed to be relatively small. Accordingly, no adjustment of the model regarding taxes is made.

[175] PEEMÖLLER (2005c), p. 32f.

# 9 Final assessment of the suggested REIT valuation tool

Having proposed an approach to REIT valuation, the strengths and weaknesses of the tool are reviewed in the following sections. Particularly, further explanations that should help to answer the research sub-question regarding the meaningfulness to introduce a new approach to REIT valuation are made while considering the previous assessment of existing REIT valuation tools.

The review concerns the general concept (9.1) associated with, and the components (9.2) included in, the proposed tool. Despite that the valuation tool should be assessed regarding its ability to fulfil both the principles of corporate valuation and the requirements formulated in Section 5.1, the primary task of corporate valuation concerns the determination of potential prices attached to a company. In this regard, a comparison of the REIT intrinsic value and the REIT stock price will be performed from a perspective potentially relevant to the valuation object. Specifically, the results of a quantitative assessment regarding the ability of the tool to project the long-term stock market returns of REITs are presented (9.3).

## 9.1 Basic concept

The valuation of a company such as a REIT is a complex issue.

Founded on market value-oriented valuation approaches, the tool relies on a going-concern scenario. Specifically, the underlying methodology of the tool relates to the APV model and is characterised by the following advantages and disadvantages.

A major strength associated with the APV concept refers to the possibility of examining the values arising from operating and investing activities separately from the value originating from debt financing activities. Consequently, the impact of each of these activities on the firm becomes obvious. Furthermore, the model offers the flexibility to reflect a discretionary number of valuation components. For example, if the REIT carries out business activities beyond those previously considered, these can also be valued as separate components. However, the APV concept does not explicitly consider advantages or disadvantages of scope, which may in reality exist between the projects carried out by a REIT, particularly because the business activities are largely concerned about real estate assets.

More data need to be collected and processed to apply the proposed tool than for REIT valuation approaches that rely on market- or cost-oriented valuation methodologies.
On the one hand, the user has to compile the factors that are needed for the determination of the cost of equity employed in the model. Particular outlay is associated with the calculation of the combined six-factor model proposed recently. Whereas the leading indicator and the stock market variable can be retrieved from databases, the availability of the remaining four factors is restricted, leaving the estimation task to the user. Likewise, a uniform applicability of the model across countries is compromised, given the differences observed concerning the impact of the explanatory variables being dependent on the REIT regime considered. Despite its reduced explanatory power, the CAPM is employed with REITs domiciled in countries that do not possess a number of REITs sufficient for meaningful conclusions to be drawn. Additionally, as REIT regimes can be subject to regulatory or other differences, the predictability of factors influencing equity returns can be hampered. Despite the potential advantages, the model assumes that the discount rates remain constant over the planning periods. However, changes in the geographical or sectoral portfolio allocation may result in changing risk and return characteristics, which are not captured through a variation of the discount rate.
On the other hand, the past and current items included in the cash flow calculation schemes have to be collected and forecast.
A reliable company forecast requires an analysis of the macroenvironment, the microenvironment and the company itself. However, an examination of the company and its environment can be very time-consuming. The forecasting task is not only affected by subjectivity, reducing the traceability of the methodology, but also demands a sufficient knowledge by the user regarding REITs and their underlying assets.
Furthermore, the valuation of REITs that are assembling their portfolios can be subject to difficulties, as the user needs to project the intentions of the REIT man-

agement regarding the future orientation of both the portfolio allocation and the business activities.
Besides this, the user benefits from the application of the valuation model as a more profound understanding of the respective firm and its environment are typically obtained. It is probable that this procedure represents the most reliable means to identify not only current strengths and weaknesses, but also future opportunities and risks regarding the profitability of the company.
To reduce the cost attached to the projection of cash flows, the explicit planning period is confined with the following period summarised in a terminal value. However, the terminal value is calculated through a rough approximation only. A major difficulty relates to the incorporation of long-term growth prospects and long-term risk in the terminal value. As seen before, the terminal value can account for a large fraction of the total REIT value. Although this issue should be more pronounced with firms operating in less capital-intensive sectors, it has been observed that several REITs are in the stage of assembling their portfolio, thus potentially leading to a relatively large share of cash inflows occurring when the portfolio has been established. In this context, the observation of comparatively high past growth rates of REITs has been addressed through the use of a terminal value calculation including two phases with different growth rates.

Fortunately, the access to information on REITs has also improved due to the availability of company data on the Internet. Additionally, the use of sophisticated software packages clearly facilitates the valuation task. In contrast, the bulk of data used in the FCF calculation is obtained from financial statements. If accounting standards show variations by REIT regime, the comparability between firms across countries might be limited.[1]
Additionally, there exists the possibility of applying a sensitivity analysis to identify a potential scope regarding future company development. In terms of its applicability, the valuation tool can be employed to derive both an absolute and a relative

[1] Adapted from THOMASCHOWSKI/REHKUGLER/NACK (2003, p. 58).

valuation measure.[2] In this regard, the tool not only provides a recommendation when a situation of a transfer of ownership is aspired to, but also can deliver information that is useful to the management of the company. However, the result of the model does not always provide a final recommendation from an investors' perspective. In this regard, taxes at the investor level are not considered in the model, but could affect investment decisions.

## 9.2 Cash flow components

Notably, the REIT represents a complex entity. In this regard, the use of two different cash flow calculation schemes helps to identify the impact of specific business activities on the valuation result. This possibility allows decisions to be made regarding whether to proceed with or to alter a specific combination of business activities. As a drawback, this methodology entails a higher amount of work. In addition, the differentiation between cash flows from different business activities can be hampered through the possibility that REITs will publish balance sheet items that are not distinguished between operating, investing and financing activities.

In the following sections, the cash flows from operating (9.2.1), investing (9.2.2) and financing (9.2.3) activities are considered in greater detail.

### 9.2.1 Operating activities

As the model includes FCFs generated from the real estate holding, management and operating business, the sustained earnings power of the underlying real estate assets is explicitly considered.

However, the cash flow calculation scheme pertaining to the real estate holding, management and operating businesses requires the collection of a variety of cash flow items. In the event that a REIT does not publish individual items, such as rental revenues or operating expenses, the estimation of a substitute increases the outlay

[2] On the one hand, the resulting net present value per share can be compared to the current stock price to identify a possible under- or overvaluation. On the other hand, the ratio of the NPV per share to the stock price can be compared to the respective ratios of comparable entities.

associated with the execution of the valuation task and potentially results in imprecise approximations.

### 9.2.2 Investing activities

Complementary to the FCFs from the real estate holding, management and operating business, the valuation tool allows the identification of the impact of real estate investing activities on the valuation result. Specifically, the tool explicitly considers cash flows from the purchase and sale of real estate assets. Recent analyses revealed that investing activities might have an important influence on the valuation result. Nevertheless, it should be noted that the projection of FCFs from investing activities could be associated with difficulties. In particular, REITs seem to acquire and sell properties depending on the state of the real estate market cycle. Accordingly, cash flows from investing activities can have values close to zero in a single year but a large positive or negative value in the previous or in the following time period.

### 9.2.3 Financing activities

Given the absence of a tax shield effect to a large extent, the question of why REITs employ considerable debt has been addressed in greater detail. This examination is supported by the separate investigation of financing activities in the valuation tool.
In this regard, not only the costs of financing, but also agency or bankruptcy costs, have been examined. Many of the valuation models consider the company to have an infinite life while ignoring the possibility of a bankruptcy. Instead, the proposed tool reflects the expected costs of a bankruptcy. However, the methodology for addressing bankruptcy costs considered in this work represents a vague estimation regarding the actual costs. Apart from this, possible principal-agent problems have been examined, but are not included in the valuation tool.

Likewise, the model assumes that the absolute amount of debt used by the REIT is known over the forecasting period. Therefore, the debt position is independent of a possible change in the value of the company. This premise can be rather justified when the valuation object has a limited lifetime. Over the long term, the premise of a debt policy that is completely uncoupled from the company development might not be realistic.[3] As documented before, REITs often have to limit their debt position to maintain their REIT status. In this context, the REIT management might have to reduce their debt exposure if the equity value of the firm decreases. In addition, REITs that follow a certain target debt ratio intend to raise the debt position following an increase in the equity value. From this perspective, it would seem to be more reasonable to use the WACC approach, which assumes a fixed debt ratio.

## 9.3 Comparison of the results of an investment strategy based on the proposed valuation tool against alternative investment strategies

Recent recommendations regarding the assessment and valuation of REITs have been considered to estimate the net present value on a per share basis. From an investors' perspective, it appears to be of particular interest whether an investment strategy based on the proposed REIT valuation tool can lead to higher returns than do alternative investment strategies.

Specifically, the results of the application of the valuation tool are used to select or not select a REIT stock investment. In this context, Appendix 7.3 includes an overview regarding the suggested approach to forecast FCFs from operating as well as from investing activities. Subsequently, the long-term performance of the REITs extracted on the basis of the valuation tool has been compared to that of alternative investment strategies. In this regard, the NAV approach has been considered as a REIT valuation method. In addition, the results on the basis of the PER as a market-oriented valuation approach are considered. Finally, the performance when using the valuation tools is benchmarked against the possibility of buying the respective listed real estate market country index, which is called passive investment strategy.

In this context, a sample of 20 REITs, listed in Figure 9.1, has been collected. The dataset includes ten firms that underperformed the listed real estate market benchmark and ten companies that outperformed the benchmark over a ten-year time

[3] STEINER/BRUNS (2002), p. 246.

## *Figure 9.1: Summary of the results of valuation-based investment strategies.*

| Name of REIT | Sector specialisation | Total return (January 2000-December 2009) | Stock price | Proposed valuation tool | | NAV approach | | PER approach | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NPV per share | Recommen-dation | NAV per share | Recommen-dation | PER | Recommen-dation |
| **Benchmark** | --- | **40.01%** | --- | --- | --- | --- | --- | **18.1** | --- |
| **Above-average returns** | | | | | | | | | |
| Tanger Factory Outlet | Merchandise centres | 132.39% | 10.38 | 31.45 | Buy | 14.21 | Buy | 11.72 | Buy |
| Simon Property Group | Merchandise centres | 129.29% | 21.90 | 51.36 | Buy | 24.52 | Buy | 22.94 | Do not buy |
| Federal Realty | Community centres | 128.67% | 18.70 | 51.32 | Buy | 104.84 | Buy | 18.34 | Do not buy |
| Health Care Property | Health care | 93.94% | 11.94 | 36.69 | Buy | 12.81 | Do not buy | 10.61 | Buy |
| Realty Income | Free-standing | 92.13% | 10.31 | 14.93 | Buy | 99.86 | Buy | 13.39 | Buy |
| AvalonBay Communities | Apartments | 89.70% | 33.48 | 48.63 | Buy | 35.18 | Do not buy | 15.74 | Do not buy |
| Essex Property Trust | Apartments | 90.03% | 34.00 | 27.02 | Do not buy | 34.39 | Do not buy | 23.00 | Do not buy |
| Vornado | Office | 83.28% | 30.41 | 27.28 | Do not buy | 35.2 | Buy | 16.29 | Do not buy |
| National Retail | Free-standing | 75.86% | 9.94 | 29.46 | Buy | 12.07 | Buy | 8.57 | Buy |
| Mid Americas | Apartments | 75.80% | 22.63 | 41.41 | Buy | 95.29 | Buy | 24.33 | Do not buy |
| **Below-average returns** | | | | | | | | | |
| Post Properties | Self-storage | -66.86% | 38.25 | 57.83 | Buy | 40.45 | Do not buy | 16.00 | Do not buy |
| Apartment & Investment Management | Apartments | -52.39% | 26.88 | 40.68 | Buy | 44.21 | Buy | 99.50 | Do not buy |
| Duke Realty | Office | -44.02% | 18.90 | 2.95 | Do not buy | N/A | N/A | 14.32 | Buy |
| Colonial Properties | Diversified | -42.47% | 17.94 | 28.26 | Buy | 32.26 | Buy | 9.70 | Buy |
| Brandywine Realty | Office | -36.21% | 16.38 | 21.64 | Buy | 91.22 | Buy | 20.47 | Do not buy |
| ProLogis | Industrial | -34.08% | 19.25 | 39.29 | Buy | 19.79 | Do not buy | 23.18 | Do not buy |
| Commonwealth REIT (formerly HRPT Properties) | Office | -32.16% | 8.92 | 45.24 | Buy | 41.63 | Buy | 10.38 | Buy |
| Weingarten Realty | Diversified | 13.41% | 17.31 | 49.37 | Buy | 18.76 | Do not buy | 13.61 | Buy |
| Kimco | Community centres | 18.08% | 11.29 | 23.22 | Buy | 12.51 | Buy | 13.77 | Buy |
| Liberty Property | Free-standing | 25.72% | 24.75 | 18.19 | Do not buy | 101.83 | Buy | 12.56 | Buy |
| **Share of REITs that have been classified correctly** | | | | | **50.00%** | | **52.63%** | | **40.00%** |

*Source: Own calculations based on the total sample (20 of 218 REITs) and annual financial statements of REITs and Bloomberg*
*Notes: Recommendations marked in blue (red) colour indicate that the tool has chosen the correct (wrong) decision in terms of achieving a positive REIT stock price performance. The benchmark equals the MSCI Real Estate USA Index. Unfortunately, some information are not available and thus denoted as "N/A".*

period starting at the beginning of 2000. To ensure comparability between the performances of investment strategies based on the different valuation tools, the key valuation date has been set to the 31st of December 1999.[4] In this regard, it is assumed that the financial statements published by the firm for the fiscal year ending in 1999 are available to the user. Considering the results of the valuation tools, the user or an investor commits capital to the selected firms as of the first of January of 2000. Accordingly, the selected stocks are held over a time period beginning in January 2000 and ending in December 2009. This procedure ensures the availability of performance data on the selected stock(s) of up to ten years. With regard to the NAV approach, the stock is purchased if the NAV per share exceeds the stock price published on December 31, 1999 by at least 10%. Similarly, a stock is bought, when the intrinsic value estimated by the proposed valuation tool exceeds the stock price prevailing at the key date of valuation by at least ten percent. With regard to the PER, the stock of a REIT is bought if the PER has a value equal to or below 15.00 and does not exceed the PER of the listed real estate market index on December 31, 1999.[5] Considering that the listed real estate market PER regarding the United States had a value of 18.10 as of 31st of December 2009, the stock is bought if it has a value equal to or below 15.00.[6]

Figure 9.1 indicates that only 50 percent of all recommendations based on the application of the proposed valuation tool are correct. Further, the approach has been found to be heavily sensitive to the forecast of the net cash received from the sale of real estate assets and cash paid for acquisitions items, both of which are included in the FCFs from the investing activities calculations scheme. Additionally, the bulk of sampled REITs exhibited investing cash flows that were close to zero for several years prior to the key valuation date. This observation points to the argument that REITs had started to establish their real estate portfolios, thus increasing the complexity of the valuation task.[7] Given that the sampled REITs mainly established their real estate portfolios during the nineties, which partly provides an explanation re-

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[4] The availability of REITs has been further confined due to the requirement that historical data on REITs for a time period of five consecutive years preceding the key valuation date are available.

[5] Adapted from DAMODARAN (2002, p. 468-481).

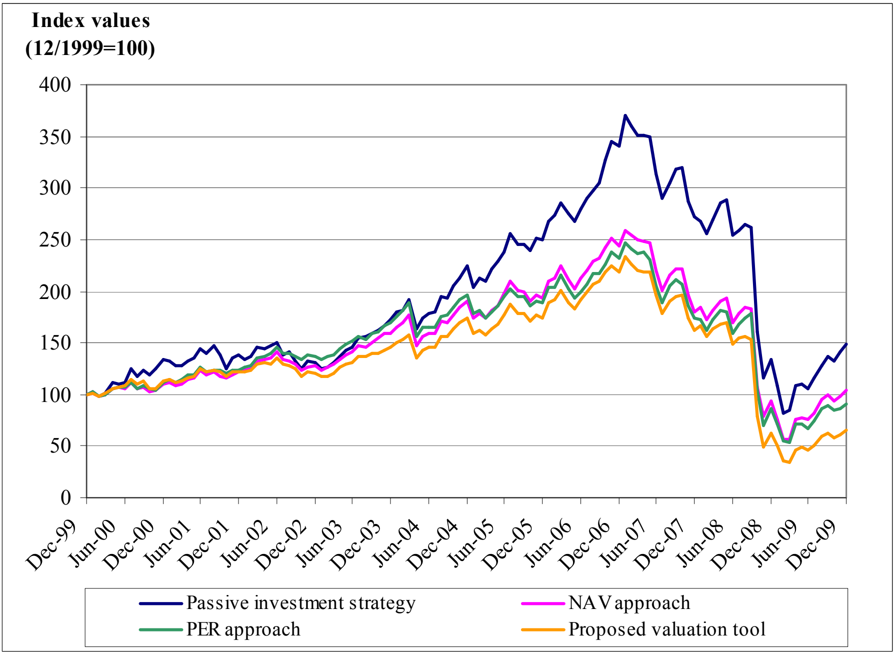
[6] Adapted from DAMODARAN (2002, p. 468-481).

[7] The complete dataset shows that the zero values belonging to these items changed into an increased number of non-negative values subsequent to the key valuation date.

garding the high growth rates observed previously, the projection of future cash flows through the proposed tool has been too optimistic. Besides this, all sampled REITs realised a positive interest rate disparity when compared to a 15-year mortgage rate at the corresponding point in time. Consequently, there exists little evidence regarding an interest rate disparity.

The resulting performance of equally-weighted portfolios selected on the basis of the recommendations by the different valuation tools are summarised in Figure 9.2.

***Figure 9.2: Summary of the performance of stocks selected due to valuation-based investment strategies.***




| | 10 years 2000-2009 | 5 years 2000-2004 | 3 years 2000-2002 |
|---|---|---|---|
| **Passive investment strategy** | 40,01% | 81,05% | 54,12% |
| **NAV approach** | 4,37% | 64,31% | 39,66% |
| **PER approach** | -10,20% | 67,28% | 35,92% |
| **Proposed valuation tool** | -42,43% | 55,68% | 37,41% |

*Source: Own calculations based on the total sample (20 of 218 REITs), Bloomberg and annual financial statements of REITs*

Accordingly, a passive investment strategy outperformed all other strategies.
In summary, the results are not superior in terms of stock market performance when basing investment decisions on the proposed valuation tool. Nevertheless, the small sample size prevents a definite conclusion. Moreover, the valuation tool may require further refinement.

# 10 Conclusions

The financial literature has scrutinised a variety of corporate valuation models. In this sense, payoff- and market-oriented methodologies have emerged as important approaches used within corporate valuation. In contrast, a scarce amount of scientific research has been devoted to the valuation of REITs. Academic research that tests the existing valuation methodologies and underlying metrics is also rare. Although REIT-specific measures such as the FFO have been proposed, their information content on stock prices has been limited in comparison to other earnings measures.

Nevertheless, the demand for a REIT valuation tool becomes apparent when considering the unique features attached to these firms. In particular, REITs are bound to a variety of legal requirements. These restrictions primarily concern the organisational structure, the stock exchange listing, the shareholder base, the asset base, the capital structure and the distribution requirements. If an entity conforms to these rules, it can typically adopt a REIT status and might be rewarded through a tax exemption on earnings distributed to its shareholders. In this work, particular attention has been paid to the type of assets held in addition to the business activities carried out by REITs. Specifically, the legal restrictions regarding the type of assets owned by a REIT confine the business activities followed by the company. Within the legal framework, the bulk of REITs concentrate their activities on the holding, management and operating of real estate assets. In contrast, real estate development, trading or servicing activities are performed to a reduced extent, provided that these are permitted through country-specific REIT legislation. Given the importance of legal restrictions, a valuation tool could specifically address the business activities, relying on a comparatively high certainty that the REIT confines its services to these operations.

However, this advantage is not specifically addressed in existing valuation tools. Specifically, the value attached to purchasing and selling real estate assets is not explicitly captured by existing approaches. In addition, previous REIT valuation models are beset with further disadvantages. Although measures such as NAV, FFO or AFFO attempt to consider the specific features of Real Estate Investment Trusts, the valuation approaches employing these measures are often criticised for neglecting the principle of future orientation. In this regard, the bulk of existing methods are classified as market- or cost-oriented valuation approaches, and these have been subject to criticism as well. Notably, it has been contended that market- or cost-oriented valuation approaches cannot substitute for a profound company valuation.

Based on these issues, a new approach to REIT valuation has been proposed in this work. This model relies on the APV concept and provides flexibility in accommodating different activities pursued by REITs. Similarly, the impact of each activity on the valuation result can be identified separately. In particular, three main cash flow sources (i.e., investing, operating and financing activities) are considered in the suggested tool. Foremost, the operating activities of the REIT are valued without taking financing and investing activities into account. This procedure helps to detect the true operating efficiency of the REIT. Based on the examination of REIT activities, the cash flows from the holding, management and operating of real estate assets contribute a large share of total revenues. Accordingly, particular attention has been paid to the forecasting of operating cash flows including these activities. Given the cyclicality of real estate markets, investing activities may exhibit a considerable impact on the valuation result. The cash flows arising from investing activities have been summarised in a separate scheme. The value effect attached to the use of debt has been disclosed while investigating several components. Unlike other REIT valuation approaches, the tool considered in this work also reflects the costs associated with bankruptcy.
In addition to the derivation of free cash flows, exceptional attention has been paid to the calculation of the cost of equity, as minor changes in this variable can lead to significant alterations of the valuation result. Specifically, a six-factor model and the CAPM have been recommended for the calculation of the cost of equity within the valuation tool.

Nevertheless, the valuation tool suggested in this study is associated with a variety of drawbacks. The main disadvantage is the comparatively large amount of data needed to accomplish the valuation task. Particular outlay is attached to the requirement to forecast cash flows from both investing and operating activities. Additionally, the user could be prompted to calculate four variables included in the six-factor model, as these may not be retrieved from databases.

The new approach suggested in this work can provide a useful starting point for future valuation of REITs. Specifically, the valuation-by-components approach allows a further development regarding the choice of components that are assumed to be the most relevant to value. Similarly, given an expected increase in long-term data availability in future years, further investigation of the proposed tool, also under consideration of investment strategies, might provide improved results. Despite the advantages of the REIT valuation tool considered here, the user should beware of relying solely on this approach. Rather, it seems to be helpful to apply other valuation approaches to verify or modify the results of the tool proposed in this study.

Various other topics relevant to REIT valuation have not been addressed by the scientific literature until now. Specifically, academic research on REITs outside the United States is very limited. Although REIT regimes have been established in 27 countries, the firms involved have not been subject to sufficient academic work. The statistical analyses considering REIT stock exchange returns as a dependent variable reveal differences in the explanatory power of independent variables subject to the country of origin pertaining to the REIT. Future research should elaborate on these differences.

Likewise, various assumptions have been made about the factors influencing free cash flows generated by REITs. In this context, little research has addressed the link between cash flows and explanatory variables. Nevertheless, recent analyses have revealed the existence of notable variations in cash flows and potentially show a connection with stock price changes as well. In this regard, there is an additional need to examine the investing activities carried out by REITs in greater detail.

Although the capital structure of REITs has been addressed by a few studies, profound explanations for why REITs employ leverage are still nonexistent. Further, the magnitude of bankruptcy costs and the probability of bankruptcy are still subject to enhanced uncertainty. In this sense, the possibility of sector-specific differences in the magnitude of both direct and indirect bankruptcy costs requires further investigation. Moreover, the probability of REITs entering into a bankruptcy proceeding should be examined. The necessity of this analysis becomes apparent when considering the large number of non-investment grade ratings that have been awarded by credit rating agencies to REITs.

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# Appendix 1: Research questions

| Main research question |
|---|
| Which approach is particularly suitable for the determination of an intrinsic value of a Real Estate Investment Trust (REIT)? |

| Sub-questions | |
|---|---|
| 1 | What are the distinctive features of a REIT? |
| 2 | What are the results of an assessment of the existing approaches to REIT valuation? |
| 3 | Which objectives are associated with the valuation of a REIT? |
| 4 | Which requirements should be fulfilled by an approach to the valuation of a REIT? |
| 5 | Which factors probably possess a high influence on the intrinsic value of a REIT? |
| 6 | How can a new approach to REIT valuation be structured? |
| 7 | Why is it meaningful to expand the spectrum of existing REIT valuation tools through a new approach? |

*Source: Own considerations*

# Appendix 2.1: Constituents of the REIT sample

| | Name of the REIT | Country of headquarters | Bloomberg ticker |
|---|---|---|---|
| 1 | Abacus Property | Australia | ABP |
| 2 | Ale Property Group | Australia | LEP |
| 3 | Ardent Leisure Group | Australia | MLE |
| 4 | Aspen | Australia | APZ |
| 5 | Australand | Australia | ALZ |
| 6 | Australia Commercial Property Trust | Australia | ARN |
| 7 | Australian Education | Australia | AEU |
| 8 | Bunnings Warehouse | Australia | BWP |
| 9 | Carindale | Australia | CDP |
| 10 | Centro | Australia | CNP |
| 11 | CFS Retail | Australia | CFX |
| 12 | Commonwealth | Australia | CPA |
| 13 | Cromwell Group | Australia | CMW |
| 14 | Dexus Property Group | Australia | DXS |
| 15 | Geo Property Group | Australia | GPM |
| 16 | GPT Group | Australia | GPT |
| 17 | ING Entertainment Fund | Australia | IEF |
| 18 | ING Industrial Fund | Australia | IIF |
| 19 | ING Office Fund | Australia | IOF |
| 20 | ING Real Estate Community | Australia | ILF |
| 21 | Living and Leisure | Australia | LLA |
| 22 | Charter Hall Retail (formerly Macquarie Countrywide) | Australia | MCW |
| 23 | EDT Retail Trust (formerly Macquarie DDR) | Australia | MDT |
| 24 | Charter Hall Office (formerly Macquarie Office) | Australia | MOF |
| 25 | Mirvac | Australia | MGR |
| 26 | Stockland Trust | Australia | SGP |
| 27 | Thakral | Australia | THG |
| 28 | Valad | Australia | VPG |
| 29 | Westfield Group | Australia | WDC |
| 30 | Westpac Office | Australia | WOT |
| 31 | Befimmo | Belgium | BEFB |
| 32 | Cofinimmo | Belgium | COFB |
| 33 | Home Invest | Belgium | HOMI |
| 34 | Intervest Offices | Belgium | INTO |
| 35 | Intervest Retail | Belgium | INTV |
| 36 | Leasinvest | Belgium | LEAS |
| 37 | Retail Estates | Belgium | RET |
| 38 | Service flats Invest | Belgium | SER |
| 39 | Warehouses de Pauw | Belgium | WDP |
| 40 | Warehouses | Belgium | WEB |
| 41 | Allied Property REIT | Canada | AP.UN |
| 42 | Artis REIT | Canada | AX.UN |
| 43 | Boardwalk REIT | Canada | BEI.UN |
| 44 | Calloway REIT | Canada | CWT.UN |

*Source: Own considerations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*

| | Name of the REIT | Country of headquarters | Bloomberg ticker |
|---|---|---|---|
| 45 | Canadian Apartment | Canada | CAR.UN |
| 46 | Canadian REIT | Canada | REF.UN |
| 47 | Chartwell Seniors | Canada | CSH.UN |
| 48 | Cominar | Canada | CUF.UN |
| 49 | Dundee REIT | Canada | D.UN |
| 50 | H&R REIT | Canada | HR.UN |
| 51 | Huntingdon REIT | Canada | HNT.UN |
| 52 | InnVest | Canada | INN.UN |
| 53 | Lakeview Hotel REIT | Canada | LHR.UN |
| 54 | Lanesborough | Canada | LRT.UN |
| 55 | Morguard REIT | Canada | MRT.UN |
| 56 | Northern Properties | Canada | NPR.UN |
| 57 | Primaris Retail | Canada | PMZ.UN |
| 58 | Retrocom Mid-Market | Canada | RMM.UN |
| 59 | Riocan | Canada | REI.UN |
| 60 | Royal Host | Canada | RYL.UN |
| 61 | ADT SIIC | France | EADT |
| 62 | Affine | France | IML |
| 63 | Fonciere des Regions | France | FDR |
| 64 | Gecina | France | GFC |
| 65 | Klepierre | France | LI |
| 66 | SIIC de Paris 8eme | France | BSHO |
| 67 | SIIC de Paris | France | IMMP |
| 68 | Silic | France | SIL |
| 69 | Soc de la Tour Eiffel | France | EIFF |
| 70 | Societe Fonciere Lyonnaise | France | FLY |
| 71 | Unibail | France | UL |
| 72 | Frontier Real Estate | Japan | 8964 |
| 73 | Global One | Japan | 8958 |
| 74 | Japan Prime Realty | Japan | 8955 |
| 75 | Japan Real Estate Investment | Japan | 8952 |
| 76 | Japan Retail Fund | Japan | 8953 |
| 77 | Mori Trust Sogo | Japan | 8961 |
| 78 | Nippon Building Fund | Japan | 8951 |
| 79 | Nippon Residential | Japan | 8962 |
| 80 | Nomura Real Estate | Japan | 8959 |
| 81 | Orix | Japan | 8954 |
| 82 | Premier Investment | Japan | 8956 |
| 83 | Tokyu REIT | Japan | 8957 |
| 84 | United Urban | Japan | 8960 |
| 85 | Corio | Netherlands | VIB |
| 86 | Eurocommercial | Netherlands | ECMPA |
| 87 | Nieuwe Steen | Netherlands | NISTI |
| 88 | Vastned Office | Netherlands | VNOI |
| 89 | Vastned Retail | Netherlands | VASTN |

