Alignment of interests of fund investors and fund managers in private equity

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Acknowledgements

While investing in small- and medium-sized businesses, I witnessed numerous and significant gaps between financial theory (at large), the developing private equity academic corpus, and practice. The growing public attention on private equity magnifies the gaps and further generates noise, and often incomplete, or incorrect, perspectives on the sector.

The purpose of this research is to contribute to the practical and academic understanding of the private equity sector in one of its defining elements: the alignment of the interests of investors in private equity (which are a vast multitude) with those of the fund managers (which are rather limited in number, and single points of contacts for investors in private equity funds). The resulting dynamics are shaping the sector, as well as the practice of investing in private equity.

I would like to thank my two academic supervisors, Prof. Dr. Andreas Grüner and Prof. Dr. Martin Hilb for their support and feedback.

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Cyril Demaria

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Summary

This dissertation aims at assessing: **how investors in private equity (LPs) can bridge the gap between their expectations and what they actually get from fund managers (GPs)**? Three original academic articles break down this question into three research questions:

i) What happens when LPs have conflicting explicit and implicit targets while investing in private equity (PE) funds?

ii) What performance do GPs generate and what do LPs effectively earn?

iii) How can LPs better understand and forecast returns to actively decide to hold or sell their PE holdings?

The **first paper** explores conflicting financial and social aims in PE through the specific case of American minority-owned businesses and enterprises (MBE). US MBE-PE has conflicting social and financial goals. As the social ones are not explicitly formulated, the search for financial returns prevail. However, by aiming at some social returns, GPs sacrifice the maximisation of financial ones.

The findings apply to US MBE-PE, and thus limit the generalisation of the conclusions. However, US MBE-PE illustrates of the fact that the search of financial returns prevail even for LPs investing in this specific domain of PE.

Do LPs get these financial returns? The **second paper** explores the question. While officially serving the interests of LPs, GPs have a clear interests to keep the interests of LPs divided to maximise their own profit. GPs still have to provide returns to LPs for 'signalling' purpose (a proxy assertion of GP quality for further fund raising). The gap in the alignment of interests appears in analysing net and gross returns, and the split of the proceeds.

We conclude that, on average, GPs get the lion's share of the profits and LPs get, at best, a limited upside. How can LPs act to challenge this status quo? LPs can only marginally negotiate the terms of limited partnership agreements (LPAs). Loyalty is not be rewarded by satisfying returns (as the second paper demonstrates).

The **third paper** demonstrates that to be more proactive, LPs need to analyse PEF performances and identify early if a fund belongs to a category of low performers. We conclude PEF J-Curves can be used (to a certain extent) as a predictor of future performance. With this information, LPs can get the "big picture" of their PE performance and thus can shape their expectations in terms of proceeds from their PE investments.

Thereby, a first step is achieved on the long road towards an alignment of interests between LPs and GPs. Our description of the PE characteristics in these three papers are the foundation for a subsequent building process to align these interests.

Zusammenfassung (summary in German)

Diese Dissertation untersucht, **wie Investoren in Private Equity (Teilhaber mit beschränkter Haftung, Limited Partners, LPs) die Lücke zwischen ihren Erwartungen und dem tatsächlich vom Fonds Manager (Komplementär, General Partner, GPs) erhaltenen Gegenwert schliessen können**. Drei akademische Artikel brechen diese Frage in drei Forschungsfragen auf:

i) Was passiert, wenn LPs explizite und implizite Ziele haben, die im Wiederspruch stehen, wenn sie in Private Equity (PE) Fonds investieren?

ii) Welche Performance generieren GPs und was verdienen LPs effektiv?

iii) Wie können LPs Renditen besser verstehen und prognostizieren, um aktiv zu entscheiden, ob sie ihren PE Anteil halten oder verkaufen sollen?

Das **erste Teil der Dissertation** untersucht anhand vom Beispiel Amerikanischer Minderheits-Beteiligungen (US MBE_PE) finanzielle und soziale Ziele in Private Equity die im Widerspruch zueinander stehen. Die finanziellen und sozialen Ziele von US MBE-PE stehen tatsächlich im Konflikt zueinander. Da die sozialen Ziele nicht explizit formuliert sind, überwiegt die Suche nach finanzieller Rendite. Indem GPs soziale Renditen anstreben, opfern sie jedoch die Maximierung der finanziellen Renditen.

Die Erkenntnisse gelten für US MBE-PE und beschränken somit die Generalisierung der Schlussfolgerungen. Jedoch zeigt das Beispiel von US MBE-PE, dass die Suche von LPs nach finanziellen Renditen sogar in dieser spezifischen PE Domäne vorherrscht.