*Source: Own considerations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*

| | Name of the REIT | Country of headquarters | Bloomberg ticker |
|---|---|---|---|
| 90 | Wereldhave | Netherlands | WHA |
| 91 | AMP REIT | New Zealand | APT |
| 92 | Goodman Property | New Zealand | GMT |
| 93 | ING Property | New Zealand | ING |
| 94 | Kiwi Income Property Trust | New Zealand | KIP |
| 95 | National Property Trust | New Zealand | NAP |
| 96 | Property for Industry | New Zealand | PFI |
| 97 | Ascendas REIT | Singapore | AREIT |
| 98 | CapitaLand | Singapore | CAPL |
| 99 | CapitaMall | Singapore | CT |
| 100 | CapitaCommercial | Singapore | CCT |
| 101 | Fortune REIT | Singapore | FRT |
| 102 | Suntec REIT | Singapore | SUN |
| 103 | Capital Property Fund | South Africa | CPL |
| 104 | Emira Property Fund | South Africa | EMI |
| 105 | Fountainhead Property Trust | South Africa | FPT |
| 106 | SA Corporate Real Estate | South Africa | SAC |
| 107 | Alarko Gayrimenkul | Turkey | ALGYO |
| 108 | Atakule Gayrimenkul | Turkey | AGYO |
| 109 | Dogus GE | Turkey | GRGYO |
| 110 | Is Gayrimenkul | Turkey | ISGYO |
| 111 | Nurol | Turkey | NUGYO |
| 112 | Özderici | Turkey | CMYO |
| 113 | Vakif | Turkey | VKGYO |
| 114 | Y&Y | Turkey | GMYO |
| 115 | Yapi Kredi | Turkey | YKGYO |
| 116 | Acadia Realty | USA | AKR |
| 117 | Agree Realty | USA | ADC |
| 118 | Alexanders Inc. | USA | ALX |
| 119 | Alexandria | USA | ARE |
| 120 | AMB Property | USA | AMB |
| 121 | American Campus Communities | USA | ACC |
| 122 | Apartment & Investment Management | USA | AIV |
| 123 | Ashford Hospitality | USA | AHT |
| 124 | Associated Estates | USA | AEC |
| 125 | AvalonBay Communities | USA | AVB |
| 126 | Biomed Realty | USA | BMR |
| 127 | Boston Properties | USA | BXP |
| 128 | Brandywine Realty | USA | BDN |
| 129 | BRE Properties | USA | BRE |
| 130 | Camden Property | USA | CPT |
| 131 | CBL Associates | USA | CBL |
| 132 | Cedar | USA | CDR |
| 133 | Colonial Properties | USA | CLP |
| 134 | Commonwealth REIT (formerly HRPT Properties) | USA | HRP |

*Source: Own considerations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*

| Name of the REIT | | Country of headquarters | Bloomberg ticker |
|---|---|---|---|
| 135 | Corporate Office | USA | OFC |
| 136 | Cousins Properties | USA | CUZ |
| 137 | Developers Diversified | USA | DDR |
| 138 | Digital Realty | USA | DLR |
| 139 | Duke Realty | USA | DIE |
| 140 | East Group | USA | EGP |
| 141 | Entertainment Properties | USA | EPR |
| 142 | Equity Lifestyle | USA | ELS |
| 143 | Equity One | USA | EQY |
| 144 | Equity Residential | USA | EQR |
| 145 | Essex Property Trust | USA | ESS |
| 146 | Extra Space Storage | USA | EXR |
| 147 | Federal Realty | USA | FRT |
| 148 | FelCor Lodging | USA | FCH |
| 149 | First Industrial | USA | FR |
| 150 | First Potomac | USA | FPO |
| 151 | Forest City | USA | FCE.A |
| 152 | Getty Realty | USA | GTY |
| 153 | Gladstone Commercial | USA | GOOD |
| 154 | Glimcher Realty | USA | GRT |
| 155 | Health Care Property | USA | HCP |
| 156 | Health Care REIT | USA | HCN |
| 157 | Healthcare Realty | USA | HR |
| 158 | Hersha Hospitality | USA | HT |
| 159 | Highwoods | USA | HIW |
| 160 | HMG Courtland | USA | HMG |
| 161 | Home Properties | USA | HME |
| 162 | Hospitality Properties | USA | HPT |
| 163 | Host Hotels | USA | HST |
| 164 | Inland Real Estate | USA | IRC |
| 165 | Investors Real Estate | USA | IRET |
| 166 | Kilroy | USA | KRC |
| 167 | Kimco | USA | KIM |
| 168 | Kite Realty | USA | KRG |
| 169 | LaSalle | USA | LHO |
| 170 | Lexington Realty | USA | LXP |
| 171 | Liberty Property | USA | LRY |
| 172 | LTC Properties | USA | LTC |
| 173 | Macerich | USA | MAC |
| 174 | Mack-Cali | USA | CLI |
| 175 | Maguire | USA | MPG |
| 176 | Mhi Hospitality | USA | MDH |
| 177 | Mid Americas | USA | MAA |
| 178 | Mission West | USA | MSW |
| 179 | Monmouth | USA | MNRTA |

*Source: Own considerations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*

| | Name of the REIT | Country of headquarters | Bloomberg ticker |
|---|---|---|---|
| 180 | National Retail | USA | NNN |
| 181 | Nationwide Health | USA | NHP |
| 182 | Omega Healthcare | USA | OHI |
| 183 | One Liberty | USA | OLP |
| 184 | Pacific Office | USA | PCE |
| 185 | Parkway Properties | USA | PKY |
| 186 | Pennsylvania REIT | USA | PEI |
| 187 | Post Properties | USA | PPS |
| 188 | ProLogis | USA | PLD |
| 189 | PS Business Trust | USA | PSB |
| 190 | Public Storage | USA | PSA |
| 191 | Ramco-Gershenson | USA | RPT |
| 192 | Realty Income | USA | O |
| 193 | Regency Centers | USA | REG |
| 194 | Roberts Realty | USA | RPI |
| 195 | Saul Centers | USA | BFS |
| 196 | Senior Housing | USA | SNH |
| 197 | Simon Property Group | USA | SPG |
| 198 | SL Green Realty | USA | SLG |
| 199 | Sovran Self Storage | USA | SSS |
| 200 | Starwood Hotels | USA | HOT |
| 201 | Strategic Hotels | USA | BEE |
| 202 | Sun Communities | USA | SUI |
| 203 | Sunstone | USA | SHO |
| 204 | Supertel Hospitality | USA | SPPR |
| 205 | Tanger Factory Outlet | USA | SKT |
| 206 | Taubman Centers | USA | TCO |
| 207 | Thomas Properties | USA | TPGI |
| 208 | United Dominion Realty | USA | UDR |
| 209 | United Mobile Homes | USA | UMH |
| 210 | Universal Health Realty | USA | UHT |
| 211 | Urstadt Biddle | USA | UBP |
| 212 | U-Store IT | USA | YSI |
| 213 | Ventas | USA | VTR |
| 214 | Vornado | USA | VNO |
| 215 | Washington Real Estate | USA | WRE |
| 216 | Weingarten Realty | USA | WRI |
| 217 | Winthrop REIT | USA | FUR |
| 218 | WP Carey | USA | WPC |

*Source: Own considerations based on EPRA (2010), Bloomberg, country-specific stock exchanges and REITs' web presences*

# Appendix 2.2: Comparison of country-specific REIT legislation: Taxation (1/3)

| *REIT regime* | *Current income* |
|---|---|
| 1 Australia | not taxable in the hands of the trustee provided the unitholders are presently entitled to the trust's income at the end of the income year |
| 2 Belgium | The eligible rental income is excluded from the taxable basis. |
| 3 Bulgaria | all income is tax-exempt |
| 4 Canada | A REIT is entitled to deduct in a year all income determined for purposes of the Income Tax Act paid or payable to unitholders in the year so it may reduce its net taxable income to zero. |
| 5 Finland | all income is tax-exempt |
| 6 France | eligible income tax-exempt |
| 7 Germany | all income is tax-exempt |
| 8 Hong Kong | REIT is exempt from profits tax but may be subject to property tax. Foreign sourced income is tax-exempt. |
| 9 Israel | Distributed eligible income is not taxed. Undistributed prohibited income is subject to a 60% tax rate. In case of a distribution a 70% tax rate comes due. |
| 10 Italy | eligible income is tax-exempt |
| 11 Japan | Corporate tax of 42% with dividends being deductible from taxable income. |
| 12 Malaysia | REITs are tax-exempt if 90% of total income is distributed |
| 13 Mexico | Mexico has two corporate taxes Income Tax and Single Rate Tax. Income tax is levied at a rate of 28% on taxable income (taxable revenues minus authorised deductions) calculated on an accrual basis. The Single Rate Tax is levied at a rate of 17.5% on a base consisting of a taxpayer's revenue less certain deductions, all determined on a cash basis. |
| 14 Netherlands | Real estate income is part of the taxable profit and is subject to a corporate income tax rate of 0% (effective exemption). |
| 15 New Zealand | subject to standard corporate tax rate (30%) |
| 16 Pakistan | all income is tax-exempt |
| 17 Philippines | Only non-distributed current income is subject to taxation. |
| 18 Puerto Rico | eligible income is tax-exempt |
| 19 Singapore | eligible rental income exempt from tax |
| 20 South Africa | Distributed income is tax-exempt. Undistributed income is subject to a tax rate of 40%. |
| 21 South Korea | income technically tax-exempt |
| 22 Spain | As a general rule, a REIT will be taxed under Corporate Income Tax (CIT), at a reduced 19% flat rate. Furthermore, the special tax regime grants a 20% exemption for rental income derived from residential real estate provided that more than 50% of the assets of the REIT consist of residential real estate (leading to an effective tax rate of 15.2%). A REIT will be taxed at the standard CIT rate of 30% on certain events. |
| 23 Taiwan | tax-exempt |
| 24 Turkey | tax-exempt |
| 25 United Arab Emirates | Rental income of a REIT is not taxable (except where the investor is a branch of a foreign bank). Other types of business income if allowed to be generated are also not taxable. |
| 26 United Kingdom | Rental income from tax-exempt property is exempt from income tax. Non tax-exempt business is taxable in the ordinary manner (28%). |
| 27 United States | tax-exempt to extent distributed |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Taxation (2/3)

| *REIT regime* | *Capital gains* |
|---|---|
| 1 Australia | Tax treatment of capital gains is similar to that of ordinary income. A 50% capital gains tax discount may be available. |
| 2 Belgium | Capital gains are tax-exempt. |
| 3 Bulgaria | Capital gains realised by a REIT are not subject to taxation. |
| 4 Canada | Capital gains follow the same system for income, except only 50% of a capital gain is included in income and 50% of a capital loss can be applied to offset taxable capital gains |
| 5 Finland | Disposals of property are permitted, but may result in penalty tax charges unless certain conditions are met. |
| 6 France | Eligible capital gains are tax-exempt. |
| 7 Germany | Capital gains are tax-exempt. |
| 8 Hong Kong | Capital gains are tax-exempt. |
| 9 Israel | Distributed capital gains are tax-exempt. |
| 10 Italy | ordinary corporate taxation |
| 11 Japan | Follows the same system as ordinary income. |
| 12 Malaysia | Capital gains are tax-exempt. |
| 13 Mexico | Upon alienation of any patrimony in the REIT, Income Tax and Single Rate Tax will apply. |
| 14 Netherlands | Capital gains/losses can be allocated to a tax-free reserve and are thus exempt from corporate income tax. |
| 15 New Zealand | Gains may be taxable depending on specific circumstances. |
| 16 Pakistan | Generally, capital gains on moveable assets held for 12 months or less are taxable at full corporate tax rate. Capital gains on sale of moveable assets held for more that 12 months is exempt from tax up to 25% of the total gain. The remaining 75% gain is taxable at corporate tax rate. The effective tax rate works out to be 26.25% in this case. As a general rule in Pakistan, capital gains on the sale of immovable property are not liable to income tax. |
| 17 Philippines | Transfer of shares in a domestic corporation subject to special rates of capital gains tax. Other types of capital gains are included in gross income. |
| 18 Puerto Rico | Eligible capital gains are tax-exempt. |
| 19 Singapore | Capital gains are tax-exempt. |
| 20 South Africa | Distributed income is tax-exempt (capital gains can only be distributed on termination of the REIT). Undistributed capital gains are taxed at an effective tax rate of 20%. |
| 21 South Korea | Income technically tax-exempt, if 90% distribution requirement met, but in certain cases 33% capital gains surtax is charged. |
| 22 Spain | As a general rule a REIT will be taxed under Corporate Income Tax (CIT) at a 19% flat rate. A REIT will be taxed at the standard CIT rate of 30% on certain events. |
| 23 Taiwan | Capital gains are tax-exempt. |
| 24 Turkey | Capital gains are tax-exempt. |
| 25 United Arab Emirates | Capital gains are tax-exempt. |
| 26 United Kingdom | Eligible property is tax-exempt. |
| 27 United States | Capital gains are tax-exempt to the extent they are distributed. |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Taxation (3/3)

| REIT regime | Withholding tax |
|---|---|
| 1 Australia | An Australian resident property trust is generally not subject to any domestic withholding tax on income earned in Australia. |
| 2 Belgium | In principle, non-Belgian source dividends and Belgian and non-Belgian source interest distributed to a REIT are exempt from Belgian withholding tax. Any withholding taxes levied should be creditable and refundable. |
| 3 Bulgaria | no information available |
| 4 Canada | Credit or refund of foreign withholding tax is possible. |
| 5 Finland | Distributions to Finnish resident individuals are subject to tax prepayment withheld at source. Under Finnish domestic law, dividends by a Finnish REIT to a non-resident recipient will be subject to 28% withholding tax at source, subject to applicable tax treaties. |
| 6 France | In principle, domestic sourced income is not subject to withholding tax. |
| 7 Germany | reduced withholding tax on distributions to the REIT |
| 8 Hong Kong | There exists no withholding tax on interest, dividends or distributions from a REIT in Hong Kong. |
| 9 Israel | Deduction only if levied on taxable income. No domestic withholding tax exists. |
| 10 Italy | No withholding tax is levied on distributions received by REIT. |
| 11 Japan | Japanese withholding tax can be credited (refundable). Foreign income taxes including withholding tax can be credited against Japanese withholding tax imposed on distributions to the shareholders. |
| 12 Malaysia | creditable for taxable income; not refundable for non-taxable income |
| 13 Mexico | Once the net gain or taxable income is determined, upon distribution, trustee will be required to make a tax withholding, unless the beneficiary of the income is exempt from paying such tax (i.e. registered pension or retirement funds). |
| 14 Netherlands | Taxes withheld are not refunded; REITs are granted a dividend tax remittance rebate instead. |
| 15 New Zealand | Generally subject to resident withholding tax of 33%, reduced by the amount of imputation credits attached. |
| 16 Pakistan | No tax withholding on receipt of dividend income, profit on debt (interest) or commission. Other withholding tax due can be avoided by the exemption certificate. |
| 17 Philippines | foreign withholding tax deductible or creditable; local withholding tax creditable. |
| 18 Puerto Rico | Eligible income received by the REIT is not subject to withholding tax. |
| 19 Singapore | no foreign withholding tax refunds in respect of tax-exempted income |
| 20 South Africa | foreign withholding tax in terms of the South African credit system or the applicable Double Tax Agreement |
| 21 South Korea | no withholding tax levied on domestic distribution; entitled to claim a foreign tax credit with a certain ceiling of tax credit. |
| 22 Spain | General withholding tax rules do apply. |
| 23 Taiwan | refundable |
| 24 Turkey | credit/refund may be possible |
| 25 United Arab Emirates | no information available |
| 26 United Kingdom | In principle, no withholding tax levied on domestic distributions that are not property income distributions. Distributions out of tax-exempt profits are generally subject to 20% withholding tax where the recipient is not a UK corporate, UK charity or UK pension fund. |
| 27 United States | There exists no refund of foreign withholding tax. REIT can use a foreign tax as deduction. |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Organisational structure

| *REIT regime* | *Legal form* |
|---|---|
| 1 Australia | resident/non-resident (public) unit trust |
| 2 Belgium | limited liability company or a limited partnership with shares under Belgian law. Company must be a resident of Belgium. |
| 3 Bulgaria | public joint stock company |
| 4 Canada | unit trust |
| 5 Finland | public limited company |
| 6 France | any entity that can be listed on a French stock exchange |
| 7 Germany | joint stock company |
| 8 Hong Kong | unit trust domiciled in Hong Kong |
| 9 Israel | public company listed for trade on the Israeli stock exchange |
| 10 Italy | closed-end or semi-closed-end funds |
| 11 Japan | trust or corporation |
| 12 Malaysia | The management company must be a public company that has links to a group involved in financial services or property development. |
| 13 Mexico | trust |
| 14 Netherlands | public limited (liability) company (NV), private company with limited liability (BV) or a unit trust (UK)/mutual funds (US); must be resident in the Netherlands. |
| 15 New Zealand | unit trusts or companies investing in real property interests or Portfolio Investment Entities (PIE) |
| 16 Pakistan | public limited company |
| 17 Philippines | stock corporation |
| 18 Puerto Rico | corporation, partnership, trust or association |
| 19 Singapore | trust or corporation |
| 20 South Africa | unit trust (PUT) or company (PLS) |
| 21 South Korea | REIT stock company or Real Estate Trust Fund (RETF) |
| 22 Spain | listed joint stock corporation |
| 23 Taiwan | trust asset held by the trustee |
| 24 Turkey | joint stock company |
| 25 United Arab Emirates | public property fund that is constituted as either an investment trust or an investment company |
| 26 United Kingdom | parent company of a REIT must be a listed closed-ended company |
| 27 United States | entity taxable as a domestic corporation under US federal income tax law |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Stock exchange listing

| *REIT regime* | *Listing* |
|---|---|
| 1 Australia | no mandatory listing |
| 2 Belgium | mandatory listing |
| 3 Bulgaria | mandatory listing on the Bulgarian Stock Exchange |
| 4 Canada | mandatory listing |
| 5 Finland | mandatory listing |
| 6 France | mandatory listing of the parent company on a French stock exchange |
| 7 Germany | mandatory listing |
| 8 Hong Kong | no mandatory listing |
| 9 Israel | mandatory listing on the Tel Aviv Stock Exchange |
| 10 Italy | no mandatory listing |
| 11 Japan | no mandatory listing |
| 12 Malaysia | no mandatory listing |
| 13 Mexico | no mandatory listing |
| 14 Netherlands | no mandatory listing |
| 15 New Zealand | no mandatory listing |
| 16 Pakistan | mandatory listing |
| 17 Philippines | mandatory listing |
| 18 Puerto Rico | no mandatory listing |
| 19 Singapore | mandatory listing on the Singapore Stock Exchange |
| 20 South Africa | mandatory listing |
| 21 South Korea | mandatory listing: General REIT/no mandatory listing: CR-REIT |
| 22 Spain | mandatory listing |
| 23 Taiwan | no mandatory listing |
| 24 Turkey | mandatory listing |
| 25 United Arab Emirates | mandatory listing |
| 26 United Kingdom | mandatory listing, can be on any stock exchange recognised by the UK tax authorities |
| 27 United States | no mandatory listing |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Shareholder base (1/2)

| *REIT regime* | *Minimum number of shareholders* |
|---|---|
| 1 Australia | no requirements |
| 2 Belgium | no requirements |
| 3 Bulgaria | no requirements |
| 4 Canada | 150 unitholders each of whom holds not less than one “block of units”, which have a fair market value of not less than $500 |
| 5 Finland | no requirements |
| 6 France | no requirements |
| 7 Germany | no requirements |
| 8 Hong Kong | no requirements |
| 9 Israel | no requirements |
| 10 Italy | no requirements |
| 11 Japan | 1,000 shareholders before listing |
| 12 Malaysia | no requirements |
| 13 Mexico | If the certificates are not traded publicity, at least ten investors that are unrelated are required. |
| 14 Netherlands | no requirements |
| 15 New Zealand | at least 20 non-associated persons, if not listed on a New Zealand stock exchange |
| 16 Pakistan | no requirements |
| 17 Philippines | at least 1,000 shareholders with at least 50 shares each |
| 18 Puerto Rico | 50 shareholders or partners |
| 19 Singapore | 500 shareholders |
| 20 South Africa | no requirements |
| 21 South Korea | no requirements |
| 22 Spain | no requirements |
| 23 Taiwan | 50 persons with certificates held for at least 335 days during a fiscal year |
| 24 Turkey | no requirements |
| 25 United Arab Emirates | no information available |
| 26 United Kingdom | no requirements |
| 27 United States | 100 shareholders |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Shareholder base (2/2)

| REIT regime | Shareholding contraints |
|---|---|
| 1 Australia | no requirements |
| 2 Belgium | no requirements |
| 3 Bulgaria | no more than 50 founders |
| 4 Canada | no requirements |
| 5 Finland | No shareholder should hold 10% or more of the share capital. |
| 6 France | no requirements |
| 7 Germany | It is not allowed that a single shareholder directly holds 10% or more of the shares or the voting rights of a REIT (including shares held on his/her behalf by a third party). |
| 8 Hong Kong | no requirements |
| 9 Israel | At least 50% of the company's voting rights should be held by more than five shareholders. |
| 10 Italy | no requirements |
| 11 Japan | no requirements |
| 12 Malaysia | Foreigners unitholders cannot hold more than 70% of the equity in the REIT's management company. |
| 13 Mexico | Each investor may not hold more than 20% of the certificates. |
| 14 Netherlands | If listed or regulatory licensed: One single corporate entity may stand alone or together with affiliates hold up to 45% of the shares. One single individual may hold up to 25% of the shares. |
| 15 New Zealand | None of the non-associated persons should hold more than 20% if not listed on a New Zealand stock exchange. |
| 16 Pakistan | The maximum number of units that may be subscribed by investors through the initial public offering shall not exceed 5% of the REIT fund. |
| 17 Philippines | In aggregate, the investors (minimum number: 1,000) must own at least 33.3% of the share capital. |
| 18 Puerto Rico | At no time during the last half of its taxable year may more than 50% of total value of outstanding shares be owned by more than five individuals. |
| 19 Singapore | no requirements |
| 20 South Africa | no requirements |
| 21 South Korea | A single shareholder and its related party cannot own more than 10% of the total number of shares issued. No single shareholder (including its related parties) is permitted to own more than 30% of shares. |
| 22 Spain | minimum free float of 25% |
| 23 Taiwan | Any five certificate holders shall not own more than half of the total value of the certificates issued. |
| 24 Turkey | no requirements |
| 25 United Arab Emirates | no information available |
| 26 United Kingdom | A REIT cannot be a 'close company'. A company is "close" where it is controlled by five or fewer shareholders. A listed company will not be close if at least 35% of the shares are owned by the public. No corporate shareholder should hold 10% or more of the shares or voting rights in a REIT. |
| 27 United States | no more than 50% of its shares held by five or fewer individuals during the last half of the taxable year |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Use of debt

| REIT regime | Restrictions regarding the use of debt |
|---|---|
| 1 Australia | no restrictions |
| 2 Belgium | The aggregate loans do not exceed 65% of the total assets. Furthermore, the annual interest costs may not exceed 80% of the total annual profits. |
| 3 Bulgaria | Short-term loans must not exceed 20% of income generating asset. |
| 4 Canada | no restrictions |
| 5 Finland | The total liabilities may not exceed 80% of the total assets under (consolidated) financial statements. |
| 6 France | no restrictions |
| 7 Germany | The equity must equal at least 45% of the total asset value of immovable property (valued at IAS 40). |
| 8 Hong Kong | Aggregate borrowings shall not at any time exceed 35% of the total gross asset value. |
| 9 Israel | The company's obligations (other than equity) do not exceed 60% of the income-yielding real estate's value. |
| 10 Italy | REITs are subject to the general tax rule concerning the limitation of interest deduction. Interest payable is limited to a 30% of the EBITDA with certain adjustments (i.e., EBITDA disregarding the asset leasing and depreciation expenses). |
| 11 Japan | no restrictions |
| 12 Malaysia | Total borrowings may not exceed 35% of the net asset value of the REIT. |
| 13 Mexico | The portion of interest payments made to foreign related parties arising from foreign related debt exceeding the 3-to-1 debt-to-equity ratio will not be deductible. |
| 14 Netherlands | The loan capital may not exceed 60% of the fiscal book value of directly/indirectly held real estate and 20% of the fiscal book value of all other investments. |
| 15 New Zealand | In case of the Development REIT scheme, the aggregate of (i) borrowings from financial institutions and capital markets; and (ii) Customers Advances shall not, at any time, exceed 60% of REIT Fund. In case of Rental REIT scheme, a REIT may borrow from financial institutions and capital markets provided that the aggregate borrowing shall not, at any time, exceed 30% of REIT Fund ("REIT Fund" means the fund raised through the issuance of units). |
| 16 Pakistan | no information available |
| 17 Philippines | Shall not exceed 35% of market value of deposited property. Provided, however, that the REIT has publicly disclosed its investment grade credit rating by a duly accredited or internationally recognised rating agency, its total borrowings and deferred tax payments may exceed 35%, but not more than 70% of the market value of its deposited property. |
| 18 Puerto Rico | no restrictions |
| 19 Singapore | Maximum leverage is 35% of the fair market value of the real estate assets of the REIT unless the borrowings or the REIT has a credit rating of at least A. |
| 20 South Africa | limited to 30% of the value of the underlying assets |
| 21 South Korea | maximum debt-to-equity ratio of 2:1 |
| 22 Spain | maximum leverage (debt-to-assets) ratio of 70% |
| 23 Taiwan | Currently, the upper limit is 35% of the net worth of the REIT. |
| 24 Turkey | short-term credits limited to three times the net asset value |
| 25 United Arab Emirates | limited to 70% of the total net asset value |
| 26 United Kingdom | EBITDA-to-interest expense ratio needs to be not less than 1.25. |
| 27 United States | no restrictions |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Development activities

| REIT regime | Restrictions regarding real estate development activities |
|---|---|
| 1 Australia | no restrictions |
| 2 Belgium | Not more than 20% of assets can be invested in one real estate project. Developments are allowed, but cannot be sold within five years of completion. |
| 3 Bulgaria | The business activity of a REIT investing in real estate is limited to carrying out real estate construction and improvements (for property management, renting, leasing, sales). |
| 4 Canada | no restrictions |
| 5 Finland | Only development by the REIT for its own account is permitted. |
| 6 France | Real property developments are also allowed but may not exceed 20% of the company's gross assets. |
| 7 Germany | Investment in development/redevelopment property is limited to 25% of the value of the asset being developed/redeveloped. |
| 8 Hong Kong | not permitted |
| 9 Israel | no restrictions |
| 10 Italy | no restrictions |
| 11 Japan | no restrictions within investment portfolio |
| 12 Malaysia | not permitted (but: REITs may acquire property that is under construction or uncompleted real estate of up to 10% of its total asset value, provided that certain criteria listed in the Securities Commision Guidelines are met.) |
| 13 Mexico | no restrictions |
| 14 Netherlands | no restrictions within investment portfolio |
| 15 New Zealand | no restrictions |
| 16 Pakistan | no restrictions |
| 17 Philippines | not permitted |
| 18 Puerto Rico | no restrictions |
| 19 Singapore | No property development activities are allowed unless the REIT intends to hold the developed property upon completion. |
| 20 South Africa | no restrictions |
| 21 South Korea | not permitted |
| 22 Spain | Minimum holding period requirement of seven years for real estate developed by the company. |
| 23 Taiwan | no restrictions |
| 24 Turkey | The lands and lots in the portfolio of REIT on which any project has not been realised for three years as from the acquisition date, must not exceed 10% of its portfolio value. |
| 25 United Arab Emirates | Property under development must not exceed 30% of the net asset value. On a consolidated level, no more than 20% of the REIT’s assets can be invested in development activities. |
| 26 United Kingdom | development acceptable provided held for income and not sold within three years of completion; otherwise fully taxable |
| 27 United States | A REIT can develop properties for its own portfolio. |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of REIT legislation: Trading activities

| REIT regime | Restrictions regarding real estate trading activities |
|---|---|
| 1 Australia | no restrictions |
| 2 Belgium | no restrictions |
| 3 Bulgaria | no restrictions |
| 4 Canada | not permitted |
| 5 Finland | Disposals of property are permitted, but may result in a penalty tax charge unless the following requirements are met: (a) the REIT disposes of less than 10% of its properties during a tax year (measured using balance sheet values); (b) shares in mutual real estate companies have been held for five years, and at least ten years have elapsed from the initial use of the buildings owned by a mutual real estate company; (c) more than five years have elapsed from a comprehensive modernisation fulfilling certain criteria (as defined in legislation). |
| 6 France | no restrictions |
| 7 Germany | not permitted |
| 8 Hong Kong | A REIT must hold its real estate for a period of at least two years, unless consent is obtained from its unitholders by way of a special resolution at a general meeting. |
| 9 Israel | no restrictions |
| 10 Italy | no restrictions |
| 11 Japan | no restrictions |
| 12 Malaysia | no restrictions |
| 13 Mexico | no restrictions |
| 14 Netherlands | no restrictions |
| 15 New Zealand | no restrictions |
| 16 Pakistan | no restrictions |
| 17 Philippines | no restrictions |
| 18 Puerto Rico | no restrictions |
| 19 Singapore | no restrictions |
| 20 South Africa | no restrictions |
| 21 South Korea | no restrictions |
| 22 Spain | Minimum holding period: qualifying assets are generally subject to a minimum three-year holding period (seven in the case of property developed by the REIT). |
| 23 Taiwan | no restrictions |
| 24 Turkey | no restrictions |
| 25 United Arab Emirates | no restrictions |
| 26 United Kingdom | no restrictions |
| 27 United States | no restrictions |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Income

| *REIT regime* | *Restrictions regarding the income* |
|---|---|
| 1 Australia | Public unit trusts investing in land, must do so for the purpose, or primarily for the purpose, of deriving rent (eligible investment business). |
| 2 Belgium | The main activity of the REIT must be (passive) investment in real estate. The bylaws may provide that the REIT can temporarily and additionally invest in securities and hold cash under certain circumstances. |
| 3 Bulgaria | see restrictions regarding asset base |
| 4 Canada | To qualify as a REIT, the only undertaking of a trust must be the investing of its funds in property (other than real property or an interest in real property or an immovable or a real right in an immovable); the acquiring, holding, maintaining, improving, leasing or managing of any real property (or interest in real property) or of any immovable (or real right in immovables) that is capital property of the trust; or any combination of the foregoing activities. |
| 5 Finland | At least 80% of the net income must be derived from the renting of residential property (measured using financial statements). |
| 6 France | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 7 Germany | At least 75% of its gross earnings must be derived from rental, leasing, letting and disposal of immovable property. |
| 8 Hong Kong | see restrictions regarding asset base |
| 9 Israel | REITs must invest primarily in real estate that generates recurring rental income. The REIT may not acquire non-income generating real estate in excess of 10% of the total net asset value of the REIT at the time of acquisition. |
| 10 Italy | At least 80% of its income must result from rental and leasing activities of real property. |
| 11 Japan | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 12 Malaysia | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 13 Mexico | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 14 Netherlands | No restrictions as long as derived from passive investment (i.e., not from property development). |
| 15 New Zealand | see restrictions regarding asset base |
| 16 Pakistan | see restrictions regarding asset base |
| 17 Philippines | see restrictions regarding asset base |
| 18 Puerto Rico | 95% or more of gross income must be derived from dividends, interest, rents from real property, gain from the sale of real property and rights to real property and payments received or accrued for entering into agreements to execute loans guaranteed with mortgages on real property, or acquire or lease real property. 75% or more of gross income must be derived from rents derived from real property located in Puerto Rico, interest on obligations secured by mortgage on real property or rights to real property located in Puerto Rico, etc. |
| 19 Singapore | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 20 South Africa | REITs may invest in shares of property companies, in immovable property and other assets, as determined by the registrar. |
| 21 South Korea | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 22 Spain | At least 80% of the REITs' revenues must be derived from eligible assets. |
| 23 Taiwan | Income must be derived from qualifying investments (see restrictions regarding asset base). |
| 24 Turkey | see restrictions regarding asset base |
| 25 United Arab Emirates | REIT must derive income from at least two types of tenant or lessee; each type of tenant or lessee must produce 25% of the total income. |
| 26 United Kingdom | At least 75% of income must be related to property business. |
| 27 United States | At least 75% of gross income from rents from real estate property or from interest on mortgages on real estate property. At least 95% of gross income from the above sources plus certain passive sources such as non-mortgage interest and dividends. |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Asset base (1/3)

| *REIT regime* | *Restrictions regarding the asset composition* | *Restrictions regarding the domicile of the real estate investments* | *Restrictions regarding the maximum share of a single property* |
|---|---|---|---|
| 1 Australia | Must invest in land either inside or outside Australia for the primary purpose of deriving rental income. | no restrictions | no restrictions |
| 2 Belgium | The REIT may only invest in 'immovable property'. This includes real estate, option rights on real estate, shares in affiliated companies investing in real estate, real estate certificates, shares of another collective investment undertakings investing in real estate and rights resulting from agreements pursuant to which one or more immovable good(s) is/are leased to the REIT. | no restrictions | Value of an individual asset in which a REIT invests may not exceed 20% of the value of the entire investment portfolio - a two-year grace period may be granted to the REIT in order for the REIT to comply with the diversification rules. |
| 3 Bulgaria | The business activity of a REIT investing in real estate is limited to purchasing real estate and limited property rights to real estate, carrying out real estate construction and improvements (for property management, renting, leasing, sales), and raising funds by issuing securities. REITs can invest up to 10% of their assets in mortgage bonds. REITs are entitled to invest up to 10% of their assets in service companies. No other investments in shares are allowed. | Real estate assets must be located in Bulgaria | no restrictions |
| 4 Canada | At least 80% of its property consisted of any combination of shares, any property that, under the terms or conditions of which or under an agreement, is convertible into shares, exchangeable for shares or confers a right to acquire shares, cash, bonds, debentures, mortgages, hypothecary claims, notes and other similar obligations, marketable securities, real property situated in Canada and interests in real property situated in Canada (which would include leasehold interests), rights to and interests in any rental or royalty computed by reference to the amount or value of production from a natural accumulation of petroleum or natural gas in Canada, not more than 10% of its property consisted of bonds, securities or shares in the capital stock of any one corporation or debtor other than Her Majesty in right of Canada or a province or a Canadian municipality. | no restrictions | no restrictions |
| 5 Finland | At least 80% of the assets must consist of shares in mutual real estate companies or residential real property (measured using financial statements). | no restrictions | no restrictions |
| 6 France | In order to be eligible for a REIT status, the principal activity of the company must be restricted to property acquisition and/or construction with the aim to rent out the property as well as direct or indirect portfolio investments in partnerships or other companies liable to corporate income tax. The partnerships and companies in which the REIT invests, should also have business activities and goals similar to the REIT. | no restrictions | no restrictions |
| 7 Germany | At least 75% of the total assets of the REIT must comprise immovable property. | no restrictions | no restrictions |
| 8 Hong Kong | REITs must invest in real estate which should generally be income generating. | no restrictions | no restrictions |
| 9 Israel | 95% or more of the value of the REIT's assets must consist of income-yielding real estate and liquid assets (cash, deposit, etc.); 75% or more of the value of the REIT's assets must consist of income-yielding real estate. | 75% of the value of the income-yielding real estate must be located in Israel. | no restrictions |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Asset base (2/3)

| REIT regime | Restrictions regarding the asset composition | Restrictions regarding the domicile of the real estate investments | Restrictions regarding the maximum share of a single property |
|---|---|---|---|
| 10 Italy | At least 80% of the REIT's assets must consist of real property. Financial leased assets are included in the 80% asset ratio. | no restrictions | no restrictions |
| 11 Japan | Investments only in "Qualified Assets", including negotiable securities, real estate, monetary debts, trust beneficiary rights, interest in silent partnerships. | no restrictions | no restrictions |
| 12 Malaysia | At least 50% of the REIT's total asset value must be invested in real estate and/or single-purpose companies investing into real estate at all times. A REIT's investment in non real estate-related assets and/or cash, deposits and money market instruments must not exceed 25% of a REIT's total asset value. | All REITs may invest in real estate-related assets and non-real estate-related assets in a foreign market (a market where the regulatory authority is a member of the International Organisation of Securities Commissions). | no restrictions |
| 13 Mexico | 70% of equity must be invested in real estate activities and the remaining 30% in Mexican Government debt securities or in shares of mutual funds investing in debt instruments. | no restrictions | no restrictions |
| 14 Netherlands | Can invest in any type of passive investment. | no restrictions | no restrictions |
| 15 New Zealand | A REIT Management Company - which manages the assets of a trust - shall only invest in real estate, real estate-related assets and non-real estate assets in ratios prescribed by the Securities Exchange Commission. | no restrictions | no restrictions |
| 16 Pakistan | A REIT Management Company - which manages the assets of a trust - shall only invest in real estate, real estate related assets and non-real estate assets in ratios prescribed by the Securities and Exchange Commission of Pakistan (SECP). The REIT scheme shall not invest in such assets which are specified by the SECP via its notification in the official gazette. | no restrictions but probably dependent on the decisions made by the SECP | no restrictions but probably dependent on the decisions made by the SECP |
| 17 Philippines | A REIT may only invest in: (a) real estate, whether freehold or leasehold, in or outside the Philippines; (b) real estate-related assets, wherever the issuers, assets, or securities are incorporated, located, issued, or traded; (c) managed funds, debt securities, and shares issued by listed local or foreign non-property corporations; (d) government securities issued on behalf of the Philippine Government, governments of other countries, and securities issued by supra-national agencies; (e) cash and cash-equivalents; (f) such other similar investment outlets as the SEC may allow. At least 75% of the deposited property of the REIT must be invested in, or consist of, income-generating real estate. | A REIT can invest in income-generating real estate outside the Philippines to the extent that this investment does not exceed 40% of the REIT's deposited property and that special permission is obtained from the SEC. | no restrictions |
| 18 Puerto Rico | At the end of each quarter of each taxable year, at least 75% of the value of total assets must be represented by real estate assets, cash or equivalents, and securities and obligations of Puerto Rico and/or of the United States (and whichever instrumentality or political subdivision thereof); and not more than 25% of the value of total assets must be represented by securities other than those mentioned above. | see income restrictions | no restrictions |

*Source: EPRA (2010)*

## Appendix 2.2: Comparison of country-specific REIT legislation: Asset base (3/3)

| REIT regime | | Restrictions regarding the asset composition | Restrictions regarding the domicile of the real estate investments | Restrictions regarding the maximum share of a single property |
|---|---|---|---|---|
| 19 | Spain | Asset test: at least 80% of their assets must be invested in: (a) real estate (acquired or developed) to be rented or, (b) other REITs (c) foreign REITs and (d) Spanish or foreign qualifying subsidiaries and real estate collective investment schemes. | no restrictions | It is compulsory that a REIT owns at least three properties, any of which must not represent more than 40% of the total asset value upon acquisition according to the information disclosed in its consolidated balance sheet. |
| 20 | Singapore | A REIT may invest in real estate, real estate-related assets, listed or unlisted debt securities and listed shares of or issued by non-property corporations, government securities and securities issued by a supra-national agency or a Singapore statutory board; and cash and cash-equivalent items. | no restrictions | no restrictions |
| 21 | South Africa | REITs may invest in shares of property companies, in immovable property and other assets, as determined by the registrar. | A REIT may only invest in property in a foreign country and property shares or participatory interests in a collective investment scheme in property in a foreign country, if that foreign country has a foreign currency sovereign rating by a rating agency. | no restrictions |
| 22 | South Korea | At least 80% of assets must be comprised of real estate, securities and cash related to real estate as of the end of each quarter at least 90% of assets must be invested in real estate, real estate associated securities, and cash. | Currently, there is no clear rule on a REIT's holding real estate in foreign jurisdiction and thus, legal advice is required. | no restrictions |
| 23 | Taiwan | Investment in real estate, related rights of real estate, securities of real estate, as well as other investment objects approved by the competent authority. | no restrictions | no restrictions |
| 24 | Turkey | REITs are required to invest in real estate, rights supported by real estate and real estate projects at a minimum rate of 50% of their portfolio values. They can invest in time deposit and demand deposits in Turkish lire or any foreign currency for investment purposes at a maximum rate of 10% of their portfolio values. | REITs can invest in foreign real estate and capital market instruments backed by real estates at a maximum rate of 49% of the portfolio value. | no restrictions |
| 25 | United Arab Emirates | A REIT is permitted to invest in the following assets: (a) real property which consists of land and/or buildings, whether freehold or leasehold; (b) property related assets such as: shares, debentures, or warrants which are issued by a body corporate, substantial activity of which relates to investment in real property and certificates which confer rights with respect to such investments; (c) units in another property fund; (d) cash, government and public securities of up to 40% of its total investments. | no restrictions | A REIT must derive income from at least two types of tenant or lessee; each type of tenant or lessee must produce 25% of the total income, and the operator must invest no more than 40% of the fund in any one property type. |
| 26 | United Kingdom | no owner-occupied properties; minimum 75 per cent of assets related to property rental business | no restrictions | One property may contribute to 40% of total value at maximum. The REIT must hold at least three separate assets. |
| 27 | United States | At least 75% of total assets in real estate assets, cash and government securities. No more than 20% of its assets consist of taxable REIT subsidiaries, which cannot operate or manage accommodation or health care facilities. | no restrictions | no restrictions |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Distribution requirements (1/2)

| REIT regime | Requirements regarding the distribution of income |
|---|---|
| 1 Australia | distribution of 100% of trust's income |
| 2 Belgium | 80% of net profit (in form of dividends) |
| 3 Bulgaria | 90% of the net income of the year |
| 4 Canada | All income of the REIT for a taxation year is paid or payable to unitholder in distributions so that the REIT does not incur tax. |
| 5 Finland | A REIT must distribute as dividends at least 90% of its net income for each financial period. However, the company may retain 40% of its net income for the purposes of acquiring property during the subsequent period of seven years. |
| 6 France | 85% of the profit resulting from leasing of real estate 100% of dividends received from a subsidiary having elected for the REIT status. |
| 7 Germany | REIT has to distribute at least 90% of its net income, calculated under German GAAP, to its shareholders until the end of the following business year. |
| 8 Hong Kong | at least 90% of its audited annual net income after tax |
| 9 Israel | Every year the REIT is obliged to distribute 90% of it profits calculated based on accounting principals, including the amount equal to the depreciation and 100% of its capital gains from disposal of real estate. |
| 10 Italy | no requirements |
| 11 Japan | more than 90% of distributable income |
| 12 Malaysia | Malaysian REITs are not required to make any minimum distribution of income but REITs will not benefit from a tax exemption if at least 90% of their total income for the year is distributed to its investors. |
| 13 Mexico | Trustees in REITs must distribute at least 95% of the REIT's taxable income. |
| 14 Netherlands | 100% of taxable profit |
| 15 New Zealand | A REIT management company shall distribute not less than 90% of the operative income arising out of the REIT scheme to the unitholders as dividend in each financial year. |
| 16 Pakistan | 90% of the annual income in each financial year |
| 17 Philippines | 90% of its distributable income [which is defined as "Net Income as adjusted for unrealised gains and losses/expenses, impairment losses and other items in accordance with internationally accepted accounting standards." (Source: EPRA Global REIT survey 2010, Philippines, p. 4) |
| 18 Puerto Rico | At least 90% of the net income of a REIT must be distributed annually as taxable dividends. |
| 19 Singapore | at least 90% of taxable income |
| 20 South Africa | no requirements |
| 21 South Korea | at least 90% of distributable income |
| 22 Spain | At least 90% of the REIT's operative income coming from rental and ancillary activities. However it is compulsory to distribute 100% of profits stemming from dividends distributed by qualifying entities. |
| 23 Taiwan | pursuant to the REIT contract |
| 24 Turkey | REITs are required to distribute at least 20% of their annual profits after the deduction of tax provisions, legal reserves and accumulated losses |
| 25 United Arab Emirates | not less than 80% of audited annual net income to the unitholders |
| 26 United Kingdom | minimum 90% of qualifying property business |
| 27 United States | at least 90% of taxable income (in form of dividends) |

*Source: EPRA (2010)*

# Appendix 2.2: Comparison of country-specific REIT legislation: Distribution requirements (2/2)

| REIT regime | Requirements regarding the distribution of capital gains |
|---|---|
| 1 Australia | Distribution of 100% of capital gains realised on disposal of property including interests held in other sub-trusts or other entities. A 50% capital gains tax discount may be available. |
| 2 Belgium | not included in the distribution obligation, if reinvested within a four-year time period |
| 3 Bulgaria | included in net income (see distribution of income) |
| 4 Canada | All capital gains are paid out and retain their character as such in the hands of unitholders, provided a designation is made by the REIT. |
| 5 Finland | Realised capital gains are included in the income distribution obligation (see distribution of income). |
| 6 France | 50% of capital gains from the disposal of either real estate or shares in real estate partnerships or shares in a subsidiary company that has elected for REIT status. |
| 7 Germany | Up to half of the proceeds from disposals can be transferred to a reserve. The distributable profits will be reduced accordingly. Any unused reserves must be dissolved at the latest by the end of the second financial year after creation. |
| 8 Hong Kong | 90% of its audited annual net income after tax (the trustee has the discretion to determine if any of the amount of the gain on disposal of real estate may form part of the net income) |
| 9 Israel | Every year the fund is obliged to distribute 100% of its capital gains from disposal of real estate. |
| 10 Italy | no requirements |
| 11 Japan | more than 90% of distributable income |
| 12 Malaysia | no requirements |
| 13 Mexico | no requirements |
| 14 Netherlands | Capital gains/losses can be allocated to a tax-free reserve. |
| 15 New Zealand | A REIT Management Company shall distribute not less than 90% of the capital gains arising out of the REIT scheme to the unitholders as dividend in each financial year. |
| 16 Pakistan | 90% of the annual income in each financial year |
| 17 Philippines | To the extent that the gains are realised, they are included in distributable income as determined by the Securities and Exchange Commission. This is not the case if the gain on the sale of REIT assets is reinvested by the REIT within one year of the date of sale. Also capital gains realised from the disposal of shares in domestic corporations are not included in distributable income since they have already been subjected to final tax. |
| 18 Puerto Rico | Gains from sale of capital assets are part of a REITs gross income computation and therefore part of its net income determination. |
| 19 Singapore | no requirements |
| 20 South Africa | Capital profits are to be reinvested and cannot be distributed to unitholders (except on termination of the REIT). |
| 21 South Korea | 90% of distributable income |
| 22 Spain | At least 50% of the profit corresponding to income derived from the transfer (where the holding period has been met) of real estate assets and qualifying holdings must be distributed. The other 50% of that profit must be reinvested in eligible assets during a period of three years. |
| 23 Taiwan | pursuant to the REIT contract |
| 24 Turkey | Will be regarded within the distributable profit. |
| 25 United Arab Emirates | included in net income (see distribution of income) |
| 26 United Kingdom | no requirements |
| 27 United States | no requirements |

*Source: EPRA (2010)*

# Appendix 2.3: Composition of real estate-specific revenues: Share of rental revenues as of total real estate-specific revenues

| *Year* / *Country of origin* | Total | Australia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 100,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 100,00% |
| **1991** | 98,61% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 98,61% |
| **1992** | 99,10% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,10% |
| **1993** | 99,07% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,07% |
| **1994** | 99,41% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,41% |
| **1995** | 98,81% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 98,81% |
| **1996** | 99,04% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,04% |
| **1997** | 99,53% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,53% |
| **1998** | 99,62% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,62% |
| **1999** | 99,46% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,46% |
| **2000** | 99,49% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,49% |
| **2001** | 96,40% | 87,14% | 100,00% | 99,42% | 73,78% | 100,00% | 99,98% | 100,00% | 34,04% | --- | --- | 99,09% |
| **2002** | 95,63% | 79,15% | 100,00% | 99,65% | 76,96% | 100,00% | 100,00% | 100,00% | 65,22% | --- | --- | 99,11% |
| **2003** | 94,01% | 73,45% | 99,97% | 99,25% | 76,31% | 100,00% | 100,00% | 100,00% | 82,27% | --- | --- | 97,17% |
| **2004** | 93,53% | 75,77% | 99,58% | 99,30% | 85,96% | 100,00% | 99,77% | 100,00% | 85,33% | 100,00% | 100,00% | 95,43% |
| **2005** | 93,39% | 74,84% | 99,63% | 99,57% | 89,53% | 100,00% | 99,71% | 100,00% | 86,05% | 100,00% | 65,74% | 95,30% |
| **2006** | 92,60% | 71,54% | 99,64% | 99,59% | 85,65% | 100,00% | 99,70% | 100,00% | 87,30% | 100,00% | 64,50% | 95,05% |
| **2007** | 92,27% | 70,29% | 99,72% | 99,70% | 85,69% | 100,00% | 99,59% | 100,00% | 86,86% | 100,00% | 40,47% | 95,34% |
| **2008** | 91,89% | 66,78% | 99,66% | 99,75% | 81,22% | 95,85% | 99,89% | 100,00% | 88,58% | 100,00% | 71,16% | 95,01% |
| **2009** | 93,44% | 74,92% | 99,68% | 99,77% | 88,58% | 100,00% | 99,94% | 100,00% | 87,65% | 100,00% | 43,61% | 96,20% |
| **Mean (2005-2009)** | **96,77%** | **74,88%** | **99,77%** | **99,56%** | **82,63%** | **99,54%** | **99,84%** | **100,00%** | **78,14%** | **100,00%** | **64,24%** | **97,99%** |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

# Appendix 2.3: Composition of real estate-specific revenues: Share of real estate development revenues as of total real estate-specific revenues

| *Year* / *Country of origin* | Total | Australia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| **1991** | 1,26% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1,26% |
| **1992** | 0,66% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,66% |
| **1993** | 0,20% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,20% |
| **1994** | 0,10% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,10% |
| **1995** | 0,23% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,23% |
| **1996** | 0,10% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,10% |
| **1997** | 0,12% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,12% |
| **1998** | 0,12% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,12% |
| **1999** | 0,23% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,23% |
| **2000** | 0,25% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,25% |
| **2001** | 2,64% | 12,86% | 0,00% | 0,00% | 21,74% | 0,00% | 0,00% | 0,00% | 61,77% | --- | --- | 0,27% |
| **2002** | 2,71% | 11,52% | 0,00% | 0,00% | 20,31% | 0,00% | 0,00% | 0,00% | 32,62% | --- | --- | 0,29% |
| **2003** | 3,33% | 17,24% | 0,03% | 0,00% | 21,32% | 0,00% | 0,00% | 0,00% | 22,41% | --- | --- | 0,45% |
| **2004** | 3,70% | 18,15% | 0,03% | 0,00% | 13,59% | 0,00% | 0,00% | 0,00% | 17,29% | 0,00% | 0,00% | 1,37% |
| **2005** | 3,62% | 17,23% | 0,00% | 0,00% | 8,89% | 0,00% | 0,00% | 0,00% | 16,01% | 0,00% | 17,13% | 1,50% |
| **2006** | 4,03% | 18,48% | 0,00% | 0,00% | 12,96% | 0,00% | 0,00% | 0,00% | 13,88% | 0,00% | 17,75% | 1,57% |
| **2007** | 4,35% | 17,00% | 0,00% | 0,00% | 15,37% | 0,00% | 0,00% | 0,00% | 14,15% | 0,00% | 29,77% | 1,94% |
| **2008** | 4,87% | 21,37% | 0,00% | 0,00% | 17,80% | 2,07% | 0,00% | 0,00% | 10,69% | 0,00% | 14,42% | 2,36% |
| **2009** | 3,51% | 15,87% | 0,00% | 0,00% | 6,94% | 0,00% | 0,00% | 0,00% | 12,42% | 0,00% | 28,20% | 1,25% |
| **Mean (2005-2009)** | **1,80%** | **16,63%** | **0,01%** | **0,00%** | **15,44%** | **0,23%** | **0,00%** | **0,00%** | **22,36%** | **0,00%** | **17,88%** | **0,71%** |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

# Appendix 2.3: Composition of real estate-specific revenues: Share of property management income as of total real estate-specific revenues

| *Year* / *Country of origin* | Total | Australia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| **1991** | 0,27% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,27% |
| **1992** | 0,35% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,35% |
| **1993** | 1,01% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1,01% |
| **1994** | 0,67% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,67% |
| **1995** | 1,29% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1,29% |
| **1996** | 1,15% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1,15% |
| **1997** | 0,46% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,46% |
| **1998** | 0,36% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,36% |
| **1999** | 0,41% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,41% |
| **2000** | 0,34% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,34% |
| **2001** | 0,95% | 0,00% | 0,00% | 0,70% | 7,17% | 0,00% | 0,02% | 0,00% | 4,18% | --- | --- | 0,82% |
| **2002** | 0,98% | 1,43% | 0,00% | 0,35% | 7,60% | 0,00% | 0,00% | 0,00% | 2,16% | --- | --- | 0,75% |
| **2003** | 2,35% | 2,71% | 0,00% | 0,90% | 6,96% | 0,00% | 0,00% | 0,00% | 0,92% | --- | --- | 2,82% |
| **2004** | 2,68% | 1,88% | 0,39% | 0,75% | 4,11% | 0,00% | 0,23% | 0,00% | 0,84% | 0,00% | 0,00% | 3,90% |
| **2005** | 2,76% | 3,89% | 0,37% | 0,49% | 4,87% | 0,00% | 0,29% | 0,00% | 0,61% | 0,00% | 0,00% | 3,82% |
| **2006** | 2,99% | 4,31% | 0,36% | 0,47% | 6,67% | 0,00% | 0,30% | 0,00% | 1,13% | 0,00% | 0,00% | 4,04% |
| **2007** | 2,84% | 8,37% | 0,28% | 0,34% | 4,45% | 0,00% | 0,41% | 0,00% | 1,35% | 0,00% | 0,00% | 3,19% |
| **2008** | 2,48% | 5,22% | 0,34% | 0,28% | 3,46% | 0,00% | 0,11% | 0,00% | 2,51% | 0,00% | 0,00% | 3,09% |
| **2009** | 2,20% | 3,75% | 0,32% | 0,26% | 3,13% | 0,00% | 0,06% | 0,00% | 2,00% | 0,00% | 0,00% | 2,91% |
| **Mean (2005-2009)** | **1,33%** | **3,51%** | **0,23%** | **0,50%** | **5,38%** | **0,00%** | **0,16%** | **0,00%** | **1,75%** | **0,00%** | **0,00%** | **1,58%** |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

# Appendix 2.3: Composition of real estate-specific revenues: Share of trading revenues as of total real estate-specific revenues

| *Year* / *Country of origin* | Total | Australia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singa-pore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1990** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1991** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1992** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1993** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1994** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1995** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1996** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1997** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1998** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1999** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2000** | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2001** | 1,81% | 0,00% | 0,00% | --- | 13,88% | 0,00% | 0,00% | 0,00% | --- | --- | --- | --- |
| **2002** | 4,88% | 12,20% | 0,00% | --- | 9,78% | 0,00% | 0,00% | 0,00% | 0,00% | --- | --- | --- |
| **2003** | 4,04% | 10,87% | 0,00% | --- | 10,46% | 0,00% | 0,00% | 0,00% | 0,00% | --- | --- | --- |
| **2004** | 2,98% | 9,77% | 0,00% | --- | 7,76% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | --- |
| **2005** | 3,12% | 9,77% | 0,00% | --- | 1,75% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 17,13% | --- |
| **2006** | 3,64% | 10,07% | 0,00% | --- | 1,10% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 17,75% | --- |
| **2007** | 4,06% | 8,62% | 0,00% | --- | 2,16% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 29,77% | --- |
| **2008** | 4,91% | 11,34% | 0,00% | --- | 18,50% | 2,07% | 0,00% | 0,00% | 0,00% | 0,00% | 14,42% | --- |
| **2009** | 4,81% | 9,27% | 0,00% | --- | 17,36% | 0,00% | 0,00% | 0,00% | 0,00% | 0,00% | 28,20% | --- |
| **Mean (2005-2009)** | **3,80%** | **9,10%** | **0,00%** | --- | **9,19%** | **0,23%** | **0,00%** | **0,00%** | **0,00%** | **0,00%** | **17,88%** | --- |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

## Appendix 2.3: Composition of real estate-specific revenues: Share of rental and development revenues as of total real estate-specific revenues

| Share of rental revenues / *Sectoral allocation* — *Country of origin* | Total | Australia | Canada | Belgium | France | Japan | Nether-lands | New Zealand | Singapore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 92,63% | 71,67% | 99,68% | 99,67% | 86,13% | 98,62% | 99,76% | 100,00% | 87,29% | 100,00% | 54,88% | 95,38% |
| Apartments | 94,90% | 16,20% | 100,00% | --- | --- | 100,00% | --- | --- | 100,00% | --- | --- | 98,60% |
| Community centres | 93,05% | 63,87% | 99,42% | --- | --- | --- | --- | --- | --- | --- | --- | 94,30% |
| Free standing | 99,97% | 100,00% | --- | --- | --- | --- | 100,00% | --- | --- | --- | --- | 99,96% |
| Health care | 99,50% | 95,87% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,91% |
| Industrial | 91,77% | 100,00% | 100,00% | 99,02% | --- | --- | --- | 100,00% | --- | --- | --- | 87,20% |
| Land lease | 100,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 100,00% |
| Lodging and resorts | 73,54% | 40,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 78,33% |
| Merchandise centres | 93,30% | 91,49% | 100,00% | 100,00% | --- | 93,08% | --- | --- | 74,57% | --- | --- | 99,16% |
| Neighbourhood centres | 97,85% | 94,49% | --- | 100,00% | --- | --- | --- | --- | --- | --- | --- | 99,38% |
| Offices | 98,06% | 99,34% | 99,82% | 99,55% | 92,49% | 100,00% | 100,00% | 100,00% | 100,00% | --- | --- | 97,71% |
| Self-storage | 99,91% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 99,91% |
| Diversified | 82,09% | 26,22% | 99,84% | --- | 85,99% | 100,00% | 99,65% | --- | --- | 100,00% | --- | 85,56% |

| Share of develop-ment revenues / *Sectoral allocation* — *Country of origin* | Total | Australia | Canada | Belgium | France | Japan | Nether-lands | New Zealand | Singapore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 4,10% | 17,80% | 0,00% | 0,00% | 12,39% | 0,69% | 0,00% | 0,00% | 13,43% | 0,00% | 22,56% | 1,71% |
| Apartments | 4,57% | 82,59% | 0,00% | --- | --- | 0,00% | --- | --- | 0,00% | --- | --- | 0,68% |
| Community centres | 2,36% | 0,00% | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | 3,54% |
| Free standing | *0,03%* | 0,00% | --- | --- | --- | --- | 0,00% | --- | --- | --- | --- | 0,04% |
| Health care | *0,00%* | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Industrial | **7,26%** | 0,00% | 0,00% | 0,00% | --- | --- | --- | 0,00% | --- | --- | --- | 11,40% |
| Land lease | *0,00%* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Lodging and resorts | **8,57%** | 60,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Merchandise centres | 5,98% | 7,61% | --- | 0,00% | --- | 3,46% | --- | --- | 33,58% | --- | --- | 0,06% |
| Neighbourhood centres | 0,89% | 2,68% | --- | 0,00% | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Offices | 1,17% | 0,04% | 0,00% | 0,00% | 4,15% | 0,00% | 0,00% | 0,00% | 0,00% | --- | --- | 1,88% |
| Self-storage | *0,00%* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Diversified | **7,87%** | 39,26% | 0,00% | --- | --- | 0,00% | 0,00% | --- | --- | 0,00% | --- | 1,36% |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