Der zweite Teil geht dieser Frage auf den Grund, ob diese Renditen schlussendlich den LPs zugute kommen. Während vordergründig den Interessen von LPs genüge geleistet wird, haben GPs ein klares Interesse, die Interessen von LPs im Zwiespalt zu halten um ihren eigenen Profit zu maximieren. Die von GPs generierten Renditen haben nach wie vor Signalwirkung (und sollen Rückschlüsse über die Qualität eines GPs erlauben und somit bei der Beschaffung weiterer Finanzmittel behilflich sein). Die Lücke in der Abstimmung der Interessen wird offensichtlich bei einem genaueren Blick auf Netto- und Brutto-Renditen sowie der Aufteilung der Erträge.

Wir schliessen, dass GPs im Durchschnitt den Löwenanteil der Profite erhalten. LPs erhalten bestenfalls einen beschränkten Anteil an der positiven Preisentwicklung. Wie können LPs diesen Status Quo in Frage stellen? LPs können nur zu einem sehr limitierten Grad die Konditionen für das Limited Partnership Agreement (LPA)

aushandeln. Loyalität wird nicht ausreichend durch zufriedenstellende Renditen belohnt (wie das zweite Dokument aufzeigt).

Der dritte Teil der Dissertation zeigt auf, dass LPs die PE-Fonds Performance analysieren müssen, um frühzeitig zu erkennen, um ein Fonds in die Kategorie der schlecht performenden Fonds fällt. Wir schliessen, dass die J-Kurve eines PE-Fonds (zu einem bestimmten Grad) als Vorhersageinstrument für zukünftige Performance beigezogen werden kann. Mit dieser Information können LPs den Überblick über ihre PE-Performance erhalten und somit ihre Erwartungen in Bezug auf die Erträge ihrer PE Investitionen formen.

Damit ist ein erster Schritt erreicht auf dem langen Weg zu einer Angleichung der Interessen zwischen Investoren (LPs) und Private Equity Fonds Managern (GPs). Unsere Beschreibung der Private Equity Charakteristiken in diesen drei Dokumenten bilden die Basis für einen nachfolgenden Prozess, diese Interessen aufeinander besser aufeinander abzustimmen.

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Abbreviations and acronyms

AIFMD	Alternative Investment Fund Manager Directive
APAC	Asia Pacific region
AUM	Assets under management
AVCAL	Australian Private Equity and Venture Capital Association
AVCJ	Asian Venture Capital Journal
Bn	Billion
Bps	Basis points
CEIOPS	Committee of European Insurance and Occupational Pensions Supervisors
CIO	Chief Investment Officer
CMBOR	Centre for Management Buy-Out Research
CSR	Corporate social responsibility
DCF	Discounted cash-flows
DCIIA	Defined Contribution Institutional Investment Association
DPI	Distribution to Paid-In
EBITDA	Earnings before Interest, Taxes, Depreciation and Amortization
EBRD	European Bank for Reconstruction and Development
EDM	Emerging Domestic Market
EIF	European Investment Fund
EIOPA	European Insurance and Occupation Pensions Authority
EMPEA	Emerging Markets Private Equity Association
ESG	Environmental, social and corporate governance
EU	European Union
EUR	Euro
EV	Enterprise Value
EVCA	European Private Equity and Venture Capital Association
FCPI	Fonds Commun de Placement dans l'Innovation
FCPR	Fonds Commun de Placement à Risque
FIP	Fonds d'Investissement de Proximité
FLP	Family Limited Partnership
FO	Family office
GBP	British Pound
GP	General Partner (manager of a private equity fund)
HNWI	High Net Worth Individual
IFC	International Finance corporation
IFRS	International Financial Reporting Standards
ILPA	International Limited Partners' Association
IOSCO	International Organisation of Securities Commission
IPO	Initial public offering
IT	Information technologies
IRR	Internal rate of return

IVA	Israel Venture Association
LAVCA	Latin American Venture Capital and Private Equity Association
LBO	Leveraged buy-out
LP	Limited Partner (investor in a private equity fund)
LPA	Limited partnership agreement
LPE	Listed private equity
MENA	Middle-East and North Africa region
MFN	Most Favored Nation
MFO	Multiple family office
Mn	Million
NACUBO	National Association of College and University Business Officers
NAV	Net asset value
NVCA	National Venture Capital Association
PICC	Paid-In to Committed Capital ratio
PIPE	Private Investment in Public Entities (or Equities)
PE	Private equity
PME	Public market equivalent
ROW	Rest of the world
RVPI	Residual Value to Paid-In
SFO	Single family office
SRI	Socially Responsible Investments / Sustainable and Responsible Investments
SWF	Sovereign Wealth Fund
TVPI	Total Value to Paid-In
UNPRI	United Nations Principles for Responsible Investment
US	United States of America
USD	US Dollar
Tn	Trillion
VaR	Value at risk
VC	Venture capital
VY	Vintage year (year of creation of a private equity fund)
vs	versus (latin for ‘against’)

Premise

This dissertation is structured as the cumulative work of three original articles presented in a monograph form. In addition to the three articles, there is an introductory section and a conclusion. The articles' content is as originally submitted to journals except the papers introductions, to avoid repetitions between the general introduction and parts of the articles.