## Appendix 2.3: Composition of real estate-specific revenues: Share of property management income and trading revenues as of total real estate-specific revenues

| Share of property management income / *Sectoral allocation* — *Country of origin* | Total | Australia | Canada | Belgium | France | Japan | Nether-lands | New Zealand | Singapore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 2,63% | 5,03% | 0,37% | 0,33% | 4,52% | 0,00% | 0,24% | 0,00% | 1,52% | 0,00% | 0,00% | 3,35% |
| Apartments | 0,69% | 1,22% | 0,00% | --- | --- | 0,00% | --- | --- | 0,00% | --- | --- | 1,02% |
| Community centres | 5,01% | 36,13% | 0,58% | --- | --- | --- | --- | --- | --- | --- | --- | 2,47% |
| Free standing | *0,00%* | 0,00% | --- | --- | --- | --- | 0,00% | --- | --- | --- | --- | 0,00% |
| Health care | 0,50% | 4,13% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,09% |
| Industrial | 0,98% | 0,00% | 0,00% | 0,98% | --- | --- | --- | 0,00% | --- | --- | --- | 1,40% |
| Land lease | *0,00%* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,00% |
| Lodging and resorts | **21,67%** | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | 25,28% |
| Merchandise centres | 1,07% | 0,90% | 0,00% | 0,00% | --- | 0,00% | --- | --- | 3,04% | --- | --- | 0,90% |
| Neighbourhood centres | 1,25% | 2,83% | --- | 0,00% | --- | --- | --- | --- | --- | --- | --- | 0,62% |
| Offices | 0,52% | 0,61% | 0,36% | 0,45% | 0,87% | 0,00% | 0,00% | 0,00% | 0,00% | --- | --- | 0,80% |
| Self-storage | *0,11%* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0,11% |
| Diversified | **7,11%** | 11,40% | 0,20% | --- | 13,64% | 0,00% | 0,35% | --- | --- | 0,00% | --- | 15,69% |

| Share of trading revenues / *Sectoral allocation* — *Country of origin* | Total | Australia | Canada | Belgium | France | Japan | Nether-lands | New Zealand | Singapore | South Africa | Turkey | USA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 4,22% | 9,64% | --- | 0,00% | 5,95% | 0,69% | 0,00% | 0,00% | 0,00% | 0,00% | 22,56% | --- |
| Apartments | 0,00% | --- | --- | --- | --- | 0,00% | --- | --- | 0,00% | --- | --- | --- |
| Community centres | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Free standing | 0,00% | 0,00% | --- | --- | --- | --- | 0,00% | --- | --- | --- | --- | --- |
| Health care | 0,00% | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industrial | 0,00% | 0,00% | --- | 0,00% | --- | --- | --- | 0,00% | --- | --- | --- | --- |
| Land lease | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Lodging and resorts | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Merchandise centres | 1,73% | 0,00% | --- | --- | --- | 3,46% | --- | --- | 0,00% | --- | --- | --- |
| Neighbourhood centres | 0,00% | 0,00% | --- | 0,00% | --- | --- | --- | --- | --- | --- | --- | --- |
| Offices | 0,84% | 0,04% | --- | 0,00% | 8,31% | 0,00% | 0,00% | 0,00% | 0,00% | --- | --- | --- |
| Self-storage | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Diversified | **11,90%** | 52,94% | --- | --- | 1,23% | 0,00% | 0,00% | --- | --- | 0,00% | --- | --- |

*Source: Own calculations based on the total sample (178 of 218 REITs) and data retrieved from SNL Financial*

# Appendix 6.1: Availability of selected variables

| *Variable* / *Country of REIT origin* | Australia | Belgium | Canada | France | Japan | Nether-lands | New Zealand | Singapore | South Africa | Turkey | United States |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 CPI | quarterly | monthly | monthly | monthly | monthly | monthly | quarterly | monthly | monthly | monthly | monthly |
| 2 CPI excl. food and energy | quarterly | monthly | monthly | monthly | monthly | monthly | quarterly | **not available** | monthly | monthly | monthly |
| 3 PPI | quarterly | monthly | monthly | monthly | monthly | monthly | quarterly | monthly | monthly | monthly | monthly |
| 4 Long-term interest rate (10 years) | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly (7 yrs.) | monthly | monthly | monthly |
| 5 Short-term interest rate (3 months) | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 6 Term structure of interest rates | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 7 Level of total retail sales | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | **not available** | monthly |
| 8 Level of consumer climate | monthly | monthly | monthly | monthly | monthly | monthly | quarterly | **not available** | quarterly | monthly | monthly |
| 9 Level of the leading indicator | monthly | monthly | monthly | monthly | monthly | monthly | monthly | quarterly | monthly | monthly | monthly |
| 10 Level of GDP | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly | quarterly |
| 11 Unemployment rate | monthly | monthly | monthly | monthly | monthly | monthly | quarterly | quarterly | **not available** | quarterly | monthly |
| 12 Level of industrial production | quarterly | monthly | monthly | monthly | monthly | monthly | quarterly | **not available** | monthly | monthly | monthly |
| 13 Level of industrial production: construction | quarterly | monthly | monthly | monthly | monthly | monthly | quarterly | **not available** | monthly | quarterly | **not available** |
| 14 Level of money supply: M1 | monthly | **not available** | monthly | monthly | monthly | **not available** | monthly | monthly | monthly | monthly | monthly |
| 15 Level of money supply: M3 | monthly | **not available** | monthly | monthly | monthly | **not available** | monthly | monthly | monthly | monthly | monthly (M2) |
| 16 National stock index | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 17 Small cap stock index | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 18 Dividend yield (national stock index) | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 19 PER (national stock index) | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 20 Bond performance index | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly | monthly |
| 21 Level of total building permits | monthly | monthly | monthly | monthly | **not available** | **not available** | monthly | **not available** | monthly | quarterly | monthly |
| 22 Level of total building starts | quarterly | monthly | monthly | monthly | **not available** | monthly | quarterly | **not available** | monthly | quarterly | monthly |
| 23 App.-based r. e. ind.: all properties | quarterly | **not available** | **not available** | **not available** | monthly | **not available** | **not available** | **not available** | **not available** | **not available** | quarterly |
| 24 App.-based r. e. ind.: apartments | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | quarterly |
| 25 App.-based r. e. ind.: hotel | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | quarterly |
| 26 App.-based r. e. ind.: office | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | quarterly |
| 27 App.-based r. e. ind.: retail | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | **not available** | quarterly |

*Source: Own considerations while taking scientific research on general stock and REITs into account*

# Appendix 6.2: Results of the application of a factor analysis

## Time period: 1985-2009
## Time interval: monthly
## Dependent variable: REIT stock market returns (total sample: 218 REITs)

**Step 1: Data editing**

| | | |
|---|---|---|
| Magnitude of the correlations | sometimes high | |
| Level of significance of the correlations | some zero levels of significance | |
| Kaiser-Meyer-Olkin criterion | 0,744 | ("middling") |
| Bartlett-test of sphericity | Chi-square | 582,997 |
| | probability of error when rejecting $H_0$ | .000 |

**Step 2: Factor extraction**

| Communalitites | | |
|---|---|---|
| | Initially | After extraction |
| GPT Group | 1,000 | 0,330 |
| Stockland Trust | 1,000 | 0,566 |
| Alexanders Inc. | 1,000 | 0,496 |
| BRE Properties | 1,000 | 0,570 |
| East Group | 1,000 | 0,534 |
| Federal Realty | 1,000 | 0,577 |
| Getty Realty | 1,000 | 0,669 |
| Health Care REIT | 1,000 | 0,513 |
| HMG Courtland Properties | 1,000 | 0,531 |
| Host Hotels | 1,000 | 0,750 |
| Pennsylvania REIT | 1,000 | 0,556 |
| Starwood | 1,000 | 0,423 |
| Urstadt Biddle | 1,000 | 0,667 |
| Washington Real Estate | 1,000 | 0,611 |
| Winthrop REIT | 1,000 | 0,325 |

*Number of factors selected*

| | |
|---|---|
| According to screeplot | 3 |
| According to a minimum eigenvalue of 1 | 5 |

| Results regarding the explained variance: prior to rotation | | | |
|---|---|---|---|
| Factor | Eigenvalue | % of variance | cumulated % |
| 1 | 2,893 | 19,288 | 19,288 |
| 2 | 1,816 | 12,105 | 31,393 |
| 3 | 1,270 | 8,469 | 39,862 |
| 4 | 1,098 | 7,317 | 47,179 |
| 5 | 1,040 | 6,932 | 54,111 |

**Step 3: Factor rotation**

| Results regarding the explained variance: after rotation | | | |
|---|---|---|---|
| Factor | Eigenvalue | % of variance | cumulated % |
| 1 | 2,639 | 17,591 | 17,591 |
| 2 | 1,855 | 12,364 | 29,955 |
| 3 | 1,259 | 8,394 | 38,348 |
| 4 | 1,195 | 7,968 | 46,317 |
| 5 | 1,169 | 7,794 | 54,111 |

| Factor loadings after rotation | | | | | |
|---|---|---|---|---|---|
| | Factor | | | | |
| | 1 | 2 | 3 | 4 | 5 |
| Federal Realty | 0,733 | | | | |
| BRE Properties | 0,688 | | | | |
| Pennsylvania REIT | 0,686 | | | | |
| East Group | 0,663 | | | | |
| Starwood | 0,527 | | | | |
| Winthrop REIT | | | | | |
| Washington Real Estate | | 0,736 | | | |
| Health Care REIT | | 0,642 | | | |
| Alexanders Inc. | | 0,607 | | | |
| GPT Group | | | | | |
| Getty Realty | | | 0,764 | | |
| Host Hotels | | | 0,683 | | |
| Urstadt Biddle | | | | 0,762 | |
| Stockland Trust | | | | | 0,584 |
| HMG Courtland Properties | | | | | 0,583 |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

# Appendix 6.3: Results of the application of a multiple regression analysis

**Time period: 1985-2009, part 1/3**

**Time interval: monthly**

**Dependent variable: portfolios comprising REIT stock market returns (total sample: 218 REITs)**

| *Country of origin* | Australia | | United States | | Australia |
|---|---|---|---|---|---|
| *Sectoral property type classification* | Total | | Total | | Neighbourhood centres |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,546 | | 0,789 | | 0,586 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,519 | | 0,772 | | 0,553 |
| F-statistic ($F_{emp}$) | 19,980 | | 47,115 | | 17,802 |
| F-statistic: level of significance | 0,000 | | 0,000 | | 0,000 |
| Standard error ($s$) | 0,518 | | 0,432 | | 3,500 |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Retail sales | Factor 3 | Inflation | Factor 5 | Short-term i. r. |
| Standardised value | -0,135 | 0,158 | 0,104 | 0,287 | 0,105 |
| t-statistic ($t_{emp}$) | -3,084 | 3,769 | 2,402 | 9,904 | 2,393 |
| t-statistic: level of significance | 0,002 | 0,000 | 0,017 | 0,000 | 0,017 |
| Confidence interval (95%): upper bound | -0,874 | 0,056 | 0,027 | 0,208 | 0,198 |
| Confidence interval (95%): lower bound | -0,193 | 0,179 | 0,276 | 0,311 | 2,036 |
| | | | | | |
| Name of the regression coefficient | M3 | Factor 4 | Unemploy. rate | | Factor 1 |
| Standardised value | 0,114 | 0,453 | 0,066 | | 0,763 |
| t-statistic ($t_{emp}$) | 2,223 | 10,304 | 1,980 | | 17,297 |
| t-statistic: level of significance | 0,027 | 0,000 | 0,049 | | 0,000 |
| Confidence interval (95%): upper bound | 0,016 | 0,274 | 0,000 | | 3,537 |
| Confidence interval (95%): lower bound | 0,256 | 0,403 | 0,117 | | 4,446 |
| | | | | | |
| Name of the regression coefficient | PER | Factor 5 | Bond index | | Factor 4 |
| Standardised value | 0,116 | -0,095 | 0,073 | | 0,118 |
| t-statistic ($t_{emp}$) | 2,644 | -2,328 | 1,982 | | 2,890 |
| t-statistic: level of significance | 0,009 | 0,021 | 0,048 | | 0,004 |
| Confidence interval (95%): upper bound | 0,004 | -0,132 | 0,000 | | 0,198 |
| Confidence interval (95%): lower bound | 0,028 | -0,011 | 0,092 | | 1,041 |
| | | | | | |
| Name of the regression coefficient | Bond index | | Factor 1 | | |
| Standardised value | 0,100 | | 0,587 | | |
| t-statistic ($t_{emp}$) | 2,322 | | 18,651 | | |
| t-statistic: level of significance | 0,021 | | 0,000 | | |
| Confidence interval (95%): upper bound | 0,068 | | 0,476 | | |
| Confidence interval (95%): lower bound | 0,823 | | 0,588 | | |
| | | | | | |
| Name of the regression coefficient | Term structure | | Factor 2 | | |
| Standardised value | -0,106 | | 0,500 | | |
| t-statistic ($t_{emp}$) | -2,603 | | 16,600 | | |
| t-statistic: level of significance | 0,010 | | 0,000 | | |
| Confidence interval (95%): upper bound | -0,140 | | 0,399 | | |
| Confidence interval (95%): lower bound | -0,019 | | 0,507 | | |
| | | | | | |
| Name of the regression coefficient | Factor 1 | | Factor 3 | | |
| Standardised value | 0,084 | | 0,216 | | |
| t-statistic ($t_{emp}$) | 1,977 | | 7,227 | | |
| t-statistic: level of significance | 0,049 | | 0,000 | | |
| Confidence interval (95%): upper bound | 0,000 | | 0,143 | | |
| Confidence interval (95%): lower bound | 0,126 | | 0,249 | | |
| | | | | | |
| Name of the regression coefficient | Factor 2 | | Factor 4 | | |
| Standardised value | 0,372 | | 0,261 | | |
| t-statistic ($t_{emp}$) | 8,828 | | 8,919 | | |
| t-statistic: level of significance | 0,000 | | 0,000 | | |
| Confidence interval (95%): upper bound | 0,216 | | 0,184 | | |
| Confidence interval (95%): lower bound | 0,340 | | 0,288 | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | | fulfilled | | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | | fulfilled | | fulfilled |
| Homoscedasticity (measued at a p-value of 0.95 if not otherwise stated) | fulfilled | | fulfilled | | fulfilled |
| Autocorrelation of the residual values | fulfilled | | slight autocorr. | | slight autocorr. |
| Normal distribution of the residual values | fulfilled (L) | | fulfilled (L) | | fulfilled (L) |
| No multicollinearity | fulfilled | | fulfilled | | fulfilled |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. As explained in Section 6.3.2, the interpretation of factors has been omitted.*

# Appendix 6.3: Results of the application of a multiple regression analysis

**Time period: 1985-2009, part 2/3**
**Time interval: monthly**
**Dependent variable: portfolios comprising REIT stock market returns (total sample: 218 REITs)**

| *Country of origin* | Australia | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Sectoral property type classification* | Diversified | Apartments | Community centres | Free standing | Health care |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,618 | 0,715 | 0,554 | 0,546 | 0,703 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,588 | 0,693 | 0,518 | 0,510 | 0,679 |
| F-statistic ($F_{emp}$) | 20,377 | 31,610 | 15,626 | 15,173 | 29,748 |
| F-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Standard error ($s$) | 0,330 | 2,408 | 4,140 | 0,701 | 0,058 |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Factor 1 | CPI | Factor 2 | Factor 1 | Div. yld. |
| Standardised value | 0,728 | 0,147 | 0,728 | 0,732 | -0,157 |
| t-statistic ($t_{emp}$) | 17,186 | 2,933 | 16,629 | 15,874 | -2,366 |
| t-statistic: level of significance | 0,000 | 0,004 | 0,000 | 0,000 | 0,019 |
| Confidence interval (95%): upper bound | 0,331 | 0,339 | 3,831 | 0,643 | -0,029 |
| Confidence interval (95%): lower bound | 0,416 | 1,722 | 4,859 | 0,824 | -0,003 |
| | | | | | |
| Name of the regression coefficient | Factor 2 | Unemploy. rate | Factor 5 | Factor 3 | Factor 1 |
| Standardised value | 0,082 | 0,131 | 0,179 | 0,181 | 0,390 |
| t-statistic ($t_{emp}$) | 2,033 | 3,374 | 4,250 | 4,116 | 10,433 |
| t-statistic: level of significance | 0,043 | 0,001 | 0,000 | 0,000 | 0,000 |
| Confidence interval (95%): upper bound | 0,001 | 0,231 | 0,573 | 0,094 | 0,032 |
| Confidence interval (95%): lower bound | 0,083 | 0,879 | 1,562 | 0,267 | 0,047 |
| | | | | | |
| Name of the regression coefficient | Factor 5 | Stock index | | | Factor 2 |
| Standardised value | 0,246 | 0,138 | | | 0,143 |
| t-statistic ($t_{emp}$) | 6,308 | 2,152 | | | 3,999 |
| t-statistic: level of significance | 0,000 | 0,032 | | | 0,000 |
| Confidence interval (95%): upper bound | 0,087 | 0,043 | | | 0,007 |
| Confidence interval (95%): lower bound | 0,165 | 0,976 | | | 0,022 |
| | | | | | |
| Name of the regression coefficient | | Building perm. | | | Factor 3 |
| Standardised value | | 0,080 | | | 0,645 |
| t-statistic ($t_{emp}$) | | 2,044 | | | 18,160 |
| t-statistic: level of significance | | 0,042 | | | 0,000 |
| Confidence interval (95%): upper bound | | 0,011 | | | 0,058 |
| Confidence interval (95%): lower bound | | 0,587 | | | 0,073 |
| | | | | | |
| Name of the regression coefficient | | Factor 3 | | | Factor 4 |
| Standardised value | | 0,608 | | | -0,133 |
| t-statistic ($t_{emp}$) | | 17,487 | | | -3,823 |
| t-statistic: level of significance | | 0,000 | | | 0,000 |
| Confidence interval (95%): upper bound | | 2,344 | | | -0,020 |
| Confidence interval (95%): lower bound | | 2,938 | | | -0,007 |
| | | | | | |
| Name of the regression coefficient | | Factor 4 | | | Factor 5 |
| Standardised value | | 0,200 | | | -0,227 |
| t-statistic ($t_{emp}$) | | 5,897 | | | -6,620 |
| t-statistic: level of significance | | 0,000 | | | 0,000 |
| Confidence interval (95%): upper bound | | 0,579 | | | -0,030 |
| Confidence interval (95%): lower bound | | 1,160 | | | -0,016 |
| | | | | | |
| Name of the regression coefficient | | Factor 5 | | | |
| Standardised value | | 0,432 | | | |
| t-statistic ($t_{emp}$) | | 12,858 | | | |
| t-statistic: level of significance | | 0,000 | | | |
| Confidence interval (95%): upper bound | | 1,590 | | | |
| Confidence interval (95%): lower bound | | 2,165 | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | not fulfilled |
| Homoscedasticity (measued at a p-value of 0.95 if not otherwise stated) | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) |
| Autocorrelation of the residual values | slight autocorr. | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (JB & L) | fulfilled (L) | fulfilled (JB) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. As explained in Section 6.3.2, the interpretation of factors has been omitted.*

## Appendix 6.3: Results of the application of a multiple regression analysis

**Time period: 1985-2009; part 3/3**

**Time interval: monthly**

**Dependent variable: portfolios comprising REIT stock market returns (total sample: 218 REITs)**

| *Country of origin* | United States | United States | United States | United States | | United States | United States |
|---|---|---|---|---|---|---|---|
| *Sectoral property type classification* | Industrial | Lodging and resorts | Merchandise centres | Offices | | Diversified | Retail |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,593 | 0,381 | 0,681 | 0,769 | | 0,385 | 0,623 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,560 | 0,332 | 0,656 | 0,751 | | 0,347 | 0,601 |
| F-statistic ($F_{emp}$) | 18,328 | 7,745 | 26,941 | 41,960 | | 10,363 | 27,460 |
| F-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,000 | | 0,000 | 0,000 |
| Standard error ($s$) | 0,493 | 0,820 | 0,435 | 0,506 | | 0,837 | 0,635 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | Factor 1 | Factor 1 | Cons. clim. | Inflation | Factor 3 | PER | Retail sales |
| Standardised value | 0,530 | 0,396 | 0,090 | 0,116 | 0,519 | 0,142 | -0,103 |
| t-statistic ($t_{emp}$) | 12,121 | 7,352 | 2,135 | 2,564 | 16,573 | 2,776 | -2,580 |
| t-statistic: level of significance | 0,000 | 0,000 | 0,034 | 0,011 | 0,000 | 0,006 | 0,010 |
| Confidence interval (95%): upper bound | 0,330 | 0,291 | 0,008 | 0,044 | 0,463 | 0,008 | -0,964 |
| Confidence interval (95%): lower bound | 0,458 | 0,504 | 0,189 | 0,334 | 0,588 | 0,047 | -0,130 |
| Name of the regression coefficient | Factor 2 | Factor 3 | M3 | Unem. rate | Factor 4 | Term struc. | M3 |
| Standardised value | 0,422 | -0,148 | 0,119 | 0,109 | 0,256 | -0,109 | 0,097 |
| t-statistic ($t_{emp}$) | 10,087 | -2,895 | 2,226 | 3,115 | 8,369 | -2,308 | 2,081 |
| t-statistic: level of significance | 0,000 | 0,004 | 0,027 | 0,002 | 0,000 | 0,022 | 0,038 |
| Confidence interval (95%): upper bound | 0,253 | -0,250 | 0,012 | 0,040 | 0,198 | -0,211 | 0,008 |
| Confidence interval (95%): lower bound | 0,375 | -0,048 | 0,188 | 0,176 | 0,320 | -0,017 | 0,303 |
| Name of the regression coefficient | Factor 4 | Factor 5 | Factor 2 | Stock index | Factor 5 | Factor 2 | Div. yld. |
| Standardised value | 0,236 | 0,384 | 0,599 | 0,156 | 0,476 | 0,498 | -0,168 |
| t-statistic ($t_{emp}$) | 5,808 | 7,736 | 16,183 | 2,692 | 15,713 | 10,130 | -1,984 |
| t-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,008 | 0,000 | 0,000 | 0,048 |
| Confidence interval (95%): upper bound | 0,116 | 0,287 | 0,390 | 0,036 | 0,421 | 0,415 | -0,056 |
| Confidence interval (95%): lower bound | 0,235 | 0,483 | 0,498 | 0,232 | 0,542 | 0,616 | 0,000 |
| Name of the regression coefficient | Factor 5 | | Factor 3 | Div. yld. | | Factor 3 | Bond index |
| Standardised value | 0,188 | | -0,193 | 0,117 | | 0,099 | 0,105 |
| t-statistic ($t_{emp}$) | 4,672 | | -5,242 | 1,997 | | 2,027 | 2,679 |
| t-statistic: level of significance | 0,000 | | 0,000 | 0,047 | | 0,044 | 0,008 |
| Confidence interval (95%): upper bound | 0,081 | | -0,197 | 0,002 | | 0,003 | 0,167 |
| Confidence interval (95%): lower bound | 0,199 | | -0,089 | 0,234 | | 0,202 | 1,092 |
| Name of the regression coefficient | | | Factor 4 | Build. perm. | | Factor 5 | Factor 3 |
| Standardised value | | | 0,485 | 0,073 | | -0,132 | 0,133 |
| t-statistic ($t_{emp}$) | | | 13,500 | 2,063 | | -2,770 | 3,480 |
| t-statistic: level of significance | | | 0,000 | 0,040 | | 0,006 | 0,001 |
| Confidence interval (95%): upper bound | | | 0,307 | 0,003 | | -0,234 | 0,058 |
| Confidence interval (95%): lower bound | | | 0,412 | 0,124 | | -0,040 | 0,208 |
| Name of the regression coefficient | | | Factor 5 | Factor 1 | | | Factor 4 |
| Standardised value | | | -0,087 | 0,291 | | | 0,696 |
| t-statistic ($t_{emp}$) | | | -2,458 | 8,828 | | | 17,354 |
| t-statistic: level of significance | | | 0,015 | 0,000 | | | 0,000 |
| Confidence interval (95%): upper bound | | | -0,117 | 0,229 | | | 0,620 |
| Confidence interval (95%): lower bound | | | -0,013 | 0,360 | | | 0,778 |
| Name of the regression coefficient | | | | Factor 2 | | | |
| Standardised value | | | | 0,107 | | | |
| t-statistic ($t_{emp}$) | | | | 3,405 | | | |
| t-statistic: level of significance | | | | 0,001 | | | |
| Confidence interval (95%): upper bound | | | | 0,046 | | | |
| Confidence interval (95%): lower bound | | | | 0,171 | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | not fulfilled | fulfilled | not fulfilled | fulfilled | | fulfilled | not fulfilled |
| Homoscedasticity (measued at a p-value of 0.95 if not otherwise stated) | fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) | | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | slight autocorr. | | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. As explained in Section 6.3.2, the interpretation of factors has been omitted.

## Appendix 6.4: Ranking of the (significant) results of the regression analysis by property sector classification (quarterly time series)

| *Explained variable: REIT stock returns* | *Property sector allocation* | Apart-ments | | Community centres | | Free stan-ding | | Health care | | Industrial | | Land lease | | Lodging and resorts | | Merch-andise centres | | Neigh-borhood centres | | Offices | | Self-storage | | Diversified | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Explanatory variables (calculated as returns)* | *Type of connection* | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – |
| 1 | CPI | 16 | 4 | 9 | 4 | 3 | 1 | 2 | 2 | 5 | 2 | 4 | 7 | 4 | 3 | 11 | 5 | 1 | 1 | 10 | 3 | 6 | 8 | 14 | 20 |
| 2 | CPI excl. food and energy | 17 | 13 | 3 | 12 | 4 | 7 | 3 | 3 | 6 | 12 | 2 | 8 | 5 | 4 | 12 | 2 | 14 | 2 | 3 | 16 | 7 | 9 | 7 | 7 |
| 3 | PPI | 4 | 5 | 9 | 5 | 14 | 2 | 3 | 9 | 2 | 12 | 4 | 8 | 7 | 4 | 12 | 23 | 4 | 5 | 3 | 9 | 7 | 9 | 7 | 2 |
| 4 | Long-term interest rates | 7 | 12 | 15 | 11 | 4 | 17 | 3 | 3 | 10 | 3 | 4 | 8 | 7 | 4 | 12 | 9 | 13 | 14 | 3 | 9 | 7 | 9 | 13 | 6 |
| 5 | Short-term interest rates | 2 | 12 | 9 | 11 | 4 | 17 | 14 | 8 | 5 | 4 | 4 | 8 | 3 | 4 | 3 | 9 | 4 | 14 | 3 | 14 | 7 | 9 | 3 | 6 |
| 6 | Term structure of interest rates | 14 | 12 | 9 | 11 | 4 | 17 | 3 | 8 | 9 | 10 | 4 | 2 | 10 | 4 | 11 | 21 | 12 | 5 | 14 | 14 | 7 | 9 | 12 | 6 |
| 7 | Level of total retail sales | 6 | 12 | 13 | 11 | 11 | 6 | 13 | 8 | 9 | 10 | 4 | 7 | 4 | 13 | 4 | 9 | 4 | 5 | 7 | 14 | 7 | 9 | 6 | 6 |
| 8 | Level of consumer climate | 3 | 12 | 9 | 11 | 2 | 16 | 3 | 8 | 2 | 10 | 4 | 7 | 3 | 13 | 3 | 9 | 2 | 5 | 3 | 14 | 2 | 9 | 3 | 6 |
| 9 | Level of the leading indicator | 2 | 12 | 2 | 11 | 2 | 6 | 2 | 8 | 2 | 10 | 2 | 7 | 2 | 4 | 2 | 19 | 2 | 2 | 2 | 14 | 6 | 9 | 5 | 2 |
| 10 | Level of GDP | 11 | 2 | 11 | 2 | 9 | 15 | 11 | 3 | 7 | 10 | 3 | 2 | 3 | 2 | 8 | 9 | 2 | 10 | 5 | 2 | 6 | 9 | 5 | 7 |
| 11 | Unemployment rate | 11 | 2 | 2 | 4 | 2 | 15 | 2 | 7 | 3 | 10 | 3 | 2 | 6 | 3 | 2 | 9 | 8 | 10 | 10 | 3 | 2 | 9 | 5 | 7 |
| 12 | Level of ind. prod. | 4 | 3 | 2 | 4 | 2 | 6 | 2 | 2 | 6 | 4 | 3 | 5 | 6 | 3 | 7 | 2 | 2 | 4 | 5 | 7 | 5 | 3 | 13 | 2 |
| 13 | Level of ind. prod.: construction | 10 | 9 | 9 | 8 | 7 | 6 | 9 | 6 | 6 | 9 | 3 | 5 | 6 | 3 | 7 | 8 | 7 | 9 | 9 | 11 | 5 | 8 | 13 | 10 |
| 14 | Level of money supply: M1 | 2 | 3 | 6 | 8 | 7 | 2 | 2 | 2 | 3 | 4 | 3 | 5 | 6 | 3 | 7 | 8 | 2 | 9 | 5 | 3 | 5 | 8 | 7 | 4 |
| 15 | Level of money supply: M3 | 3 | 2 | 8 | 4 | 7 | 2 | 8 | 5 | 5 | 4 | 3 | 2 | 6 | 7 | 7 | 8 | 6 | 2 | 8 | 6 | 5 | 8 | 12 | 9 |
| 16 | National stock index | 8 | 2 | 8 | 4 | 2 | 2 | 8 | 2 | 3 | 7 | 3 | 4 | 2 | 7 | 2 | 8 | 2 | 3 | 8 | 3 | 5 | 3 | 3 | 4 |
| 17 | Small cap stock index | 3 | 6 | 6 | 6 | 6 | 3 | 2 | 4 | 4 | 7 | 3 | 4 | 2 | 3 | 6 | 8 | 5 | 7 | 5 | 8 | 5 | 3 | 6 | 8 |
| 18 | Dividend yield (national stock index) | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 4 | 4 | 2 | 2 | 4 | 2 | 6 | 2 | 8 | 5 | 3 | 7 | 5 | 2 | 6 | 3 | 2 |
| 19 | PER (national stock index) | 3 | 2 | 6 | 5 | 5 | 3 | 6 | 4 | 4 | 3 | 2 | 4 | 3 | 2 | 5 | 8 | 2 | 6 | 2 | 7 | 2 | 6 | 3 | 3 |
| 20 | Bond performance index | 5 | 4 | 2 | 3 | 5 | 3 | 2 | 4 | 4 | 3 | 2 | 4 | 3 | 2 | 2 | 2 | 2 | 3 | 6 | 3 | 3 | 3 | 3 | 2 |
| 21 | Level of total building permits | 2 | 4 | 2 | 4 | 2 | 3 | 2 | 4 | 2 | 4 | 2 | 4 | 3 | 4 | 2 | 7 | 2 | 5 | 2 | 3 | 2 | 5 | 2 | 5 |
| 22 | Level of total building starts | 4 | 2 | 4 | 4 | 4 | 5 | 4 | 4 | 3 | 4 | 2 | 4 | 3 | 4 | 3 | 3 | 2 | 2 | 5 | 3 | 2 | 5 | 2 | 5 |
| 23 | App.-based r. e. ind.: all properties | 4 | 2 | 4 | 3 | 4 | 2 | 4 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 2 |
| 24 | App.-based r. e. ind.: apartments | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 |
| 25 | App.-based r. e. ind.: hotel | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 4 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| 26 | App.-based r. e. ind.: office | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 3 | 3 |
| 27 | App.-based r. e. ind.: retail | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

*Source: Own calculations based on the total sample (218 REITs)*

*Notes: The ranking is performed in descending order based on the share of significant coefficients as of the total number of significant coefficients The highest ranking corresponds to cells marked in red colour, the orange cells refer to the second highest rankings, and the yellow cells to the third highest rankings.*

## Appendix 6.5: Results of the application of a vector autoregressive model

### Time period: 1985-2009; time interval: monthly; dependent variable: portfolios comprising REIT stock market returns (total sample: 218 REITs)

| *Country of origin* | United States | United States | | | | | | United States | |
|---|---|---|---|---|---|---|---|---|---|
| *Sectoral property type classification* | Free standing | Industrial | | | | | | Retail | |
| **VAR model specification** | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,982 | 0,940 | | | | | | 0,967 | |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,848 | 0,478 | | | | | | 0,718 | |
| Standard error ($s$) | 92,033 | 0,724 | | | | | | 0,531 | |
| F-statistic ($F_{emp}$) | 7,304 | 2,034 | | | | | | 3,886 | |
| F-statistic: level of significance | 0,000 | 0,009 | | | | | | 0,000 | |
| **Optimal lag order selection** | | | | | | | | | |
| Akaike Information Criterion (AIC) | 14,000 | 14,000 | | | | | | 14,000 | |
| Schwarz Information Criterion (SIC) | 2,000 | 2,000 | | | | | | 2,000 | |
| **Significant independent variables** | | | | | | | | | |
| Name of the independent variable | Free standing (-10) | Industrial (-1) | Long-term i. r. (-1) | Leading ind. (-1) | Ind. prod. (-1) | Dividend yld. (-14) | Bond index (-5) | Retail (-10) | M3 (-4) |
| Coefficient | 0,299 | -0,341 | -1,835 | 5,216 | 0,374 | 0,944 | 0,973 | 0,378 | -1,150 |
| t-statistic ($t_{emp}$) | 2,351 | -2,083 | -2,430 | 3,369 | 2,487 | 2,206 | 2,214 | 2,190 | -2,073 |
| t-statistic: level of significance | 0,019 | 0,038 | 0,016 | 0,001 | 0,013 | 0,028 | 0,028 | 0,029 | 0,039 |
| Name of the independent variable | Free standing (-11) | Industrial (-6) | Long-term i. r. (-1) | Leading ind. (-2) | Ind. prod. (-10) | PER (-3) | Bond index (-8) | Core inf. (-3) | PER (-1) |
| Coefficient | -0,298 | -0,307 | -1,999 | -11,978 | 0,435 | 0,107 | 1,983 | -4,261 | 0,062 |
| t-statistic ($t_{emp}$) | -2,618 | -2,215 | -2,682 | -3,182 | 2,261 | 2,187 | 4,285 | -2,217 | 3,038 |
| t-statistic: level of significance | 0,009 | 0,028 | 0,008 | 0,002 | 0,025 | 0,030 | 0,000 | 0,027 | 0,003 |
| Name of the independent variable | Free standing (-12) | Industrial (-12) | Long-term i. r. (-6) | Leading ind. (-6) | Ind. prod. (-12) | PER (-6) | Bond index (-13) | Short-term i. r. (-4) | PER (-11) |
| Coefficient | 0,468 | -0,335 | -2,894 | 9,280 | 0,530 | 0,097 | -1,140 | -1,076 | -0,091 |
| t-statistic ($t_{emp}$) | 3,904 | -2,665 | -3,828 | 2,946 | 2,672 | 2,176 | -2,315 | -2,125 | -2,291 |
| t-statistic: level of significance | 0,000 | 0,008 | 0,000 | 0,003 | 0,008 | 0,030 | 0,021 | 0,034 | 0,023 |
| Name of the independent variable | Long-term i. r. (-2) | Inflation (-9) | Long-term i. r. (-4) | Leading ind. (-7) | M1 (-6) | PER (-13) | Build. perm. (-4) | Unem. rate (-1) | Bond index (-2) |
| Coefficient | 1,032 | 1,178 | 0,478 | -7,393 | 0,704 | 0,162 | 0,795 | -0,375 | 0,218 |
| t-statistic ($t_{emp}$) | 2,111 | 1,981 | 2,420 | -2,082 | 2,172 | 3,155 | 2,591 | -2,201 | 2,409 |
| t-statistic: level of significance | 0,036 | 0,049 | 0,016 | 0,038 | 0,031 | 0,002 | 0,010 | 0,029 | 0,017 |
| Name of the independent variable | M3 (-13) | Core inf. (-2) | Short-term i. r. (-9) | Unemploy. rate (-1) | M1 (-7) | Bond index (-2) | Term struc. (-2) | Unem. rate (-12) | Build. perm. (-1) |
| Coefficient | 3,327 | -8,100 | -1,170 | -0,431 | -0,744 | 0,241 | 0,288 | 0,346 | 0,402 |
| t-statistic ($t_{emp}$) | 2,020 | -2,477 | -2,348 | -2,060 | -2,240 | 1,993 | 1,995 | 1,969 | 2,052 |
| t-statistic: level of significance | 0,044 | 0,014 | 0,020 | 0,040 | 0,026 | 0,047 | 0,047 | 0,050 | 0,041 |
| Name of the independent variable | Build. perm. (-12) | PPI (-6) | Short-term i. r. (-10) | Unemploy. rate (-2) | M3 (-7) | Bond index (-3) | Term struc. (-7) | Ind. prod. (-10) | |
| Coefficient | 1,452 | 1,308 | -1,494 | -0,563 | 1,208 | 1,094 | -0,409 | -0,305 | |
| t-statistic ($t_{emp}$) | 1,973 | 1,995 | -2,712 | -2,468 | 2,189 | 2,283 | -2,371 | -2,403 | |
| t-statistic: level of significance | 0,050 | 0,047 | 0,007 | 0,014 | 0,029 | 0,023 | 0,018 | 0,017 | |
| Name of the independent variable | Term struc. (-6) | PPI (-12) | Short-term i. r. (-13) | Unemploy. rate (-6) | Dividend yld. (-7) | Bond index (-4) | | M1 (-3) | |
| Coefficient | 0,961 | 1,328 | -1,341 | 0,505 | 1,273 | 1,239 | | 0,658 | |
| t-statistic ($t_{emp}$) | 2,179 | 2,250 | -3,049 | 2,120 | 3,344 | 2,574 | | 2,279 | |
| t-statistic: level of significance | 0,030 | 0,025 | 0,003 | 0,035 | 0,001 | 0,011 | | 0,023 | |
| **Stability of the VAR** | | | | | | | | | |
| All roots have modulus less than one and lie inside the unit circle | mostly fulfilled | mostly fulfilled | | | | | | mostly fulfilled | |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

# Appendix 6.6: Results of the application of the Granger causality test

**Time period: 1985-2009; time interval: monthly; dependent variable: portfolios comprising REIT stock market returns (total sample: 218 REITs)**

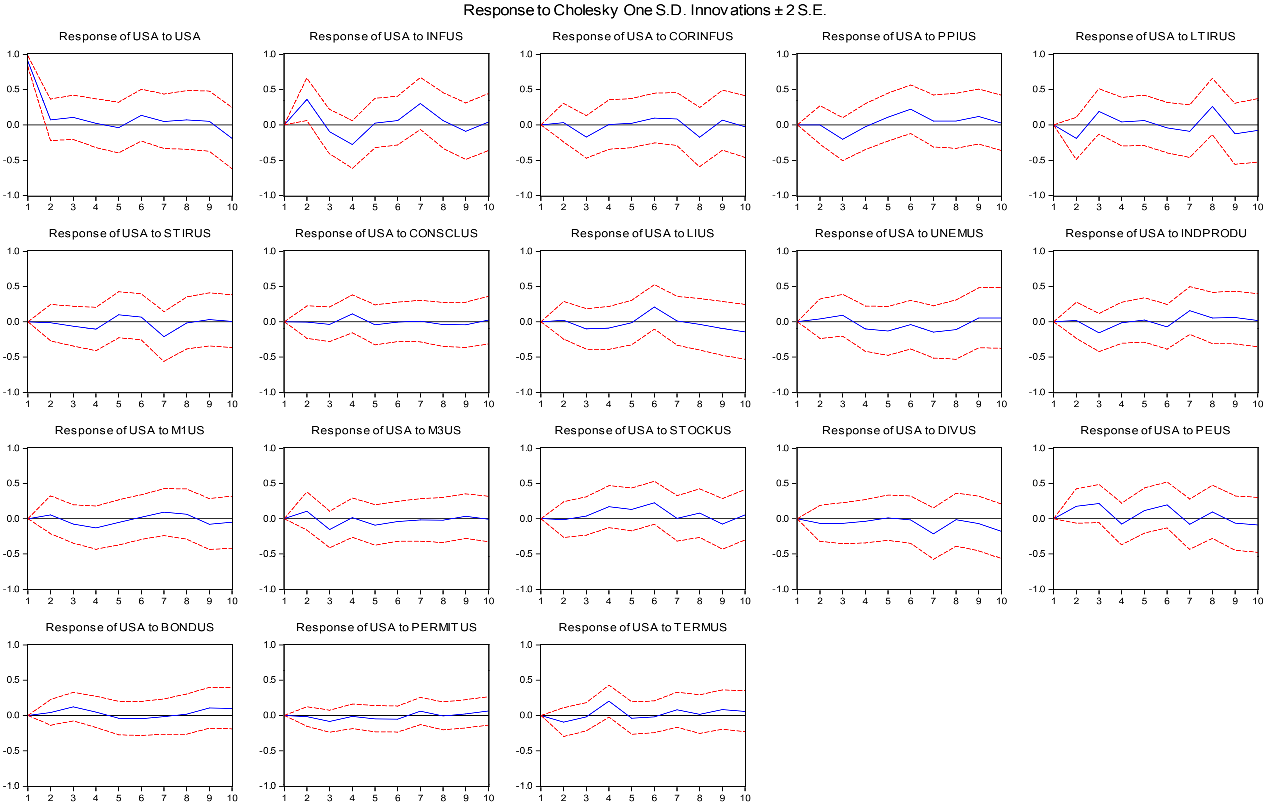
| *Country of origin* | United States | United States | United States | United States |
|---|---|---|---|---|
| *Sectoral property type classification* | Apartments | Community centres | Industrial | Diversified |
| **Independent variables with a significant impact (at least at the five percent level)** | | | | |
| Name of the independent variable | M1 | Cons. clim. | Core inf. | Dividend yld. |
| Chi-squared (Wald)-statistic | 25,01531 | 7,010636 | 26,47579 | 28,22899 |
| Degrees of freedom | 14 | 2 | 14 | 14 |
| Probability value | 0,0344 | 0,03 | 0,0225 | 0,0133 |
| | | | | |
| Name of the independent variable | | PER | Long-term i. r. | |
| Chi-squared (Wald)-statistic | | 17,11106 | 43,48995 | |
| Degrees of freedom | | 2 | 14 | |
| Probability value | | 0,0002 | 0,0001 | |
| | | | | |
| Name of the independent variable | | | Short-term i. r. | |
| Chi-squared (Wald)-statistic | | | 36,70396 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0008 | |
| | | | | |
| Name of the independent variable | | | Leading ind. | |
| Chi-squared (Wald)-statistic | | | 33,66576 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0023 | |
| | | | | |
| Name of the independent variable | | | Unemploy. rate | |
| Chi-squared (Wald)-statistic | | | 43,82543 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0001 | |
| | | | | |
| Name of the independent variable | | | Ind. prod. | |
| Chi-squared (Wald)-statistic | | | 32,449 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0035 | |
| | | | | |
| Name of the independent variable | | | M1 | |
| Chi-squared (Wald)-statistic | | | 33,02154 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0029 | |
| | | | | |
| Name of the independent variable | | | Dividend yld. | |
| Chi-squared (Wald)-statistic | | | 39,92906 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0003 | |
| | | | | |
| Name of the independent variable | | | PER | |
| Chi-squared (Wald)-statistic | | | 33,77819 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0022 | |
| | | | | |
| Name of the independent variable | | | Bond index | |
| Chi-squared (Wald)-statistic | | | 41,84714 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0001 | |
| | | | | |
| Name of the independent variable | | | Term struc. | |
| Chi-squared (Wald)-statistic | | | 28,89071 | |
| Degrees of freedom | | | 14 | |
| Probability value | | | 0,0108 | |

*Source: Own calculations based on the total sample (15 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent.*

# Appendix 6.7: Results of the application of a impulse response analysis

**Time period: 1985-2009; time interval: monthly; dependent variable: portfolio comprising US-American REIT stock market returns**




*Source: Own calculations based on the total sample (15 of 218 REITs)*

*Note: The projection period is measured in months on the horizontal axis. The magnitude of the response, with 1.0 equalling one standard deviation, is written on the vertical axis. The dashed lines represent +/- two standard errors and are used to determine the statistical significance. The impulse response is supposed to be different from zero at months when the dashed lines do not straddle zero. [See RUNKLE (1987) for further information.]*

## Appendix 6.8: Number of significant relationships with REIT stock returns obtained from the impulse response analysis (quarterly time series)

| | | Total | | Australia | | Belgium | | Canada | | Nether-lands | | New Zealand | | South Africa | | Turkey | | United States | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Exogeneous variables (calculated as returns)* | Number | Share as of the total number of relationships | + | – | + | – | + | – | + | – | + | – | + | – | + | – | + | – |
| 1 | CPI | 0 | 0,00% | | | | | | | | | | | | | | | | |
| 2 | CPI excl. food and energy | 3 | 5,66% | | 1 | | | 1 | | | | | | | | | 1 | | |
| 3 | PPI | 0 | 0,00% | | | | | | | | | | | | | | | | |
| 4 | Long-term interest rates | 2 | 3,77% | 1 | 1 | | | | | | | | | | | | | | |
| 5 | Short-term interest rates | 1 | 1,89% | | 1 | | | | | | | | | | | | | | |
| 6 | Term structure of interest rates | 2 | 3,77% | | 1 | | | | | | | | | | | | | 1 | |
| 7 | Level of total retail sales | 1 | 1,89% | 1 | | | | | | | | | | | | | | | |
| 8 | Level of consumer climate | 3 | 5,66% | 1 | | | | | | 1 | | | | | | | | 1 | |
| 9 | Level of the leading indicator | 5 | 9,43% | 2 | | | | | | 1 | | | | | | | | 2 | |
| 10 | Level of GDP | 2 | 3,77% | | | | | | | | | | | 1 | | | | 1 | |
| 11 | Unemployment rate | 3 | 5,66% | | | | | | | | | | | | | | 1 | | 2 |
| 12 | Level of ind. prod. | 2 | 3,77% | | | | | | | | | | | | 1 | 1 | | | |
| 13 | Level of ind. prod.: construction | 3 | 5,66% | 1 | | | | 1 | | | 1 | | | | | | | | |
| 14 | Level of money supply: M1 | 2 | 3,77% | | | | | | 1 | | | | | | 1 | | | | |
| 15 | Level of money supply: M3 | 2 | 3,77% | | | | | | | | | | | | 1 | | | | 1 |
| 16 | National stock index | 3 | 5,66% | 3 | | | | | | | | | | | | | | | |
| 17 | Small cap stock index | 0 | 0,00% | | | | | | | | | | | | | | | | |
| 18 | Dividend yield (national stock index) | 4 | 7,55% | | | | | | | | 2 | | | | | | | | 2 |
| 19 | PER (national stock index) | 5 | 9,43% | 2 | | | | | | | | 1 | | | | | | 2 | |
| 20 | Bond performance index | 4 | 7,55% | 1 | 2 | | | | | | 1 | | | | | | | | |
| 21 | Level of total building permits | 1 | 1,89% | | | | | | | | | | | 1 | | | | | |
| 22 | Level of total building starts | 0 | 0,00% | | | | | | | | | | | | | | | | |
| 23 | App.-based r. e. ind.: all properties | 2 | 3,77% | | | | | | | | | | | | | | | | 2 |
| 24 | App.-based r. e. ind.: apartments | 1 | 1,89% | | | | | | | | | | | | | | | | 1 |
| 25 | App.-based r. e. ind.: hotel | 0 | 0,00% | | | | | | | | | | | | | | | | |
| 26 | App.-based r. e. ind.: office | 1 | 1,89% | | | | | | | | | | | | | | | | 1 |
| 27 | App.-based r. e. ind.: retail | 1 | 1,89% | | | | | | | | | | | | | | | | 1 |
| Total | | **53** | | **12** | **6** | **0** | **0** | **2** | **1** | **2** | **4** | **1** | **0** | **2** | **3** | **1** | **2** | **7** | **10** |

*Source: Own calculations based on the total sample (218 REITs)*

*Notes: The highest number of significant connections (see Section 6.5.3 and Appendix 6.7 for explanations how to determine significant connections) corresponds to cells marked in red colour. If no significant connections have been detected or if the country-specific variable had not been available (see Appendix 6.1 for further information), the corresponding cells are marked in grey colour.*

## Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

**Time period: 1994-2008; time interval: annually; dependent variable: REIT dividends per share returns**

| ***Country of origin*** | **United States** | **United States** | **United States** | **United States** | **United States** |
|---|---|---|---|---|---|
| ***Name of REIT*** | **BRE Properties** | **Equity Residential** | **Omega Healthcare** | **Post Properties** | **Weingarten Realty** |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,558 | 0,631 | 0,531 | 0,593 | 0,544 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,438 | 0,530 | 0,403 | 0,483 | 0,420 |
| F-statistic ($F_{emp}$) | 4,635 | 6,270 | 4,144 | 5,353 | 4,378 |
| F-statistic: level of significance | 0,025 | 0,010 | 0,034 | 0,016 | 0,029 |
| Standard error ($s$) | 2,186 | 2,239 | 48,399 | 11,697 | 1,239 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Rental rev. | Operating expenses | Rental rev. |
| Standardised value | 0,505 | 0,665 | -0,724 | -0,636 | 0,803 |
| t-statistic ($t_{emp}$) | 2,520 | 3,631 | -3,505 | -3,211 | 2,683 |
| t-statistic: level of significance | 0,028 | 0,004 | 0,005 | 0,008 | 0,021 |
| Confidence interval (95%): upper bound | 5,203 | 10,882 | -598,719 | -913,510 | 3,670 |
| Confidence interval (95%): lower bound | 77,050 | 44,377 | -136,804 | -170,450 | 37,181 |
| | | | | | |
| Name of the regression coefficient | | Operating expenses | | | |
| Standardised value | | -0,431 | | | |
| t-statistic ($t_{emp}$) | | -2,354 | | | |
| t-statistic: level of significance | | 0,038 | | | |
| Confidence interval (95%): upper bound | | -368,980 | | | |
| Confidence interval (95%): lower bound | | -12,359 | | | |
| | | | | | |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | not fulfilled | fulfilled (at a p-value of 0.975) |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | not fulfilled | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | orthogonalisation | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (39 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

## Time period: 1994-2008; time interval: annually; dependent variable: adjusted REIT stock market returns

| *Country of origin* | Australia | United States | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | GPT Group | Brandywine Realty | Colonial Properties | Equity Lifestyle | Omega Healthcare | Saul Centers | Simon Property Group | Tanger Factory Outlet | Washington Real Estate | Winthrop REIT |
| **Step 3: Examination of the regression function** | | | | | | | | | | |
| **Regression function** | | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,633 | 0,802 | 0,526 | 0,536 | 0,754 | 0,705 | 0,509 | 0,663 | 0,580 | 0,622 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,532 | 0,748 | 0,397 | 0,410 | 0,687 | 0,587 | 0,375 | 0,528 | 0,466 | 0,519 |
| F-statistic ($F_{emp}$) | 6,314 | 14,819 | 4,073 | 4,240 | 11,265 | 5,979 | 3,798 | 4,917 | 5,074 | 6,029 |
| F-statistic: level of significance | 0,009 | 0,000 | 0,036 | 0,032 | 0,001 | 0,010 | 0,043 | 0,019 | 0,019 | 0,011 |
| Standard error ($s$) | 7,733 | 14,969 | 23,782 | 9,254 | 28,455 | 7,892 | 7,305 | 12,557 | 13,756 | 23,054 |
| | | | | | | | | | | |
| **Regression coefficients** | | | | | | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Change in w. c. | Rental rev. | Rental rev. | Rental rev. | Rental rev. | Rental rev. | Oper. expen. | Change in w. c. |
| Standardised value | 1,312 | 0,894 | 0,683 | -1,646 | -1,872 | -0,950 | -0,854 | 0,885 | 0,686 | -0,670 |
| t-statistic ($t_{emp}$) | 2,833 | 6,655 | 3,293 | -2,601 | -5,403 | -3,727 | -3,145 | 3,530 | 3,263 | -3,052 |
| t-statistic: level of significance | 0,016 | 0,000 | 0,007 | 0,025 | 0,000 | 0,004 | 0,009 | 0,005 | 0,008 | 0,011 |
| Confidence interval (95%): upper bound | 38,828 | 51,518 | 401,214 | -345,668 | -1087,659 | -99,546 | -6,024 | 45,658 | 331,766 | -892,501 |
| Confidence interval (95%): lower bound | 309,075 | 102,437 | 2018,049 | -28,779 | -457,990 | -25,049 | -1,064 | 201,978 | 1707,156 | -144,565 |
| | | | | | | | | | | |
| Name of the regression coefficient | | | | Oper. expen. | Oper. expen. | Straight-l. r. adj. | | | | |
| Standardised value | | | | 2,053 | 1,530 | 0,657 | | | | |
| t-statistic ($t_{emp}$) | | | | 3,286 | 4,991 | 2,689 | | | | |
| t-statistic: level of significance | | | | 0,007 | 0,000 | 0,023 | | | | |
| Confidence interval (95%): upper bound | | | | 194,125 | 60,811 | 287,224 | | | | |
| Confidence interval (95%): lower bound | | | | 981,825 | 156,759 | 3067,327 | | | | |
| | | | | | | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | normal (L) | normal (L) | normal (L) | normal (L) | normal (L) | normal (L) | normal (L) | normal (L) | not normal | normal (L) |
| No multicollinearity | fulfilled | orthogon. | orthogon. | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (48 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (1/5)**

| *Country of origin* | Australia | Australia | Canada | Netherlands | United States |
|---|---|---|---|---|---|
| *Name of REIT* | Bunnings Warehouse | Commonwealth REIT | Riocan | Vastned Office | Camden |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,710 | 0,788 | 0,783 | 0,812 | 0,782 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,565 | 0,661 | 0,674 | 0,717 | 0,673 |
| F-statistic ($F_{emp}$) | 4,890 | 6,192 | 7,205 | 8,613 | 7,164 |
| F-statistic: level of significance | 0,047 | 0,039 | 0,021 | 0,014 | 0,021 |
| Standard error ($s$) | 6,768 | 2,541 | 2,877 | 11,746 | 1,730 |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Operating expenses | Rental rev. | Change in w. c. | Rental rev. | Operating expenses |
| Standardised value | -1,044 | 0,904 | 0,859 | -0,572 | -0,794 |
| t-statistic ($t_{emp}$) | -3,776 | 3,885 | 4,512 | -2,576 | -4,163 |
| t-statistic: level of significance | 0,009 | 0,012 | 0,004 | 0,042 | 0,006 |
| Confidence interval (95%): upper bound | -8774,093 | 116,404 | 225,952 | -791,824 | -682,936 |
| Confidence interval (95%): lower bound | -1874,187 | 571,677 | 761,364 | -20,374 | -177,292 |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled | orthogonalisation | fulfilled | orthogonalisation |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

## Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (2/5)**

| *Country of origin* | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | **CBL Associates** | **Cousins Properties** | **Duke Realty** | **East Group** | **Entertainment Properties Trust** |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,962 | 0,853 | 0,977 | 0,861 | 0,880 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,899 | 0,736 | 0,945 | 0,751 | 0,783 |
| F-statistic ($F_{emp}$) | 15,271 | 7,269 | 31,350 | 7,771 | 9,130 |
| F-statistic: level of significance | 0,024 | 0,026 | 0,009 | 0,023 | 0,016 |
| Standard error ($s$) | 1,794 | 47,067 | 5,908 | 1,897 | 1,527 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Straight-l. rents adj. | Change in w. c. | Rental rev. | Rental rev. |
| Standardised value | -0,639 | 0,745 | 1,144 | 0,694 | -0,681 |
| t-statistic ($t_{emp}$) | -5,687 | 3,527 | 7,540 | 4,169 | -3,310 |
| t-statistic: level of significance | 0,011 | 0,017 | 0,005 | 0,009 | 0,021 |
| Confidence interval (95%): upper bound | -27,134 | 11065,492 | 8859,998 | 12,422 | -68,152 |
| Confidence interval (95%): lower bound | -7,663 | 70535,382 | 21801,601 | 52,382 | -8,573 |
| | | | | | |
| Name of the regression coefficient | Stock-based comp. | | | Operating expenses | |
| Standardised value | -0,625 | | | -0,428 | |
| t-statistic ($t_{emp}$) | -5,564 | | | -2,570 | |
| t-statistic: level of significance | 0,011 | | | 0,050 | |
| Confidence interval (95%): upper bound | -10836,930 | | | -786,085 | |
| Confidence interval (95%): lower bound | -2950,419 | | | 0,120 | |
| | | | | | |
| Name of the regression coefficient | | | | Change in w. c. | |
| Standardised value | | | | -0,442 | |
| t-statistic ($t_{emp}$) | | | | -2,657 | |
| t-statistic: level of significance | | | | 0,045 | |
| Confidence interval (95%): upper bound | | | | -492,662 | |
| Confidence interval (95%): lower bound | | | | -8,169 | |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | slight autocorr. | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (3/5)**

| *Country of origin* | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | Equity Residential | Essex Property Trust | Health Care Property | Hersha Hospitality | Home Properties |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,950 | 0,778 | 0,761 | 0,840 | 0,876 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,910 | 0,666 | 0,641 | 0,743 | 0,814 |
| F-statistic ($F_{emp}$) | 23,846 | 6,994 | 6,362 | 8,730 | 14,140 |
| F-statistic: level of significance | 0,002 | 0,022 | 0,027 | 0,020 | 0,004 |
| Standard error ($s$) | 0,854 | 2,857 | 1,313 | 1,215 | 1,305 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Rental rev. | Rental rev. | Rental rev. |
| Standardised value | 0,620 | 1,887 | 0,566 | 0,577 | 0,877 |
| t-statistic ($t_{emp}$) | 6,209 | 4,271 | 2,613 | 3,220 | 6,104 |
| t-statistic: level of significance | 0,002 | 0,005 | 0,040 | 0,023 | 0,001 |
| Confidence interval (95%): upper bound | 13,230 | 75,610 | 1,583 | 0,936 | 13,788 |
| Confidence interval (95%): lower bound | 31,924 | 278,460 | 48,119 | 8,345 | 32,239 |
| | | | | | |
| Name of the regression coefficient | Operating expenses | Operating expenses | | Change in w. c. | |
| Standardised value | -0,738 | -2,011 | | -0,712 | |
| t-statistic ($t_{emp}$) | -7,392 | -4,530 | | -3,977 | |
| t-statistic: level of significance | 0,001 | 0,004 | | 0,011 | |
| Confidence interval (95%): upper bound | -682,900 | -1164,675 | | -76,492 | |
| Confidence interval (95%): lower bound | -330,488 | -347,715 | | -16,434 | |
| | | | | | |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | fulfilled | fulfilled | orthogonalisation | orthogonalisation |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (4/5)**

| *Country of origin* | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | Investors Real Estate | Parkway Properties | PS Business Parks | Sun Communities | Tanger Factory Outlet |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,919 | 0,856 | 0,885 | 0,703 | 0,861 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,879 | 0,741 | 0,793 | 0,555 | 0,750 |
| F-statistic ($F_{emp}$) | 22,701 | 7,425 | 9,627 | 4,741 | 7,734 |
| F-statistic: level of significance | 0,001 | 0,025 | 0,014 | 0,050 | 0,023 |
| Standard error ($s$) | 1,325 | 4,494 | 6,566 | 1,361 | 1,094 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Operating expenses | Rental rev. | Rental rev. | Rental rev. |
| Standardised value | 1,279 | -0,898 | -0,428 | -0,730 | -0,757 |
| t-statistic ($t_{emp}$) | 6,496 | -5,291 | -2,826 | -3,284 | -4,537 |
| t-statistic: level of significance | 0,001 | 0,003 | 0,037 | 0,017 | 0,006 |
| Confidence interval (95%): upper bound | 72,700 | -1166,999 | -356,331 | -19,756 | -13,322 |
| Confidence interval (95%): lower bound | 160,567 | -403,811 | -16,878 | -2,887 | -3,686 |
| | | | | | |
| Name of the regression coefficient | Operating expenses | | Change in w. c. | | Straight-l. rents adj. |
| Standardised value | -1,589 | | 0,513 | | -0,498 |
| t-statistic ($t_{emp}$) | -8,083 | | 3,385 | | -2,986 |
| t-statistic: level of significance | 0,000 | | 0,020 | | 0,031 |
| Confidence interval (95%): upper bound | -399,990 | | 267,893 | | -2655,513 |
| Confidence interval (95%): lower bound | -214,098 | | 1958,102 | | -198,476 |
| | | | | | |
| Name of the regression coefficient | | | Straight-l. rents adj. | | |
| Standardised value | | | 0,660 | | |
| t-statistic ($t_{emp}$) | | | 4,351 | | |
| t-statistic: level of significance | | | 0,007 | | |
| Confidence interval (95%): upper bound | | | 3218,058 | | |
| Confidence interval (95%): lower bound | | | 12512,870 | | |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | slight autocorr. | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled | orthogonalisation | orthogonalisation | orthogonalisation |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

## Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components

### Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (5/5)

| *Country of origin* | United States | United States |
|---|---|---|
| *Name of REIT* | Taubman Centers | Washington Real Estate |
| **Step 3: Examination of the regression function** | | |
| **Regression function** | | |
| Coefficient of determination ($R^2$) | 0,704 | 0,951 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,555 | 0,902 |
| F-statistic ($F_{emp}$) | 4,746 | 19,380 |
| F-statistic: level of significance | 0,050 | 0,007 |
| Standard error ($s$) | 3,434 | 0,539 |
| | | |
| **Regression coefficients** | | |
| Name of the regression coefficient | Rental rev. | Rental rev. |
| Standardised value | -0,774 | 0,341 |
| t-statistic ($t_{emp}$) | -3,482 | 3,076 |
| t-statistic: level of significance | 0,013 | 0,037 |
| Confidence interval (95%): upper bound | -56,269 | 1,609 |
| Confidence interval (95%): lower bound | -9,821 | 31,439 |
| | | |
| Name of the regression coefficient | | Operating expenses |
| Standardised value | | -0,903 |
| t-statistic ($t_{emp}$) | | -8,156 |
| t-statistic: level of significance | | 0,001 |
| Confidence interval (95%): upper bound | | -563,358 |
| Confidence interval (95%): lower bound | | -277,207 |
| | | |
| Name of the regression coefficient | | |
| Standardised value | | |
| t-statistic ($t_{emp}$) | | |
| t-statistic: level of significance | | |
| Confidence interval (95%): upper bound | | |
| Confidence interval (95%): lower bound | | |
| | | |
| **Step 4: Examination of the underlying assumptions** | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled |
| Homoscedasticity | fulfilled (at a p-value of 0.99) | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | orthogonalisation |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

## Appendix 7.1: Results of the application of a multiple regression analysis regarding cash flow calculation components
### Time period: 1999-2008; time interval: annually; dependent variable: adjusted REIT stock market returns

| *Country of origin* | Australia | Australia | Australia | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Bunnings Warehouse | Commonwealth | GPT Group | Equity Lifestyle | Glimcher Realty | LTC Properties | Sovran Self Storage | Sun Communities | Vornado | Washington Real Estate |
| **Step 3: Examination of the regression function** | | | | | | | | | | |
| **Regression function** | | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,905 | 0,775 | 0,865 | 0,832 | 0,866 | 0,829 | 0,823 | 0,728 | 0,866 | 0,917 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,857 | 0,640 | 0,758 | 0,749 | 0,732 | 0,743 | 0,681 | 0,592 | 0,732 | 0,834 |
| F-statistic ($F_{emp}$) | 19,036 | 5,740 | 8,041 | 9,939 | 6,469 | 9,683 | 5,794 | 5,355 | 6,475 | 11,068 |
| F-statistic: level of significance | 0,002 | 0,045 | 0,021 | 0,010 | 0,049 | 0,010 | 0,041 | 0,039 | 0,049 | 0,019 |
| Standard error ($s$) | 0,005 | 12,418 | 6,840 | 6,544 | 20,050 | 24,943 | 12,275 | 8,464 | 5,168 | 7,884 |
| **Regression coefficients** | | | | | | | | | | |
| Name of the regression coefficient | Rental rev. | | Rental rev. | Rental rev. | Straight-line r. adj. | Oper. expen. | Oper. expen. | Oper. expen. | Change in w. c. | Rental rev. |
| Standardised value | -1,112 | | 1,236 | -0,993 | -0,911 | 0,886 | 0,726 | -0,777 | 0,578 | 0,667 |
| t-statistic ($t_{emp}$) | -7,464 | | 2,895 | -3,563 | -4,980 | 5,248 | 3,855 | -3,648 | 3,151 | 4,630 |
| t-statistic: level of significance | 0,000 | | 0,034 | 0,012 | 0,008 | 0,002 | 0,012 | 0,011 | 0,034 | 0,010 |
| Confidence interval (95%): upper bound | -1,858 | | 24,007 | -324,622 | -23747,535 | 3106,598 | 766,849 | -1474,141 | 57,616 | 145,629 |
| Confidence interval (95%): lower bound | -0,941 | | 404,873 | -60,305 | -6745,829 | 8534,431 | 3837,496 | -290,526 | 911,653 | 581,869 |
| | | | | | | | | | | |
| Name of the regression coefficient | Oper. expen. | | | Oper. expen. | | | | | Straight-line r. adj. | Oper. expen. |
| Standardised value | 0,747 | | | 1,342 | | | | | 0,523 | 0,636 |
| t-statistic ($t_{emp}$) | 4,724 | | | 4,807 | | | | | 2,858 | 4,420 |
| t-statistic: level of significance | 0,003 | | | 0,003 | | | | | 0,046 | 0,012 |
| Confidence interval (95%): upper bound | 2,602 | | | 399,381 | | | | | 180,032 | 1238,683 |
| Confidence interval (95%): lower bound | 8,195 | | | 1227,569 | | | | | 12391,344 | 5423,418 |
| | | | | | | | | | | |
| Name of the regression coefficient | | | | Change in w. c. | | | | | | |
| Standardised value | | | | 0,643 | | | | | | |
| t-statistic ($t_{emp}$) | | | | 2,696 | | | | | | |
| t-statistic: level of significance | | | | 0,036 | | | | | | |
| Confidence interval (95%): upper bound | | | | 69,036 | | | | | | |
| Confidence interval (95%): lower bound | | | | 1423,308 | | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | slight autocorr. | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | orthogon. | orthogon. | orthogon. | orthogon. | orthogon. | orthogon. |

*Source: Own calculations based on the total sample (125 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

## Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1994-2008; time interval: annually; dependent variable: REIT dividends per share returns**

| *Country of origin* | United States | United States |
|---|---|---|
| *Name of REIT* | **Equity Lifestyle** | **Parkway Properties** |
| **Step 3: Examination of the regression function** | | |
| **Regression function** | | |
| Coefficient of determination ($R^2$) | 0,670 | 0,636 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,580 | 0,536 |
| F-statistic ($F_{emp}$) | 7,457 | 6,398 |
| F-statistic: level of significance | 0,005 | 0,009 |
| Standard error ($s$) | 98,533 | 13,838 |
| | | |
| **Regression coefficients** | | |
| Name of the regression coefficient | Change in w. c. | Rental rev. |
| Standardised value | 0,530 | 0,680 |
| t-statistic ($t_{emp}$) | 2,688 | 3,500 |
| t-statistic: level of significance | 0,021 | 0,005 |
| Confidence interval (95%): upper bound | 49,969 | 9,384 |
| Confidence interval (95%): lower bound | 501,773 | 41,173 |
| | | |
| Name of the regression coefficient | | Operating expenses |
| Standardised value | | -0,515 |
| t-statistic ($t_{emp}$) | | -2,501 |
| t-statistic: level of significance | | 0,029 |
| Confidence interval (95%): upper bound | | -280,068 |
| Confidence interval (95%): lower bound | | -17,876 |
| | | |
| Name of the regression coefficient | | Change in w. c. |
| Standardised value | | 0,438 |
| t-statistic ($t_{emp}$) | | 2,207 |
| t-statistic: level of significance | | 0,049 |
| Confidence interval (95%): upper bound | | 0,041 |
| Confidence interval (95%): lower bound | | 29,563 |
| | | |
| **Step 4: Examination of the underlying assumptions** | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled |
| Autocorrelation of the residual values | slight autocorr. | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (39 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1994-2008; time interval: annually; dependent variable: adjusted REIT stock market returns**

| *Country of origin* | Australia | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | GPT Group | Brandywine Realty | CBL Associates | Omega Healthcare | Winthrop REIT |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,767 | 0,588 | 0,678 | 0,665 | 0,766 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,704 | 0,476 | 0,591 | 0,574 | 0,702 |
| F-statistic ($F_{emp}$) | 12,093 | 5,235 | 7,733 | 7,276 | 11,983 |
| F-statistic: level of significance | 0,001 | 0,017 | 0,005 | 0,006 | 0,001 |
| Standard error ($s$) | 6,154 | 21,570 | 5,778 | 33,240 | 18,146 |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | | Rental rev. | Rental rev. | Change in w. c. |
| Standardised value | 0,921 | | 0,529 | -1,718 | -0,889 |
| t-statistic ($t_{emp}$) | 4,487 | | 3,091 | -3,811 | -5,894 |
| t-statistic: level of significance | 0,001 | | 0,010 | 0,003 | 0,000 |
| Confidence interval (95%): upper bound | 83,574 | | 12,951 | -1718,218 | -27,007 |
| Confidence interval (95%): lower bound | 244,472 | | 76,998 | -460,216 | -12,321 |
| Name of the regression coefficient | | | Change in w. c. | Oper. expen. | |
| Standardised value | | | -0,572 | 1,027 | |
| t-statistic ($t_{emp}$) | | | -3,346 | 2,951 | |
| t-statistic: level of significance | | | 0,007 | 0,013 | |
| Confidence interval (95%): upper bound | | | -26,690 | 30,776 | |
| Confidence interval (95%): lower bound | | | -5,510 | 211,369 | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity (measued at a p-value of 0.95 if not otherwise stated) | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | slight autocorr. | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (JB & L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | orthogon. | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (48 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (1/4)**

| *Country of origin* | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | Carindale Properties | GPT Group | Canadian Apartment | Corio | Goodman Property Group |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,985 | 0,931 | 0,887 | 0,842 | 0,886 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,978 | 0,875 | 0,830 | 0,764 | 0,801 |
| F-statistic ($F_{emp}$) | 134,440 | 16,757 | 15,627 | 10,691 | 10,414 |
| F-statistic: level of significance | 0,000 | 0,004 | 0,003 | 0,008 | 0,023 |
| Standard error ($s$) | 2,833 | 3,233 | 17,230 | 0,898 | 5,079 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Rental rev. | Rental rev. | Rental rev. |
| Standardised value | 0,947 | 0,865 | 1,346 | -0,656 | 2,552 |
| t-statistic ($t_{emp}$) | 9,423 | 4,042 | 6,136 | -4,048 | 5,071 |
| t-statistic: level of significance | 0,000 | 0,010 | 0,001 | 0,007 | 0,007 |
| Confidence interval (95%): upper bound | 970,843 | 36,740 | 2.844,884 | -38,535 | 275,119 |
| Confidence interval (95%): lower bound | 1.651,898 | 165,102 | 6.618,344 | -9,498 | 940,988 |
| | | | | | |
| Name of the regression coefficient | | | Operating expenses | Change in w. c. | Operating expenses |
| Standardised value | | | -1,252 | 0,642 | -1,822 |
| t-statistic ($t_{emp}$) | | | -5,716 | 3,961 | -3,958 |
| t-statistic: level of significance | | | 0,001 | 0,007 | 0,017 |
| Confidence interval (95%): upper bound | | | -10.537,206 | 33,321 | -1.223,973 |
| Confidence interval (95%): lower bound | | | -4.220,314 | 141,020 | -214,776 |
| | | | | | |
| Name of the regression coefficient | | | | | Change in w. c. |
| Standardised value | | | | | -1,304 |
| t-statistic ($t_{emp}$) | | | | | -3,653 |
| t-statistic: level of significance | | | | | 0,022 |
| Confidence interval (95%): upper bound | | | | | -2.493,418 |
| Confidence interval (95%): lower bound | | | | | -339,980 |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | autocorr. | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | orthogonalisation | fulfilled |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (2/4)**

| *Country of origin* | **United States** | **United States** | **United States** | **United States** | **United States** |
|---|---|---|---|---|---|
| *Name of REIT* | **Agree Realty** | **BRE Properties** | **Corporate Office Properties Trust** | **Duke Realty** | **Hersha Hospitality Trust** |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,811 | 0,797 | 0,921 | 0,998 | 0,882 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,660 | 0,696 | 0,857 | 0,994 | 0,812 |
| F-statistic ($F_{emp}$) | 5,369 | 7,853 | 14,486 | 231,252 | 12,498 |
| F-statistic: level of significance | 0,047 | 0,017 | 0,006 | 0,004 | 0,009 |
| Standard error ($s$) | 0,907 | 1,819 | 11,258 | 1,967 | 1,041 |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Operating expenses | Operating expenses | Rental rev. |
| Standardised value | -0,858 | 1,075 | 0,445 | 0,845 | 0,776 |
| t-statistic ($t_{emp}$) | -4,416 | 4,611 | 3,527 | 28,458 | 5,056 |
| t-statistic: level of significance | 0,007 | 0,004 | 0,017 | 0,001 | 0,004 |
| Confidence interval (95%): upper bound | -89,280 | 163,517 | 284,526 | 1.144,332 | 4,279 |
| Confidence interval (95%): lower bound | -23,584 | 533,298 | 1.813,536 | 1.551,996 | 13,132 |
| Name of the regression coefficient | | Operating expenses | Change in w. c. | Change in w. c. | Change in w. c. |
| Standardised value | | -0,916 | -0,545 | 0,541 | -0,441 |
| t-statistic ($t_{emp}$) | | -3,793 | -4,326 | 18,428 | -2,876 |
| t-statistic: level of significance | | 0,009 | 0,008 | 0,003 | 0,035 |
| Confidence interval (95%): upper bound | | -1.777,969 | -1.235,178 | 9.630,454 | -33,393 |
| Confidence interval (95%): lower bound | | -383,573 | -314,343 | 15.497,490 | -1,874 |
| Name of the regression coefficient | | | Straight-l. rents adj. | | |
| Standardised value | | | -0,650 | | |
| t-statistic ($t_{emp}$) | | | -5,160 | | |
| t-statistic: level of significance | | | 0,004 | | |
| Confidence interval (95%): upper bound | | | -30,391 | | |
| Confidence interval (95%): lower bound | | | -10,180 | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | fulfilled | orthogonalisation | orthogonalisation | orthogonalisation |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

## Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (3/4)**

| *Country of origin* | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|
| *Name of REIT* | Kimco Realty | Lexington Realty | Liberty Property | Macerich Company | Realty Income |
| **Step 3: Examination of the regression function** | | | | | |
| **Regression function** | | | | | |
| Coefficient of determination ($R^2$) | 0,882 | 0,894 | 0,953 | 0,411 | 0,982 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,823 | 0,762 | 0,891 | 0,337 | 0,968 |
| F-statistic ($F_{emp}$) | 14,943 | 6,759 | 15,313 | 5,572 | 69,019 |
| F-statistic: level of significance | 0,003 | 0,044 | 0,025 | 0,046 | 0,000 |
| Standard error ($s$) | 7,620 | 14,352 | 1,528 | 3,365 | 6,001 |
| | | | | | |
| **Regression coefficients** | | | | | |
| Name of the regression coefficient | Rental rev. | Change in w. c. | Rental rev. | Straight-l. rents adj. | Operating expenses |
| Standardised value | 0,928 | 0,771 | 0,966 | 0,641 | 0,817 |
| t-statistic ($t_{emp}$) | 6,614 | 3,273 | 7,730 | 2,361 | 6,607 |
| t-statistic: level of significance | 0,001 | 0,031 | 0,005 | 0,046 | 0,001 |
| Confidence interval (95%): upper bound | 374,166 | 269,917 | 148,836 | 0,041 | 7.415,860 |
| Confidence interval (95%): lower bound | 813,545 | 3.290,323 | 357,156 | 3,476 | 16.862,233 |
| | | | | | |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| | | | | | |
| Name of the regression coefficient | | | | | |
| Standardised value | | | | | |
| t-statistic ($t_{emp}$) | | | | | |
| t-statistic: level of significance | | | | | |
| Confidence interval (95%): upper bound | | | | | |
| Confidence interval (95%): lower bound | | | | | |
| | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB) | fulfilled (JB & L) |
| No multicollinearity | orthogonalisation | fulfilled | orthogonalisation | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

**Time period: 1999-2008; time interval: annually; dependent variable: REIT dividends per share returns (4/4)**

| *Country of origin* | United States | United States |
|---|---|---|
| *Name of REIT* | Starwood Hotels | Washington Real Estate |
| **Step 3: Examination of the regression function** | | |
| **Regression function** | | |
| Coefficient of determination ($R^2$) | 0,837 | 0,970 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,790 | 0,929 |
| F-statistic ($F_{emp}$) | 17,971 | 24,042 |
| F-statistic: level of significance | 0,002 | 0,013 |
| Standard error ($s$) | 16,036 | 0,463 |
| | | |
| **Regression coefficients** | | |
| Name of the regression coefficient | Change in w. c. | Rental rev. |
| Standardised value | -0,744 | -0,556 |
| t-statistic ($t_{emp}$) | -4,488 | -4,289 |
| t-statistic: level of significance | 0,003 | 0,023 |
| Confidence interval (95%): upper bound | -480,382 | -265,488 |
| Confidence interval (95%): lower bound | -148,844 | -39,319 |
| | | |
| Name of the regression coefficient | | Operating expenses |
| Standardised value | | -0,518 |
| t-statistic ($t_{emp}$) | | -4,406 |
| t-statistic: level of significance | | 0,022 |
| Confidence interval (95%): upper bound | | -772,250 |
| Confidence interval (95%): lower bound | | -124,533 |
| | | |
| Name of the regression coefficient | | Change in w. c. |
| Standardised value | | 0,497 |
| t-statistic ($t_{emp}$) | | 4,121 |
| t-statistic: level of significance | | 0,026 |
| Confidence interval (95%): upper bound | | 27,711 |
| Confidence interval (95%): lower bound | | 215,645 |
| | | |
| **Step 4: Examination of the underlying assumptions** | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled |
| No correlation between the indep. var. and the residual term | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (122 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.2: Results of the application of a test of incremental information content regarding cash flow calculation components

## Time period: 1999-2008; time interval: annually; dependent variable: adjusted REIT stock market returns

| *Country of origin* | Australia | Australia | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Cromwell Group | GPT Group | Agree Realty | Colonial Properties | Host Hotels | National Retail | Sovran Self Storage | Urstadt Biddle | Ventas | Vornado |
| **Step 3: Examination of the regression function** | | | | | | | | | | |
| **Regression function** | | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,622 | 0,866 | 0,933 | 0,955 | 0,786 | 0,716 | 0,854 | 0,890 | 0,735 | 0,929 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,514 | 0,759 | 0,880 | 0,896 | 0,678 | 0,574 | 0,738 | 0,802 | 0,602 | 0,834 |
| F-statistic ($F_{emp}$) | 5,768 | 8,104 | 17,471 | 16,007 | 7,328 | 5,044 | 7,339 | 10,123 | 5,540 | 9,791 |
| F-statistic: level of significance | 0,033 | 0,021 | 0,004 | 0,023 | 0,020 | 0,044 | 0,025 | 0,013 | 0,037 | 0,045 |
| Standard error ($s$) | 35,824 | 6,817 | 5,897 | 12,121 | 13,829 | 11,283 | 11,116 | 10,294 | 27,357 | 4,011 |
| **Regression coefficients** | | | | | | | | | | |
| Name of the regression coefficient | Rental rev. | Rental rev. | Change in w. c. | Rental rev. | Change in w. c. | Rental rev. | Rental rev. | Rental rev. | Rental rev. | Oper. expen. |
| Standardised value | 0,688 | 0,904 | 0,571 | -0,400 | 0,672 | -0,573 | -0,517 | 0,510 | -0,938 | 0,631 |
| t-statistic ($t_{emp}$) | 2,963 | 5,530 | 4,580 | -3,256 | 3,551 | -2,559 | -3,032 | 3,440 | -3,138 | 3,918 |
| t-statistic: level of significance | 0,021 | 0,003 | 0,006 | 0,047 | 0,012 | 0,043 | 0,029 | 0,018 | 0,020 | 0,030 |
| Confidence interval (95%): upper bound | 17,071 | 85,803 | 854,819 | -384,359 | 113,008 | -1.365,544 | -1.157,478 | 50,813 | -1.145,464 | 103,444 |
| Confidence interval (95%): lower bound | 152,076 | 234,881 | 3.042,151 | -4,377 | 613,940 | -30,709 | -95,275 | 351,200 | -141,704 | 998,912 |
| Name of the regression coefficient | | | Stock-ba. co. | Change in w. c. | | Change in w. c. | Oper. expen. | Oper. expen. | | |
| Standardised value | | | 0,509 | 0,846 | | 0,781 | 0,549 | -0,653 | | |
| t-statistic ($t_{emp}$) | | | 4,098 | 6,924 | | 3,395 | 3,220 | -4,405 | | |
| t-statistic: level of significance | | | 0,009 | 0,006 | | 0,015 | 0,023 | 0,007 | | |
| Confidence interval (95%): upper bound | | | 4.045,517 | 540,863 | | 94,563 | 611,874 | -5.396,470 | | |
| Confidence interval (95%): lower bound | | | 17.658,027 | 1.460,957 | | 582,916 | 5.454,896 | -1.419,008 | | |
| Name of the regression coefficient | | | | | | | | Change in w. c. | | |
| Standardised value | | | | | | | | -0,421 | | |
| t-statistic ($t_{emp}$) | | | | | | | | -2,842 | | |
| t-statistic: level of significance | | | | | | | | 0,036 | | |
| Confidence interval (95%): upper bound | | | | | | | | -882,785 | | |
| Confidence interval (95%): lower bound | | | | | | | | -44,342 | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | not normal | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | orthogon. | orthogon. | fulfilled | orthogon. | fulfilled | fulfilled | orthogon. | orthogon. | fulfilled | orthogon. |

*Source: Own calculations based on the total sample (125 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values.*

# Appendix 7.3: Recommendations regarding the projection of cash flow calculation items: operating activities

| Cash flow calculation item (*iur*) | Reference figure (*ref*) | Recommended approach |
|---|---|---|
| Rental revenues | Total real estate assets | 1. Calculate arithmetic mean of the annual growth rates of the total real estate assets over five years preceding key valuation date |
| | | 2. Adjust mean annual growth rate for extraordinary development activities if necessary; apply a maximum growth rate of 15% of the total real estate assets per annum if the growth rate calculated in 1. exceeds this value |
| | | 3. Forecast total real estate assets through multiplying the (adjusted) mean rate on an annual basis starting with the size of the total real estate assets preceding the key valuation date |
| | | 4. Apply Formula 7.4 with total real estate assets acting as the reference figure |
| | | 5. Multiply share obtained from Formula 7.4 with the corresponding forecasts regarding the total real estate assets |
| Other income | included in the rental revenues item | |
| Operating expenses | Gross effective income | 1. Apply Formula 7.4 with the gross effective income as the reference figure |
| | | 2. Compare the resulting mean value with the findings contained in Figures 7.8 and 7.9 and adjust if necessary; reduce the G & A expenses (property operating expenses) share by a percentage equalling 10% (5%) of the total assets growth rate when economies of scale are likely |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding GEI |
| Operating distributions received from unconsolidated joint venture holdings | Rental revenues | 1. Apply Formula 7.4 with the rental revenues item as the reference figure |
| | | 2. Adjust the share if the company has already announced an increased participation in unconsolidated joint ventures in the future, i.e., assign a growth rate to the share for example |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding rental revenues |
| Straight-line rents adjustment | Rental revenues | 1. Apply Formula 7.4 with the rental revenues item as the reference figure |
| | | 2. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding rental revenues |
| Stock-based compensation expense | --- | 1. Calculate the average growth rate pertaining to the item over five years preceding the key valuation date |
| | | 2. Calculate mean value of the stock-based compensation expense item over five years preceding the key valuation date |
| | | 3. Multiply the mean growth rate with the mean value on an annual basis over the explicit forecasting period |
| Increase/decrease of non-cash working capital | Rental revenues | 1. Apply Formula 7.4 with the rental revenues item as the reference figure |
| | | 2. Adjust the share if the company has already announced an increased participation in businesses changing the position such as trading or development activities in the future, i.e., assign a growth rate to the share for example |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding rental revenues |

*Source: Own considerations*

# Appendix 7.3: Recommendations regarding the projection of cash flow calculation items: investing activities

| Cash flow calculation item (*iur*) | Reference figure (*ref*) | Recommended approach |
|---|---|---|
| Net cash received from sale of real estate assets | Total real estate assets | 1. Calculate arithmetic mean of the annual growth rates of the total real estate assets over five years preceding the key valuation date |
| | | 2. Adjust mean annual growth rate for extraordinary development activities if necessary; apply a maximum growth rate of 15% of the total real estate assets per annum if the growth rate calculated in 1. exceeds this value |
| | | 3. Forecast total real estate assets through multiplying the (adjusted) mean rate on an annual basis starting with the size of the total real estate assets preceding the key valuation date |
| | | 4. Apply Formula 7.4 with total real estate assets acting as the reference figure |
| | | 5. Estimate level of net cash received on the basis of the corporate strategy, i.e., assign multiple growth rate cycles |
| | | 6. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding the total real estate assets |
| Capital distributions received from unconsolidated joint venture holdings | Net cash received from sale of real estate assets | 1. Apply Formula 7.4 with the net cash received from sale of real estate assets item as the reference figure |
| | | 2. Adjust the share if the company has already announced an increased participation in unconsolidated joint ventures in the future, i.e., assign a growth rate to the share for example |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding net cash received from sale of real estate assets |
| Cash paid for real estate acquisitions | Total real estate assets | 1. Apply Formula 7.4 with the total real estate assets as a reference figure |
| | | 2. Estimate level of cash paid for real estate acquisitions on the basis of the corporate strategy, i.e., assign multiple growth rate cycles |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding real estate assets |
| Capital improvements | Total real estate assets | 1. Apply Formula 7.4 with the total real estate assets as a reference figure |
| | | 2. Adjust the share if the company incorporates capital improvement activities in the corporate strategy |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding total real estate assets |
| Leasing costs | Rental revenues | 1. Apply Formula 7.4 with the rental revenues item as the reference figure |
| | | 2. Multiply share obtained from Formula 7.4 with the corresponding forecasts regarding rental revenues |
| Cash paid for additions to interests in unconsolidated joint venture holdings | Sum of cash paid for real estate acquisitions, capital improvements and leasing costs | 1. Apply Formula 7.4 with the sum of cash paid for real estate acquisitions, capital improvements and leasing costs as a reference figure |
| | | 2. Adjust the share if the company has already announced an increased participation in unconsolidated joint ventures in the future, i.e., assign a growth rate to the share for example |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding the reference figure |
| Other real estate-related equity investments | Cash paid for real estate acquisitions | 1. Apply Formula 7.4 with the cash paid for real estate acquisitions as the reference figure |
| | | 2. Adjust the share if the company has already announced an increased participation in other real estate-related equity investments |
| | | 3. Multiply (adjusted) share obtained from Formula 7.4 with the corresponding forecasts regarding cash paid for real estate acquisitions if the share has a value of 5% or more |

*Source: Own considerations*

## Appendix 7.4: Results of the application of the four-factor model

### Time period: 1995-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 1/4

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Agree Realty | Associated Estates | Brandywine Realty | BRE Properties | Colonial Properties | Duke Realty | East Group | Equity Lifestyle |
| **Step 3: Examination of the regression function** | | | | | | | | |
| **Regression function** | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,090 | 0,204 | 0,277 | 0,215 | 0,396 | 0,076 | 0,403 | 0,318 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,067 | 0,184 | 0,258 | 0,195 | 0,381 | 0,053 | 0,387 | 0,301 |
| F-statistic ($F_{emp}$) | 3,877 | 10,070 | 15,018 | 10,781 | 25,767 | 3,236 | 26,460 | 18,326 |
| F-statistic: level of significance | 0,005 | 0,000 | 0,000 | 0,000 | 0,000 | 0,014 | 0,000 | 0,000 |
| Standard error ($s$) | 0,068 | 7,137 | 0,901 | 5,346 | 0,909 | 0,130 | 4,534 | 4,579 |
| **Regression coefficients** | | | | | | | | |
| Name of the regression coefficient | DY | SMB | SMB | SMB | SMB | HML | SMB | SMB |
| Standardised value | 0,228 | 0,305 | 0,270 | 0,275 | 0,270 | 0,195 | 0,324 | 0,188 |
| t-statistic ($t_{emp}$) | 2,812 | 4,109 | 3,816 | 3,737 | 4,183 | 2,325 | 5,038 | 2,736 |
| t-statistic: level of significance | 0,006 | 0,000 | 0,000 | 0,000 | 0,000 | 0,021 | 0,000 | 0,007 |
| Confidence interval (95%): upper bound | 0,002 | 0,919 | 0,100 | 0,568 | 0,121 | 0,002 | 0,838 | 0,210 |
| Confidence interval (95%): lower bound | 0,013 | 2,620 | 0,315 | 1,843 | 0,338 | 0,029 | 1,919 | 1,302 |
| | | | | | | | | |
| Name of the regression coefficient | | DTA | DTA | HML | DTA | DTA | DTA | HML |
| Standardised value | | -0,291 | -0,494 | -0,223 | -0,621 | -0,162 | -0,621 | -0,201 |
| t-statistic ($t_{emp}$) | | -3,940 | -7,018 | -2,888 | -9,654 | -2,035 | -9,704 | -2,792 |
| t-statistic: level of significance | | 0,000 | 0,000 | 0,004 | 0,000 | 0,044 | 0,000 | 0,006 |
| Confidence interval (95%): upper bound | | -1,758 | -0,338 | -1,350 | -0,440 | -0,022 | -2,205 | -1,134 |
| Confidence interval (95%): lower bound | | -0,584 | -0,189 | -0,253 | -0,291 | 0,000 | -1,459 | -0,194 |
| | | | | | | | | |
| Name of the regression coefficient | | DY | | DTA | | | | DTA |
| Standardised value | | 0,252 | | -0,378 | | | | -0,540 |
| t-statistic ($t_{emp}$) | | 3,324 | | -5,163 | | | | -7,911 |
| t-statistic: level of significance | | 0,001 | | 0,000 | | | | 0,000 |
| Confidence interval (95%): upper bound | | 0,386 | | -1,589 | | | | -1,885 |
| Confidence interval (95%): lower bound | | 1,515 | | -0,710 | | | | -1,132 |
| | | | | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | not fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | autocorr. | fulfilled | fulfilled | fulfilled | fulfilled | slight autocorr. | slight autocorr. | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (JB & L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (JB) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (50 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 1995-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 2/4

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|
| *Name of REIT* | Health Care Property | Health Care REIT | Highwoods | Hospitality Properties | HRPT Properties | Kimco | Liberty Property |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,369 | 0,429 | 0,062 | 0,742 | 0,394 | 0,109 | 0,070 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,353 | 0,415 | 0,038 | 0,736 | 0,379 | 0,086 | 0,046 |
| F-statistic ($F_{emp}$) | 22,984 | 29,495 | 2,607 | 113,077 | 25,568 | 4,781 | 2,945 |
| F-statistic: level of significance | 0,000 | 0,000 | 0,038 | 0,000 | 0,000 | 0,001 | 0,022 |
| Standard error ($s$) | 5,172 | 5,056 | 1,840 | 4,764 | 5,793 | 0,239 | 1,266 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | HML | SMB | HML | SMB | SMB | DTA | HML |
| Standardised value | -0,381 | 0,267 | 0,167 | 0,104 | 0,312 | -0,250 | 0,184 |
| t-statistic ($t_{emp}$) | -5,506 | 4,244 | 1,974 | 2,472 | 4,819 | -3,197 | 2,191 |
| t-statistic: level of significance | 0,000 | 0,000 | 0,050 | 0,014 | 0,000 | 0,002 | 0,030 |
| Confidence interval (95%): upper bound | -2,009 | 0,692 | 0,000 | 0,143 | 0,994 | -0,052 | 0,014 |
| Confidence interval (95%): lower bound | -0,948 | 1,897 | 0,377 | 1,278 | 2,375 | -0,012 | 0,274 |
| Name of the regression coefficient | DTA | HML | | HML | DTA | | |
| Standardised value | -0,526 | -0,166 | | 0,181 | -0,531 | | |
| t-statistic ($t_{emp}$) | -7,998 | -2,517 | | 4,095 | -8,241 | | |
| t-statistic: level of significance | 0,000 | 0,013 | | 0,000 | 0,000 | | |
| Confidence interval (95%): upper bound | -2,148 | -1,180 | | 0,524 | -2,465 | | |
| Confidence interval (95%): lower bound | -1,297 | -0,142 | | 1,502 | -1,512 | | |
| Name of the regression coefficient | DY | DTA | | DTA | DY | | |
| Standardised value | 0,250 | -0,645 | | -0,741 | 0,257 | | |
| t-statistic ($t_{emp}$) | 3,715 | -10,321 | | -17,636 | 3,899 | | |
| t-statistic: level of significance | 0,000 | 0,000 | | 0,000 | 0,000 | | |
| Confidence interval (95%): upper bound | 0,360 | -2,589 | | -3,891 | 0,447 | | |
| Confidence interval (95%): lower bound | 1,179 | -1,757 | | -3,107 | 1,363 | | |
| Name of the regression coefficient | | | | DY | | | |
| Standardised value | | | | 0,273 | | | |
| t-statistic ($t_{emp}$) | | | | 6,337 | | | |
| t-statistic: level of significance | | | | 0,000 | | | |
| Confidence interval (95%): upper bound | | | | 0,832 | | | |
| Confidence interval (95%): lower bound | | | | 1,586 | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | not fulfilled | fulfilled | not fulfilled | fulfilled |
| Autocorrelation of the residual values | slight autocorr. | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (L) | fulfilled (JB) | fulfilled (JB) | fulfilled (JB & L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (50 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

## Appendix 7.4: Results of the application of the four-factor model

### Time period: 1995-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 3/4

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|
| *Name of REIT* | LTC Properties | National Retail | Omega Healthcare | Parkway Properties | Pennsylvania REIT | ProLogis | Public Storage |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,160 | 0,065 | 0,197 | 0,339 | 0,301 | 0,263 | 0,571 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,139 | 0,041 | 0,176 | 0,323 | 0,283 | 0,245 | 0,560 |
| F-statistic ($F_{emp}$) | 7,486 | 2,735 | 9,615 | 20,163 | 16,869 | 14,027 | 52,159 |
| F-statistic: level of significance | 0,000 | 0,031 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Standard error ($s$) | 1,023 | 1,324 | 1,237 | 5,651 | 0,921 | 5,827 | 4,486 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | HML | DTA | HML | SMB | SMB | DTA | HML |
| Standardised value | -0,220 | -0,206 | -0,178 | 0,464 | 0,262 | -0,498 | -0,320 |
| t-statistic ($t_{emp}$) | -2,756 | -2,581 | -2,277 | 6,862 | 3,774 | -7,009 | -5,601 |
| t-statistic: level of significance | 0,007 | 0,011 | 0,024 | 0,000 | 0,000 | 0,000 | 0,000 |
| Confidence interval (95%): upper bound | -0,251 | -0,251 | -0,273 | 1,666 | 0,100 | -2,180 | -1,765 |
| Confidence interval (95%): lower bound | -0,042 | -0,033 | -0,019 | 3,014 | 0,320 | -1,222 | -0,845 |
| Name of the regression coefficient: HML | DTA | | DTA | DTA | DTA | DY | DTA |
| Standardised value | -0,370 | | -0,434 | -0,469 | -0,389 | 0,148 | -0,734 |
| t-statistic ($t_{emp}$) | -4,876 | | -5,849 | -6,968 | -5,626 | 2,031 | -13,530 |
| t-statistic: level of significance | 0,000 | | 0,000 | 0,000 | 0,000 | 0,044 | 0,000 |
| Confidence interval (95%): upper bound | -0,292 | | -0,403 | -2,105 | -0,292 | 0,013 | -2,897 |
| Confidence interval (95%): lower bound | -0,124 | | -0,200 | -1,175 | -0,140 | 0,935 | -2,159 |
| Name of the regression coefficient | | | | | DY | | DY |
| Standardised value | | | | | 0,298 | | -0,120 |
| t-statistic ($t_{emp}$) | | | | | 4,194 | | -2,166 |
| t-statistic: level of significance | | | | | 0,000 | | 0,032 |
| Confidence interval (95%): upper bound | | | | | 0,082 | | -0,744 |
| Confidence interval (95%): lower bound | | | | | 0,228 | | -0,034 |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (JB) | fulfilled (L) | fulfilled (L) | fulfilled (JB & L) | fulfilled (JB) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (50 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 1995-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 4/4

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|
| *Name of REIT* | Ramco-Gershenson | Simon Property Group | Sovran Self Storage | Tanger Factory Outlet | United Dominion Realty | Vornado | Washington Real Estate |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,376 | 0,339 | 0,488 | 0,284 | 0,198 | 0,185 | 0,277 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,360 | 0,323 | 0,475 | 0,266 | 0,178 | 0,165 | 0,259 |
| F-statistic ($F_{emp}$) | 23,655 | 20,170 | 37,485 | 15,599 | 9,695 | 8,938 | 15,055 |
| F-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 | 0,000 |
| Standard error ($s$) | 5,043 | 0,939 | 5,541 | 5,141 | 6,352 | 1,014 | 0,946 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | SMB | DTA | SMB | SMB | SMB | HML | SMB |
| Standardised value | 0,501 | -0,596 | 0,338 | 0,248 | 0,292 | -0,186 | 0,287 |
| t-statistic ($t_{emp}$) | 7,619 | -8,863 | 5,680 | 3,531 | 3,921 | -2,358 | 4,054 |
| t-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,001 | 0,000 | 0,020 | 0,000 |
| Confidence interval (95%): upper bound | 1,717 | -0,424 | 1,239 | 0,483 | 0,746 | -0,228 | 0,119 |
| Confidence interval (95%): lower bound | 2,919 | -0,269 | 2,559 | 1,708 | 2,260 | -0,020 | 0,344 |
| Name of the regression coefficient: HML | DTA | | DTA | HML | DTA | DTA | HML |
| Standardised value | -0,345 | | -0,693 | -0,254 | -0,382 | -0,427 | -0,179 |
| t-statistic ($t_{emp}$) | -5,283 | | -11,705 | -3,439 | -5,159 | -5,716 | -2,419 |
| t-statistic: level of significance | 0,000 | | 0,000 | 0,001 | 0,000 | 0,000 | 0,017 |
| Confidence interval (95%): upper bound | -1,524 | | -3,157 | -1,446 | -1,887 | -0,325 | -0,216 |
| Confidence interval (95%): lower bound | -0,695 | | -2,245 | -0,391 | -0,842 | -0,158 | -0,022 |
| Name of the regression coefficient | DY | | | DTA | | | DTA |
| Standardised value | 0,277 | | | -0,462 | | | -0,485 |
| t-statistic ($t_{emp}$) | 4,128 | | | -6,607 | | | -6,894 |
| t-statistic: level of significance | 0,000 | | | 0,000 | | | 0,000 |
| Confidence interval (95%): upper bound | 0,435 | | | -1,838 | | | -0,349 |
| Confidence interval (95%): lower bound | 1,233 | | | -0,992 | | | -0,194 |
| Name of the regression coefficient | | | | DY | | | |
| Standardised value | | | | 0,180 | | | |
| t-statistic ($t_{emp}$) | | | | 2,511 | | | |
| t-statistic: level of significance | | | | 0,013 | | | |
| Confidence interval (95%): upper bound | | | | 0,110 | | | |
| Confidence interval (95%): lower bound | | | | 0,924 | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | not fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (JB) | fulfilled (L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (JB & L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (50 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 1/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Acadia Realty | Alexanders Inc. | Alexandria | AMB Property | American Campus Communities | Apartment & Investment Management | Ashford Hospitality | AvalonBay Communities |
| **Step 3: Examination of the regression function** | | | | | | | | |
| **Regression function** | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,351 | 0,273 | 0,244 | 0,229 | 0,278 | 0,372 | 0,207 | 0,253 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,298 | 0,214 | 0,182 | 0,166 | 0,220 | 0,320 | 0,142 | 0,192 |
| F-statistic ($F_{emp}$) | 6,630 | 4,597 | 3,947 | 3,640 | 4,727 | 7,247 | 3,189 | 4,155 |
| F-statistic: level of significance | 0,000 | 0,003 | 0,007 | 0,011 | 0,003 | 0,000 | 0,021 | 0,006 |
| Standard error ($s$) | 4,680 | 10,082 | 0,921 | 1,000 | 6,722 | 7,107 | 0,814 | 0,319 |
| **Regression coefficients** | | | | | | | | |
| Name of the regression coefficient | SMB | DTA | DTA | SMB | DTA | DTA | DTA | DTA |
| Standardised value | 0,456 | 0,356 | 0,326 | 0,460 | 0,360 | 0,390 | 0,297 | 0,264 |
| t-statistic ($t_{emp}$) | 3,221 | 2,825 | 2,535 | 2,976 | 2,865 | 3,335 | 2,255 | 2,065 |
| t-statistic: level of significance | 0,002 | 0,007 | 0,014 | 0,005 | 0,006 | 0,002 | 0,029 | 0,044 |
| Confidence interval (95%): upper bound | 0,606 | 0,873 | 0,051 | 0,103 | 0,611 | 1,000 | 0,021 | 0,002 |
| Confidence interval (95%): lower bound | 2,617 | 5,179 | 0,445 | 0,533 | 3,481 | 4,035 | 0,369 | 0,138 |
| | | | | | | | | |
| Name of the regression coefficient | DTA | | | | | DY | | |
| Standardised value | 0,362 | | | | | 0,298 | | |
| t-statistic ($t_{emp}$) | 3,040 | | | | | 2,597 | | |
| t-statistic: level of significance | 0,004 | | | | | 0,012 | | |
| Confidence interval (95%): upper bound | 0,512 | | | | | 0,442 | | |
| Confidence interval (95%): lower bound | 2,511 | | | | | 3,467 | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | slight autocorr. | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 2/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States | | United States |
|---|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Biomed Realty | Boston Properties | Brandywine Realty | Camden Property | Cedar | Colonial Properties | Corporate Office | | Cousins Properties |
| **Step 3: Examination of the regression function** | | | | | | | | | |
| **Regression function** | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,217 | 0,397 | 0,276 | 0,202 | 0,281 | 0,293 | 0,567 | | 0,235 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,153 | 0,347 | 0,216 | 0,137 | 0,223 | 0,235 | 0,532 | | 0,173 |
| F-statistic ($F_{emp}$) | 3,387 | 8,057 | 4,660 | 3,109 | 4,797 | 5,073 | 16,034 | | 3,766 |
| F-statistic: level of significance | 0,016 | 0,000 | 0,003 | 0,023 | 0,002 | 0,002 | 0,000 | | 0,010 |
| Standard error ($s$) | 0,903 | 1,934 | 0,968 | 0,410 | 0,373 | 1,032 | 5,956 | | 1,083 |
| **Regression coefficients** | | | | | | | | | |
| Name of the regression coefficient | | HML | DTA | DTA | DTA | DTA | SMB | DTA | HML |
| Standardised value | | -0,416 | 0,385 | 0,442 | 0,339 | 0,429 | 0,276 | 0,407 | -0,451 |
| t-statistic ($t_{emp}$) | | -3,105 | 3,065 | 3,349 | 2,707 | 3,452 | 2,387 | 4,190 | -2,992 |
| t-statistic: level of significance | | 0,003 | 0,004 | 0,002 | 0,009 | 0,001 | 0,021 | 0,000 | 0,004 |
| Confidence interval (95%): upper bound | | -0,851 | 0,108 | 0,058 | 0,028 | 0,158 | 0,241 | 1,380 | -0,466 |
| Confidence interval (95%): lower bound | | -0,182 | 0,522 | 0,233 | 0,187 | 0,599 | 2,800 | 3,924 | -0,092 |
| Name of the regression coefficient | | DTA | | | | | HML | DY | |
| Standardised value | | 0,322 | | | | | -0,435 | 0,203 | |
| t-statistic ($t_{emp}$) | | 2,811 | | | | | -3,837 | 2,134 | |
| t-statistic: level of significance | | 0,007 | | | | | 0,000 | 0,038 | |
| Confidence interval (95%): upper bound | | 0,165 | | | | | -2,998 | 0,078 | |
| Confidence interval (95%): lower bound | | 0,990 | | | | | -0,937 | 2,614 | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled |
| Homoscedasticity | fulfilled (at a p-value of 0.99) | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) | fulfilled | fulfilled | fulfilled | | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (JB & L) | fulfilled (L) | not fulfilled | fulfilled (JB) | fulfilled (L) | fulfilled (L) | | fulfilled (JB & L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of 5 percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model
## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 3/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Developers Diversified | Digital Realty | Duke Realty | Entertain-ment Properties | Equity Lifestyle | Equity One | Equity Residential | Essex Property Trust |
| **Step 3: Examination of the regression function** | | | | | | | | |
| **Regression function** | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,272 | 0,260 | 0,257 | 0,190 | 0,174 | 0,357 | 0,273 | 0,394 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,213 | 0,199 | 0,196 | 0,124 | 0,106 | 0,304 | 0,213 | 0,344 |
| F-statistic ($F_{emp}$) | 4,576 | 4,295 | 4,239 | 2,879 | 2,574 | 6,796 | 4,591 | 7,960 |
| F-statistic: level of significance | 0,003 | 0,005 | 0,005 | 0,032 | 0,049 | 0,000 | 0,003 | 0,000 |
| Standard error ($s$) | 5,758 | 2,048 | 0,955 | 0,787 | 6,667 | 7,167 | 6,693 | 6,607 |
| **Regression coefficients** | | | | | | | | |
| Name of the regression coefficient | HML | DTA | SMB | SMB | SMB | SMB | DTA | SMB |
| Standardised value | -0,390 | 0,260 | 0,387 | 0,286 | 0,352 | 0,381 | 0,391 | 0,313 |
| t-statistic ($t_{emp}$) | -2,651 | 2,048 | 2,552 | 2,228 | 2,711 | 2,702 | 3,107 | 2,284 |
| t-statistic: level of significance | 0,011 | 0,046 | 0,014 | 0,030 | 0,009 | 0,009 | 0,003 | 0,027 |
| Confidence interval (95%): upper bound | -2,310 | 0,008 | 0,055 | 0,015 | 0,406 | 0,530 | 0,781 | 0,194 |
| Confidence interval (95%): lower bound | -0,318 | 0,883 | 0,466 | 0,289 | 2,732 | 3,610 | 3,639 | 3,033 |
| Name of the regression coefficient | DTA | | DTA | HML | | DY | | DTA |
| Standardised value | 0,328 | | 0,256 | -0,271 | | 0,345 | | 0,408 |
| t-statistic ($t_{emp}$) | 2,601 | | 2,008 | -2,108 | | 2,978 | | 3,546 |
| t-statistic: level of significance | 0,012 | | 0,050 | 0,040 | | 0,005 | | 0,001 |
| Confidence interval (95%): upper bound | 0,362 | | 0,000 | -0,273 | | 0,735 | | 1,078 |
| Confidence interval (95%): lower bound | 2,820 | | 0,408 | -0,007 | | 3,785 | | 3,900 |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled (at a p-value of 0.99) | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | not fulfilled | fulfilled |
| Autocorrelation of the residual values | autocorr. | fulfilled | fulfilled | fulfilled | fulfilled | slight auto. | slight auto. | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | not fulfilled | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | orthogon. | orthogon. | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model
## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 4/8

| *Country of origin* | United States | | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Federal Realty | | FelCor Lodging | First Potomac | Getty Realty | Health Care REIT | Highwoods | Host Hotels |
| **Step 3: Examination of the regression function** | | | | | | | | |
| **Regression function** | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,571 | | 0,314 | 0,235 | 0,528 | 0,404 | 0,223 | 0,231 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,536 | | 0,258 | 0,173 | 0,489 | 0,355 | 0,160 | 0,168 |
| F-statistic ($F_{emp}$) | 16,292 | | 5,607 | 3,773 | 13,694 | 8,308 | 3,521 | 3,682 |
| F-statistic: level of significance | 0,000 | | 0,001 | 0,009 | 0,000 | 0,000 | 0,013 | 0,011 |
| Standard error ($s$) | 5,814 | | 0,941 | 1,588 | 5,903 | 8,372 | 0,685 | 0,953 |
| **Regression coefficients** | | | | | | | | |
| Name of the regression coefficient | SMB | DTA | DTA | SMB | SMB | HML | SMB | DTA |
| Standardised value | 0,293 | 0,344 | 0,502 | 0,351 | 0,278 | -0,371 | 0,322 | 0,335 |
| t-statistic ($t_{emp}$) | 2,541 | 3,559 | 4,102 | 2,279 | 2,299 | -2,790 | 2,077 | 2,588 |
| t-statistic: level of significance | 0,014 | 0,001 | 0,000 | 0,027 | 0,026 | 0,007 | 0,043 | 0,013 |
| Confidence interval (95%): upper bound | 0,331 | 0,957 | 0,209 | 0,046 | 0,182 | -3,460 | 0,005 | 0,059 |
| Confidence interval (95%): lower bound | 2,829 | 3,440 | 0,611 | 0,728 | 2,719 | -0,562 | 0,299 | 0,465 |
| Name of the regression coefficient | HML | DY | | DTA | HML | DY | DTA | |
| Standardised value | -0,467 | 0,190 | | 0,314 | -0,527 | 0,448 | 0,297 | |
| t-statistic ($t_{emp}$) | -4,134 | 2,011 | | 2,428 | -4,445 | 4,012 | 2,283 | |
| t-statistic: level of significance | 0,000 | 0,050 | | 0,019 | 0,000 | 0,000 | 0,027 | |
| Confidence interval (95%): upper bound | -3,076 | 0,001 | | 0,071 | -3,280 | 1,775 | 0,020 | |
| Confidence interval (95%): lower bound | -1,064 | 2,475 | | 0,749 | -1,238 | 5,339 | 0,313 | |
| Name of the regression coefficient | | | | | | | DY | |
| Standardised value | | | | | | | 0,333 | |
| t-statistic ($t_{emp}$) | | | | | | | 2,612 | |
| t-statistic: level of significance | | | | | | | 0,012 | |
| Confidence interval (95%): upper bound | | | | | | | 0,044 | |
| Confidence interval (95%): lower bound | | | | | | | 0,336 | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) |
| Autocorrelation of the residual values | fulfilled | | fulfilled | fulfilled | slight autocorr. | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | | fulfilled (L) | fulfilled (JB&L) | fulfilled (JB & L) | fulfilled (L) | fulfilled (JB) | fulfilled (L) |
| No multicollinearity | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 5/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|
| *Name of REIT* | HRPT Properties | Investors Real Estate | Kite Realty | Macerich | Mack-Cali | Mid Americas | National Retail |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,266 | 0,456 | 0,195 | 0,384 | 0,499 | 0,515 | 0,431 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,206 | 0,412 | 0,129 | 0,334 | 0,458 | 0,475 | 0,384 |
| F-statistic ($F_{emp}$) | 4,446 | 10,280 | 2,966 | 7,651 | 12,195 | 12,987 | 9,276 |
| F-statistic: level of significance | 0,004 | 0,000 | 0,028 | 0,000 | 0,000 | 0,000 | 0,000 |
| Standard error ($s$) | 0,638 | 4,034 | 0,945 | 0,914 | 7,301 | 6,668 | 0,839 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | DY | SMB | HML | HML | SMB | SMB | HML |
| Standardised value | 0,409 | 0,535 | -0,371 | -0,453 | 0,257 | 0,342 | -0,407 |
| t-statistic ($t_{emp}$) | 3,305 | 4,122 | -2,397 | -3,347 | 2,060 | 2,793 | -3,131 |
| t-statistic: level of significance | 0,002 | 0,000 | 0,020 | 0,002 | 0,045 | 0,007 | 0,003 |
| Confidence interval (95%): upper bound | 0,087 | 0,911 | -0,359 | -0,421 | 0,039 | 0,558 | -0,371 |
| Confidence interval (95%): lower bound | 0,359 | 2,644 | -0,032 | -0,105 | 3,177 | 3,423 | -0,081 |
| Name of the regression coefficient | | | | DTA | HML | HML | DTA |
| Standardised value | | | | 0,380 | -0,466 | -0,372 | 0,260 |
| t-statistic ($t_{emp}$) | | | | 3,282 | -3,818 | -3,093 | 2,331 |
| t-statistic: level of significance | | | | 0,002 | 0,000 | 0,003 | 0,024 |
| Confidence interval (95%): upper bound | | | | 0,123 | -3,663 | -2,929 | 0,029 |
| Confidence interval (95%): lower bound | | | | 0,514 | -1,137 | -0,622 | 0,387 |
| Name of the regression coefficient | | | | | DY | DTA | |
| Standardised value | | | | | 0,359 | 0,385 | |
| t-statistic ($t_{emp}$) | | | | | 3,508 | 3,738 | |
| t-statistic: level of significance | | | | | 0,001 | 0,000 | |
| Confidence interval (95%): upper bound | | | | | 1,158 | 1,224 | |
| Confidence interval (95%): lower bound | | | | | 4,266 | 4,072 | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) | fulfilled |
| Autocorrelation of the residual values | fulfilled | slight auto. | fulfilled | fulfilled | slight auto. | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

## Appendix 7.4: Results of the application of the four-factor model
### Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 6/8

| *Country of origin* | United States | | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | One Liberty | | Parkway Properties | Pennsylvania REIT | Post Properties | ProLogis | Ramco-Gershenson | Regency Centers | Saul Centers |
| **Step 3: Examination of the regression function** | | | | | | | | | |
| **Regression function** | | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,532 | | 0,418 | 0,389 | 0,286 | 0,206 | 0,385 | 0,237 | 0,340 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,494 | | 0,371 | 0,340 | 0,227 | 0,141 | 0,335 | 0,174 | 0,286 |
| F-statistic ($F_{emp}$) | 13,932 | | 8,809 | 7,814 | 4,897 | 3,178 | 7,675 | 3,797 | 6,305 |
| F-statistic: level of significance | 0,000 | | 0,000 | 0,000 | 0,002 | 0,021 | 0,000 | 0,009 | 0,000 |
| Standard error ($s$) | 1,812 | | 1,877 | 0,365 | 7,617 | 0,785 | 9,081 | 6,708 | 7,321 |
| **Regression coefficients** | | | | | | | | | |
| Name of the regression coefficient | SMB | DY | HML | HML | SMB | DTA | SMB | HML | HML |
| Standardised value | 0,338 | 0,209 | -0,407 | -0,342 | 0,305 | 0,331 | 0,485 | -0,433 | -0,493 |
| t-statistic ($t_{emp}$) | 2,812 | 2,118 | -3,093 | -2,536 | 2,051 | 2,517 | 3,516 | -2,873 | -3,517 |
| t-statistic: level of significance | 0,007 | 0,039 | 0,003 | 0,014 | 0,046 | 0,015 | 0,001 | 0,006 | 0,001 |
| Confidence interval (95%): upper bound | 0,155 | 0,021 | -0,825 | -0,143 | 0,034 | 0,042 | 1,462 | -2,820 | -3,484 |
| Confidence interval (95%): lower bound | 0,934 | 0,792 | -0,175 | -0,017 | 3,307 | 0,378 | 5,364 | -0,499 | -0,950 |
| Name of the regression coefficient | HML | | DTA | DTA | DTA | | DTA | | |
| Standardised value | -0,306 | | 0,387 | 0,394 | 0,295 | | 0,355 | | |
| t-statistic ($t_{emp}$) | -2,594 | | 3,435 | 3,414 | 2,362 | | 3,061 | | |
| t-statistic: level of significance | 0,012 | | 0,001 | 0,001 | 0,022 | | 0,004 | | |
| Confidence interval (95%): upper bound | -0,718 | | 0,284 | 0,054 | 0,285 | | 1,015 | | |
| Confidence interval (95%): lower bound | -0,091 | | 1,086 | 0,210 | 3,538 | | 4,892 | | |
| Name of the regression coefficient | DTA | | | DY | | | DY | | |
| Standardised value | 0,475 | | | 0,313 | | | 0,388 | | |
| t-statistic ($t_{emp}$) | 4,704 | | | 2,774 | | | 3,419 | | |
| t-statistic: level of significance | 0,000 | | | 0,008 | | | 0,001 | | |
| Confidence interval (95%): upper bound | 0,519 | | | 0,030 | | | 1,356 | | |
| Confidence interval (95%): lower bound | 1,292 | | | 0,185 | | | 5,220 | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled (at a p-value of 0.99) |
| Autocorrelation of the residual values | fulfilled | | fulfilled | fulfilled | fulfilled | slight auto. | slight auto. | slight auto. | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (JB & L) | fulfilled (JB & L) |
| No multicollinearity | fulfilled | | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 7/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|
| *Name of REIT* | Senior Housing | Simon Property Group | SL Green Realty | Sovran Self Storage | Starwood Hotels | Supertel Hospitality | Tanger Factory Outlet |
| **Step 3: Examination of the regression function** | | | | | | | |
| **Regression function** | | | | | | | |
| Coefficient of determination ($R^2$) | 0,532 | 0,417 | 0,334 | 0,206 | 0,326 | 0,280 | 0,610 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,494 | 0,369 | 0,280 | 0,141 | 0,271 | 0,221 | 0,579 |
| F-statistic ($F_{emp}$) | 13,952 | 8,765 | 6,149 | 3,183 | 5,924 | 4,755 | 19,199 |
| F-statistic: level of significance | 0,000 | 0,000 | 0,000 | 0,021 | 0,001 | 0,003 | 0,000 |
| Standard error ($s$) | 7,712 | 0,952 | 0,299 | 7,316 | 2,944 | 0,945 | 0,674 |
| **Regression coefficients** | | | | | | | |
| Name of the regression coefficient | SMB | HML | HML | DTA | DTA | DTA | SMB |
| Standardised value | 0,369 | -0,490 | -0,315 | 0,291 | 0,540 | 0,432 | 0,509 |
| t-statistic ($t_{emp}$) | 3,065 | -3,722 | -2,239 | 2,211 | 4,453 | 3,443 | 4,639 |
| t-statistic: level of significance | 0,004 | 0,001 | 0,030 | 0,032 | 0,000 | 0,001 | 0,000 |
| Confidence interval (95%): upper bound | 0,870 | -0,470 | -0,109 | 0,157 | 0,764 | 0,144 | 0,190 |
| Confidence interval (95%): lower bound | 4,184 | -0,140 | -0,006 | 3,281 | 2,021 | 0,548 | 0,479 |
| | | | | | | | |
| Name of the regression coefficient | HML | DTA | DTA | | | | HML |
| Standardised value | -0,423 | 0,360 | 0,420 | | | | -0,341 |
| t-statistic ($t_{emp}$) | -3,587 | 3,193 | 3,486 | | | | -3,169 |
| t-statistic: level of significance | 0,001 | 0,002 | 0,001 | | | | 0,003 |
| Confidence interval (95%): upper bound | -3,716 | 0,120 | 0,047 | | | | -0,301 |
| Confidence interval (95%): lower bound | -1,048 | 0,526 | 0,175 | | | | -0,067 |
| | | | | | | | |
| Name of the regression coefficient | DY | | | | | | DTA |
| Standardised value | 0,323 | | | | | | 0,305 |
| t-statistic ($t_{emp}$) | 3,266 | | | | | | 3,304 |
| t-statistic: level of significance | 0,002 | | | | | | 0,002 |
| Confidence interval (95%): upper bound | 1,026 | | | | | | 0,093 |
| Confidence interval (95%): lower bound | 4,309 | | | | | | 0,381 |
| **Step 4: Examination of the underlying assumptions** | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | slight auto. | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Normal distribution of the residual values | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB= small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 7.4: Results of the application of the four-factor model

## Time period: 2005-2009; time interval: monthly; dependent variable: REIT excess stock market returns; part 8/8

| *Country of origin* | United States | United States | United States | United States | United States | United States | United States | United States |
|---|---|---|---|---|---|---|---|---|
| *Name of REIT* | Thomas Properties | United Dominion Realty | Universal Health Realty | Urstadt Biddle | Ventas | Vornado | Washington Real Estate | Weingarten Realty |
| **Step 3: Examination of the regression function** | | | | | | | | |
| **Regression function** | | | | | | | | |
| Coefficient of determination ($R^2$) | 0,236 | 0,281 | 0,498 | 0,435 | 0,448 | 0,292 | 0,294 | 0,393 |
| Adjusted coefficient of determination ($R^2_{adj}$) | 0,173 | 0,223 | 0,457 | 0,388 | 0,403 | 0,234 | 0,236 | 0,344 |
| F-statistic ($F_{emp}$) | 3,775 | 4,797 | 12,138 | 9,416 | 9,931 | 5,054 | 5,098 | 7,934 |
| F-statistic: level of significance | 0,009 | 0,002 | 0,000 | 0,000 | 0,000 | 0,002 | 0,002 | 0,000 |
| Standard error ($s$) | 11,795 | 8,911 | 8,174 | 4,860 | 0,201 | 0,840 | 5,406 | 1,203 |
| **Regression coefficients** | | | | | | | | |
| Name of the regression coefficient | SMB | DTA | SMB | SMB | HML | HML | HML | HML |
| Standardised value | 0,390 | 0,326 | 0,391 | 0,681 | -0,516 | -0,307 | -0,462 | -0,349 |
| t-statistic ($t_{emp}$) | 2,536 | 2,604 | 3,139 | 5,148 | -4,025 | -2,115 | -3,191 | -2,596 |
| t-statistic: level of significance | 0,014 | 0,012 | 0,003 | 0,000 | 0,000 | 0,040 | 0,002 | 0,012 |
| Confidence interval (95%): upper bound | 0,664 | 0,563 | 0,987 | 1,630 | -0,105 | -0,298 | -2,421 | -0,477 |
| Confidence interval (95%): lower bound | 5,732 | 4,368 | 4,499 | 3,718 | -0,035 | -0,008 | -0,550 | -0,061 |
| Name of the regression coefficient | DTA | | HML | HML | | DTA | DTA | DY |
| Standardised value | 0,407 | | -0,339 | 0,216 | | 0,424 | 0,287 | 0,383 |
| t-statistic ($t_{emp}$) | 3,154 | | -2,772 | 1,669 | | 3,412 | 2,313 | 3,404 |
| t-statistic: level of significance | 0,003 | | 0,008 | 0,101 | | 0,001 | 0,025 | 0,001 |
| Confidence interval (95%): upper bound | 1,434 | | -3,365 | -0,142 | | 0,125 | 0,174 | 0,178 |
| Confidence interval (95%): lower bound | 6,471 | | -0,536 | 1,539 | | 0,484 | 2,483 | 0,689 |
| Name of the regression coefficient | | | DY | | | | | |
| Standardised value | | | 0,343 | | | | | |
| t-statistic ($t_{emp}$) | | | 3,346 | | | | | |
| t-statistic: level of significance | | | 0,002 | | | | | |
| Confidence interval (95%): upper bound | | | 1,156 | | | | | |
| Confidence interval (95%): lower bound | | | 4,635 | | | | | |
| **Step 4: Examination of the underlying assumptions** | | | | | | | | |
| Expected value of the residual term is equal to zero | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| No correlation between the independent variables and the residual term | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Homoscedasticity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |
| Autocorrelation of the residual values | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | slight auto. | fulfilled |
| Normal distribution of the residual values | fulfilled (JB & L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (L) | fulfilled (JB) | not fulfilled |
| No multicollinearity | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled | fulfilled |

*Source: Own calculations based on the total sample (96 of 218 REITs)*

*Notes: All results listed in the Appendix are significant at a level of five percent. Referring to the tests of the normal distribution, L indicates that the LILLIEFORS (1967) test indicated normality but not the JARQUE/ BERA (1980, 1987) test, JB indicates that exclusively the JARQUE/ BERA (1980, 1987) test documents normality whereas JB & L implies that both types of normality tests point to normally distributed residual values. SMB=small minus big (size factor), HML=high minus low (book-to-market equity factor), DTA=debt-to-total assets (leverage factor), DY=dividend yield.*

# Appendix 8.1: Review of examinations on bankruptcy costs outside the United States; part 1/2

| Author(s) | Year of publication | Country | Analysed time horizon | Number of companies | Company industry(ies) | Firm size | | Magnitude of direct bankruptcy costs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean value in mln. home currency | Basis | Mean value | Median value | Basis |
| ROBERTSON/ TREES | 1985 | Australia | 1980 | 308 | N/A | 0.069 AUD | total book value of assets | 38,8% | N/A | liquidation proceeds |
| DJANKOV et al. | 2008 | Australia | 2006 | 1 | hotel business | N/A | N/A | 8% | N/A | estate at the time of entry into the bankruptcy proceeding |
| PHAM/CHOW | 1989 | Australia | 1976-1983 | 14 | finance, property, manufacturing, retailing | 75.7 AUD | sum of the book value of debt and the market value of equity at the fiscal year-end prior to the date of bankruptcy filing | 2,5% | N/A | sum of the book value of debt and the market value of equity at the fiscal year-end prior to the date of bankruptcy filing |
| DJANKOV et al. | 2008 | Belgium | 2006 | 1 | hotel business | N/A | N/A | 4% | N/A | estate at the time of entry into the bankruptcy proceeding |
| FISHER/MARTEL | 1999 | Canada | 1977-1988 | 393 | N/A | 2.453 CAD | total assets (measured in thousands of fourth quarter 1993 Canadian Dollars normalised by the GDP deflator) | 22,5% | 5,7% | total book value of assets at the time of filing (measured in thousands of fourth quarter 1993 Canadian Dollars normalised by the GDP deflator) |
| DJANKOV et al. | 2008 | Canada | 2006 | 1 | hotel business | N/A | N/A | 4% | N/A | estate at the time of entry into the bankruptcy proceeding |
| DJANKOV et al. | 2008 | France | 2006 | 1 | hotel business | N/A | N/A | 9% | N/A | estate at the time of entry into the bankruptcy proceeding |
| DJANKOV et al. | 2008 | Japan | 2006 | 1 | hotel business | N/A | N/A | 1% | N/A | estate at the time of entry into the bankruptcy proceeding |

*Source: Own considerations based on scientific research on the costs of bankruptcy*

*Note: Unfortunately, some studies did not provide precise information regarding the reference figure or the date of measurement of certain figures. Moreover, some information are not available and thus denoted as "N/A".*

# Appendix 8.1: Review of examinations on bankruptcy costs outside the United States; part 2/2

| Author(s) | Year of publication | Country | Analysed time horizon | Number of companies | Company industry(ies) | Firm size | | Magnitude of direct bankruptcy costs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean value in mln. home currency | Basis | Mean value | Median value | Basis |
| COUWENBERG/DE JONG | 2008 | Netherlands | 1983-2000 | 137 | N/A | 10.45 Gulden | total book value of assets | 10,7% | N/A | total book value of assets |
| DJANKOV et al. | 2008 | Netherlands | 2006 | 1 | hotel business | N/A | N/A | 4% | N/A | estate at the time of entry into the bankruptcy proceeding |
| BRADBURY/LLOYD | 1994 | New Zealand | 1980-1987 | 27 | construction, light manufacturing, retail and wholesale, information technology, agriculture | 1.62 NZD | median value of the total book value of assets at the date of receivership | 4,4% | 8,9% | median value of the total book value of assets at the date of receivership |
| DJANKOV et al. | 2008 | New Zealand | 2006 | 1 | hotel business | N/A | N/A | 4% | N/A | estate at the time of entry into the bankruptcy proceeding |
| DJANKOV et al. | 2008 | Singapore | 2006 | 1 | hotel business | N/A | N/A | 1% | N/A | estate at the time of entry into the bankruptcy proceeding |
| NEGASH | 2001 | South Africa | 1995-1997 | 63 | N/A | N/A | N/A | 1%-19% | N/A | total assets |
| DJANKOV et al. | 2008 | South Africa | 2006 | 1 | hotel business | N/A | N/A | 18% | N/A | estate at the time of entry into the bankruptcy proceeding |
| DJANKOV et al. | 2008 | Turkey | 2006 | 1 | hotel business | N/A | N/A | 7% | N/A | estate at the time of entry into the bankruptcy proceeding |

*Source: Own considerations based on scientific research on the costs of bankruptcy*

*Note: Unfortunately, some studies did not provide precise information regarding the reference figure or the date of measurement of certain figures. Moreover, some information are not available and thus denoted as "N/A".*

## Appendix 8.2: Review of examinations on indirect bankruptcy costs

| Author(s) | Year of publication | Country | Analysed time horizon | Number of companies | Company industry(ies) | Firm size | | Magnitude of indirect bankruptcy costs | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean value in mln. home currency | Unit | Mean value | Median value | Reference figure |
| ALTMAN | 1984 | United States | 1970-1978 | 19[1] | retail and industrial | 141.8 USD | market value of equity plus book value of debt plus market value of debt plus the value of capitalised leases at the fiscal year-end prior to the bankruptcy filing date | 6,5% | 2,6% | market value of equity plus book value of debt plus market value of debt plus the value of capitalised leases at the fiscal year-end prior to the bankruptcy filing date |
| KWANSA/CHO | 1995 | United States | 1980-1992 | 10[1] | restaurant companies | N/A | N/A | 7,7% | N/A | book value of equity plus book value of debt plus capitalised leases at the fiscal year-end prior to the bankruptcy filing date |
| MAKSIMOVIC/ PHILLIPS | 1998 | United States | 1978-1989 | 302[2] | manufacturing firms | N/A | N/A | indirect bankruptcy costs are not significant | | |
| PHAM/CHOW | 1989 | Australia | 1976-1983 | 142 | finance, property, manufacturing, retailing | 75.7 AUD | sum of the book value of debt and the market value of equity at the fiscal year-end prior to the date of bankruptcy filing | 13,4% | N/A | sum of the book value of debt and the market value of equity at the fiscal year-end prior to the date of bankruptcy filing |

*Source: Own considerations based on scientific research on the costs of bankruptcy*

*Note: The footnotes indicate the type of filing. Unfortunately, some studies did not provide precise information regarding the reference figure or the date of measurement of certain figures. Moreover, some information are not available and thus denoted as "N/A".*

[1] *N/A*
[2] *Chapter 11 filings*

# Appendix 8.3: Review of examinations on bankruptcy prediction concerning the United States; part 1/2

| Author(s) | Year of publication | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Firm size | | Statistical approach | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Mean value in mln. US-Dollars | Unit | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| ALTMAN | 1968 | 1946-1965 | 48 | 66 | manufacturing | 6,40 | asset size | linear discriminant analysis | 93,5% | 4,0% | 21,0% | holdout sample consisting of 25 bankrupt firms and 33 non-bankrupt firms |
| ALTMAN | 2000 | 1969-1975 | 86 | N/A | manufacturing | N/A | N/A | linear discriminant analysis | 82,0% | N/A | N/A | N/A |
| | | 1976-1995 | 110 | N/A | | N/A | N/A | | 85,0% | N/A | N/A | N/A |
| | | 1997-1999 | 120 | N/A | | N/A | N/A | | 94,0% | N/A | N/A | N/A |
| ALTMAN/HALDEMAN/ NARAYANAN | 1977 | 1969-1975 | 53 | 58 | manufacturing, retailing | 96[3] / 167[4] | tangible asset size | linear discriminant analysis | 91,0% | 7,5% | 10,3% | LACHENBRUCH (1967) validation test |
| BLUM | 1974 | 1954-1968 | 115 | 115 | industrial | N/A | N/A | linear discriminant analysis | 93.0%[2] | 12%[2] | 0%[2] | holdout sample consisting of eleven out of 21 ranges |
| DEAKIN | 1972 | 1954-1964 | 79 | 79 | N/A | N/A | N/A | linear discriminant analysis | 87,0% | 13,0% | 14,0% | holdout sample consisting of 11 failed and 23 non-failed firms selected at random for the time period between 1963 and 1964 |
| KARELS/PRAKASH | 1987 | 1972-1976 | 16 | 186 | N/A | N/A | N/A | linear discriminant analysis | 93,5% | 45,5% | 4,0% | sub-sample including data from 1976 containing 175 non-bankrupt and 11 bankrupt firms are used as a holdout sample |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A" with the columns expressing firm size deleted due to missing availability of data.*

[1] *The classification accuracy rates are measured at the fiscal year end prior to the bankrupty filing date.*
[2] *The classification accuracy rate measured by BLUM (1974) refers to firms with five years of financial statement data.*
[3] *Mean firm size of failed firms*
[4] *Mean firm size of non-failed firms*

# Appendix 8.3: Review of examinations on bankruptcy prediction concerning the United States; part 2/2

| Author(s) | Year of publication | Country | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Statistical approach | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| MARTIN | 1977 | United States | 1969-1976 | 12 | 5702 | financial | logit analysis | 82,1% | 58,3% | 17,8% | holdout sample collected for the time period between 1970 and 1971 |
| | | | | 12 | 5605 | financial | logit analysis | 85,5% | 41,7% | 14,4% | holdout sample collected for the time period between 1971 and 1972 |
| | | | | 10 | 5577 | financial | logit analysis | 87,8% | 20,0% | 12,2% | holdout sample collected for the time period between 1972 and 1973 |
| | | | | 13 | 5552 | financial | logit analysis | 87,4% | 7,7% | 12,6% | holdout sample collected for the time period between 1973 and 1974 |
| | | | | 18 | 5528 | financial | logit analysis | 90,3% | 16,7% | 9,7% | holdout sample collected for the time period between 1974 and 1975 |
| | | | | 23 | 5575 | financial | logit analysis | 91,1% | 8,7% | 8,9% | holdout sample collected for the time period between 1975 and 1976 |
| OHLSON | 1980 | United States | 1970-1976 | 105 | 2058 | industrial | logit analysis | 82,85 | 12,4% | 17,4% | no holdout sample employed |
| PLATT/PLATT | 1990 | United States | 1972-1986 | 57 | 57 | mining, food, textiles, lumber, paper, chemicals, metals machinery, transportation, equipment, wholesale, retailing, other | logit analysis | 90,0% | 7,0% | 14,0% | LACHENBRUCH (1967) validation test |
| SHUMWAY | 2001 | United States | 1962-1983 | 118 | 1704 | N/A | binary logit analysis | 67.6%[2] / 55.0%[3] / 75.0%[4] | N/A | N/A | holdout sample collected for the time period between 1984 and 1992 |
| COATS/FANT | 1993 | United States | 1970-1989 | 94 | 188 | N/A | neural network analysis | 92,9% | 17,0% | 2,1% | holdout sample consisting of four out of eight non-overlapping sets |
| | | | | | | | linear discriminant analysis | 83,0% | 31,9% | 9,6% | |
| SANTOMERO/ VINSO | 1977 | United States | 1965-1974 | 10 | 214 | financial | stochastic process modelling approach | 95,5% | 40,0% | 2,8% | N/A |
| VINSO | 1979 | United States | 1971 | 20 | 20 | electric utilities, airlines, oil drilling, others | stochastic process modelling approach | N/A | N/A | N/A | N/A |
| WILCOX | 1973 | United States | 1949-1971 | 52 | 52 | N/A | stochastic process modelling approach | 93,8% | N/A | N/A | N/A |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A" with the columns expressing firm size deleted due to missing availability of data.*

[1] *The classification accuracy rates are measured at the fiscal year-end prior to the bankrupty filing date.*

[2] *Classification rate based on the first decile of fitted probability values when using the variables included in the model suggested by ALTMAN (1968)*

[3] *Classification rate based on the first decile of fitted probability values when using the variables included in the model suggested by ZMIJEWSKI (1984)*

[4] *Classification rate based on the first decile of fitted probability values when using accounting (net income to total assets and total liabilities to total assets) and market-driven (market size, past stock returns, idiosyncratic standard deviation of stock returns) variables*

## Appendix 8.4: Review of examinations on bankruptcy prediction outside the United States; part 1/4

| Author(s) | Year of publication | Country | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Firm size | | Statistical approach/model | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mean value in mln. home currency | Unit | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| BOOTH | 1983 | Australia | 1964-1979 | 35 | 35 | N/A | 5.4[2] AUD/ 5.1[3] AUD | total asset size | linear discriminant analysis | 62,5% | 25,0% | 50,0% | holdout sample containing 13 data pairs collected for the time period between 1973 and 1979 |
| CASTAGNA/MATOLCSY | 1981 | Australia | 1963-1977 | 21 | 21 | motel owner, retailing, wholesale, grocery chain, electrical sales and manufacturing, merchant, engineering, textiles, land development, building materials manufacturing, footwear distribution, building, building materials supply, machinery manufacturing | N/A | N/A | linear discriminant analysis | 92,9% | 9,5% | 4,8% | LACHENBRUCH (1967) validation test |
| EDWARDS et al. | 2005 | Australia | 1990-2002 | 28 | 40 | N/A | N/A | N/A | linear discriminant analysis | 71,7% | 52,2% | 4,3% | no holdout sample employed |
| | | | | | | | | | decision tree model | 69,6% | 4,4% | 56,5% | no holdout sample employed |
| | | | | | | | | | logistic regression model | 90,1% | 20,0% | 5,9% | holdout sample containing five bankrupt and 17 non-bankrupt firms for the time period between 1995 and 2002 |
| | | | | | | | | | neural network analysis | 68,2% | 20,0% | 35,3% | holdout sample containing five bankrupt and 17 non-bankrupt firms for the time period between 1995 and 2002 |
| IZAN | 1984 | Australia | 1963-1979 | 53 | 50 | building materials, chemical and petroleum, developers and contractors, electrical, engineering and supplies, finance, pastoral and related, retailing, steel and heavy engineering, textiles and clothing, trade and services, diversified and investment | N/A | N/A | linear discriminant analysis | 91,9% | 5,9% | 10,4% | LACHENBRUCH (1967) validation test |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A".*

[1] *The classification accuracy rates are measured at the fiscal year end prior to the bankrupty filing date.*

[2] *Mean firm size of failed firms*

[3] *Mean firm size of non-failed firms*

## Appendix 8.4: Review of examinations on bankruptcy prediction outside the United States; part 2/4

| Author(s) | Year of publication | Country | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Firm size | | Statistical approach/model | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mean value in mln. home currency | Unit | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| CIELEN/PEETERS/ VANHOOF | 2004 | Belgium | 1994-1996 | 276[4] | 90[4] | N/A | N/A | N/A | linear programming model | 78,0% | 29,5% | 19,3% | holdout sample used but not further specified |
| | | | | | | | | | data envelopment model | 85,1% | 25,6% | 11,2% | |
| | | | | | | | | | rule induction model | 79,9% | 45,3% | 11,0% | |
| POMPE/BILDERBEEK | 2005 | Belgium | 1986-1994 | 1369 | 3000 | industrial | N/A | N/A | linear discriminant analysis | 80%[2] / 76%[3] | N/A | N/A | holdout sample consisting of 750 annual reports of non-bankrupt firms and 238 bankrupt companies collected for the time period between 1986 and 1994 |
| | | | | | | | | | neural network analysis | 81%[2] / 77%[3] | N/A | N/A | |
| ALTMAN/LAVALLEE | 1981 | Canada | 1970-1979 | 27 | 27 | manufacturing, retailing, wholesale | 12.6[4] CAD / 15.6[5] CAD | tangible asset size | linear discriminant analysis | 83,0% | N/A | N/A | LACHENBRUCH (1967) validation test |
| BORITZ/KENNEDY/SUN | 2007 | Canada | 1987-2002 | 266 | 266 | manufacturing, holding, mining, oil, gas, transportation and communication, wholesale and retail, finance, insurance and real estate, services, other | 322.9[4] CAD/ 334.5[5] CAD (29.0[6] CAD / 33.2[7] CAD) | total asset size | ALMAN (1968)[8] | 62,5% | 58,3% | 16,7% | holdout sample consisting of 24 failed firms and 24 non-failed companies |
| | | | | | | | | | ALTMAN/ LAVALLEE (1981)[8] | 39,6% | 41,7% | 37,5% | |
| | | | | | | | | | OHLSON (1980)[8] | 68,8% | 41,7% | 20,8% | |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A".*

[1] *The classification accuracy rates are measured at the fiscal year end prior to the bankrupty filing date.*

[2] *Classification accuracy of young firms (age of less than 8 years; measured between the start of the firm and the deposit date of the financial statements published immediately prior to the bankruptcy filing date)*

[3] *Classification accuracy of old firms (age of 8 years or more; measured between the start of the firm and the deposit date of the financial statements published immediately prior to the bankruptcy filing date)*

[4] *Mean firm size of failed firms*

[5] *Mean firm size of non-failed firms*

[6] *Median firm size of failed firms*

[7] *Median firm size of non-failed firms*

[8] *Coefficients of the model have been re-estimated.*

## Appendix 8.4: Review of examinations on bankruptcy prediction outside the United States; part 3/4

| Author(s) | Year of publication | Country | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Firm size | | Statistical approach/model | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mean value in mln. home currency | Unit | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| MICHA | 1984 | France | 1972-1980 | 520 | 1.150 | iron ore mining, shipbuilding, steel, garments, automobiles, office equipment and data processing equipment, building materials, soft drinks and alcoholic beverages, miscellaneous mining, dairy produce | N/A | N/A | linear discriminant analysis | 80,2% | N/A | N/A | holdout sample used but not further specified |
| NEVES/VIEIRA | 2006 | France | 1998-2000 | 583 | 1.500 | N/A | N/A | N/A | linear discriminant analysis | 66,1% | N/A | N/A | cross-validation of the data set using one of ten sets for testing |
| | | | | | | | | | ALTMAN (1968) | 62,7% | N/A | N/A | |
| | | | | | | | | | extended neural network analyis (hidden layer learning vector quantisation) | 84,1% | 11,1% | 10,6% | |
| KO | 1982 | Japan | 1960-1980 | 41 | 41 | N/A | N/A | N/A | linear discriminant analysis | 82,9% | N/A | N/A | LACHENBRUCH (1967) validation test |
| SHIRATA | 1998 | Japan | 1986-1996 | 686 | 300 | N/A | 3,757 Yen[2]/ 3,847 Yen[3] | total asset size | linear discriminant analysis | 84,0% | 16,8% | 15,1% | holdout sample used but not further specified |
| | | | | | | | | | ALTMAN (1968)[4] | 72,3% | 22,6% | 32,9% | |
| TAKAHASHI/ KUROKAWA/ WATASE | 1984 | Japan | 1961-1977 | 40 | 40 | N/A | N/A | N/A | linear discriminant analysis | 81,3% | 0,0% | 20,5% | holdout sample consisting of 24 failed firms and 24 non-failed companies |
| BILDERBEEK | 1979 | Nether-lands | 1950-1974 | 38 | 59 | N/A | N/A | N/A | linear discriminant analysis | 80,0% | N/A | N/A | N/A |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A".*

[1] *The classification accuracy rates are measured at the fiscal year end prior to the bankrupty filing date.*

[2] *Mean firm size of failed firms*

[3] *Mean firm size of non-failed firms*

[4] *The market value of equity-to-book value of total debt variable included in the model suggested by ALTMAN (1968) has not been utilised by SHIRATA (1998).*

## Appendix 8.4: Review of examinations on bankruptcy prediction outside the United States; part 4/4

| Author(s) | Year of publication | Country | Analysed time horizon | Number of failed companies | Number of non-failed companies | Company industry(ies) | Firm size | | Statistical approach/model | Classification accuracy[1] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Mean value in mln. home currency | Unit | | Overall | Type I error | Type II error | Holdout sample used to calculate classification accuracy rates |
| RIKKERS/THIBEAULT | 2009 | Nether-lands | 1996-2007 | 240 | 998 | N/A | N/A | N/A | structural form model | 63,8% | 40,0% | 32,4% | holdout sample consisting of 60 failed firms and 250 non-failed companies |
| CHUNG/TAN/ HOLDSWORTH | 2008 | New Zealand | 2004-2007 | 10 | 35 | N/A | N/A | N/A | combination of multiple discriminant analysis and neural network analysis | 62,0% | N/A | N/A | holdout sample used but not further specified |
| KURUPPU/LASWAD/ OYELERE | 2003 | New Zealand | 1987-1993 | 85 | 50 | N/A | N/A | N/A | linear discriminant analysis | 71,1% | 8,2% | 64,0% | LACHENBRUCH (1967) validation test |
| | | | | | | | | | ALTMAN (1968) | 45,9% | 58,8% | 46,0% | no test based on a holdout sample reported |
| SORI/JALIL | 2009 | Singapore | 1990-2000 | 17 | 17 | investment holding, electronics & information technology, manufacturing, food and beverages, properties, construction, engineering, retailing | N/A | N/A | linear discriminant analysis | 81,6% | 24,5% | 12,5% | holdout sample used but not further specified |
| TA/SEAH | 1988 | Singapore | 1975-1983 | 22 | 21 | N/A | 89.5 USD [2&3] | total asset size | linear discriminant analysis | 86,2% | 15,0% | 9,5% | holdout sample used but not further specified |
| COURT/RADLOFF | 1994 | South Africa | 1975-1985 | 20 | 18 | N/A | N/A | N/A | combination of regression analysis and Bayes-Fisher discriminant analysis | 68.4% - 84.2%[4] | 25-60%[4] | 0-6%[4] | no test based on a holdout sample reported |
| UĞURLU/AKSOY | 2006 | Turkey | 1996-2003 | 27 | 27 | manufacturing firms | N/A | N/A | linear discriminant analysis | N/A | 18,2% | 11,6% | no holdout sample employed |
| | | | | | | | | | logistic regression model | 95,6% | 8,6% | 2,5% | |
| UNAL | 1988 | Turkey | 1979-1984 | 33 | 29 | N/A | N/A | N/A | linear discriminant analysis | 97,0% | 3,0% | 3,0% | no test based on a holdout sample reported |

*Source: Own considerations based on scientific research on bankruptcy prediction*

*Note: If not stated otherwise, the holdout sample used to obtain accuracy classification rates represents a sub-sample of the data described in the columns named "Analysed time horizon", "Number of failed companies" and "Number of non-failed companies". Moreover, some information are not available and thus denoted as "N/A".*

[1] *The classification accuracy rates are measured at the fiscal year end prior to the bankrupty filing date.*
[2] *Mean firm size of failed firms*
[3] *Mean firm size of non-failed firms*
[4] *The amounts of the Type I and the Type II error depend on the business failure rate. [See COURT/RADLOFF (1994), p. 17.]*

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## – EXPERIENCE –

**SILVIA QUANDT & CIE. AG, GERMANY** 2011

*SENIOR ASSOCIATE, CORPORATE FINANCE*

- Prepared key materials (e.g. presentations, teaser, information memoranda) to pitch for or to process Equity Capital Markets and Mergers & Acquisitions transactions;
- Built models based on discounted cash flow and multiplier approaches, using them for company calculations;
- Capitalised on existing network of business partners, institutional and wealthy private clients to promote the investment banking services of Silvia Quandt & Cie. AG;
- Coordinated work done by analysts;
- Served as staffer and mentor for interns.

**FERI FINANCE AG, GERMANY** 2005-2011

*DEPUTY DIRECTOR, PORTFOLIO MANAGEMENT*

- Cemented in-depth understanding in analysing and managing real estate securities and funds of 2 billion Euros;
- Implemented and managed a real estate fund with commissions exceeding 2 million Euros per year;
- Reduced asset management costs by 20 percent through effective renegotiations with third-party asset managers;
- Acquired and advised institutional clients on their investment strategy to elevate Feri's profits and business growth;
- Built, trained and managed a team of three analysts after promotion to senior portfolio manager in 2007.

**AMERICAN EXPRESS BANK GMBH, GERMANY** 2002-2003

*INTERN/STUDENT TRAINEE, INSTITUTIONAL ASSET MANAGEMENT*

- Streamlined funds reporting, prepared client presentations, conducted market research, trained personnel on Excel;
- Contracted distribution agreements as a result of identifying new business partners;
- Recognised with the "American Express Achievement Award" in both 2002 and 2003.

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## – EDUCATION –

**UNIVERSITY OF ST. GALLEN, SWITZERLAND** 2005-2011
*DOCTORATE IN FINANCE AND BANKING*
- Concentration in corporate valuation of Real Estate Investment Trusts.

**EUROPEAN BUSINESS SCHOOL, GERMANY** 2001-2005
*DIPLOMA IN INTERNATIONAL BUSINESS ADMINISTRATION*
- Majors in Finance and Banking, and Real Estate Economics;
- Awarded “Werner Lehmann-Preis” and “DIA-Forschungspreis” for the diploma thesis.

**UNIVERSITY OF READING, ENGLAND** 2003-2004
*MASTER OF SCIENCE IN REAL ESTATE INVESTMENT*
- Emphasis on financial modeling in a real estate context;
- Earned “The University of Reading Business School Postgraduate Board of Studies Commendation”.

Passed Advanced Level equivalents in mathematics and physics while studying in Germany between 1997 and 2000.

## – OTHER –

- Completed the Investment Banking Training Program of the Investment Banking Institute in 2011.
- Launched and ran an individual operation focused on sold-out concerts and sporting events in 2003.
- Led a team of ten students to program and to implement a university-wide “Facebook”-style system in 2002.
- Tutored students in mathematics and physics as a member of a private coaching organisation from 1999 to 2003.
- Proficient in Excel, PowerPoint, Word, Access, Outlook, Bloomberg, Lotus Notes, EViews and SPSS.
- Language skills: German (native), English (fluent), French (basic).
- Interests include participation in Initial Public Offerings, playing soccer, and travelling.