The first article was published by the Journal of Private Equity, the second by the Journal of Alternative Investments and the third by the Journal of Financial and Risk Perspectives.

Conferences where these papers were presented are referenced in the relevant chapters.

The dissertation has been edited by a professional whose mother tongue is English.

0. Introduction

The PE industry represents an estimated USD 3,000 bn and includes approximately 15,000 LPs and 4,000 GPs worldwide [Preqin estimates, 2012[1]]. The sector is structured by standardized contracts [Hobohm, 2010], specific time horizons for investments (which might differ from group to group) and the expectation that this might generate partial/total losses with a given probability [Weidig and Mathonet, 2004], and certain returns. Limited Partners [Demaria, 2013 for a definition] and General Partners [Demaria, 2013 for a definition] are now surrounded by a mesh of legal and tax advisors, placement agents, gatekeepers and consultants (the 'ecosystem') who have specific roles and influence in the process[2].

0.1. Research objective and research questions

To understand what is at stake **empirically**, it is necessary to emphasize that capital will continue to flow to the private equity asset class and that this flow will increase in absolute and relative (to total assets under management) terms. This inflow will take place while a generational change will be under way at the helm of GPs. It will, therefore, be increasingly necessary to understand the structural components that distinguish GPs as performing well or not (see Chapter 2 for more elements).

Simultaneously, understanding the behavior of LPs would help in explaining certain phenomena and would possibly limit or prevent a chaotic inflow of capital (nudging LPs or regulating their activities) to private equity. Quantitative analysis can only give an understanding of the volumes, but not of the dynamics behind these volumes. Certain actions can actually cancel each other out, while others echo or amplify the consequences: for example, signals to the LP community play a significant role (see above). Opinion leaders in the LP community have designed specific strategies that are often difficult to replicate. These strategies, combined with portfolio structuring, have sometimes insulated themselves from some of the consequences of shifts in asset allocation and market booms and busts. It is, hence, necessary to understand who the new opinion leaders are and what ultimately drives them.

[1] Cornelius *et al.* [2013] estimate that 11 percent are managed by funds-of-funds and secondary funds. According to them, between 2000 and 2011, there were 1,000 partnerships active in PE and real assets.

[2] For instance, Rikato and Berk [2012] state that placement agents are involved in 10 percent of fund raising (though Toll and Oberfeld [2014, p. 65] state 16 to 35 percent of PE funds used them; and Preqin state that 41 to 50 percent of funds used a placement agent between 2006 and 2011), and charge on average a two percent placement fee ultimately born by LPs (though Toll and Oberfeld [2014, p. 65] state in the majority of the cases it is the GP who bears the cost). They also note that placement agents select their mandates and avoid the placements which might not lead to successful fund raising. Placement agents offer services such as faster fund raising, fund formation and structuring, marketing strategy and services, material preparation (such as due diligence packages), project management to final closing, post-closing activities, on-going market intelligence, and the management and support of LP relationships. In particular, placement agents can help GPs expand their investor base, provide a permanentely updated knowledge of the market and provide proof of credibility.

The **academic and empirical** context of research on private equity is of scarce and patchy data, often biased, and without reliable benchmarks. Even more, these data are often outdated and only provide insights on past phenomena that may not be relevant today or in the future. Our goal is to produce research reflecting these limitations, to investigate the sector from a different angle and to offer instruments that can be used by LPs and GPs to better know each other and the private equity sector.

A lot of what makes private equity a sector cannot be reduced to quantitative analysis. Though dominating large portions of the academic research and literature, the body of knowledge called 'market finance' was produced to analyze liquid financial markets (such as stock exchanges) and their applications. It is only, at best, partially applicable to private equity. Due diligence, investments (involving 'gut feelings', described by Shefrin [2002, p. 21] as a combination of cognition and emotion), value creation, monitoring, networking, reporting, reputations [Nahata, 2008; Demiroglu and James, 2010], access to information and the principal-agent dynamics cannot easily be turned into equations (though Ewens, Jones and Rhodes-Kropf [2012] state that the 'dead weight loss associated with the principal-agent problem could be 6% (sic) of the [… USD] 530 billion invested in venture capital over […] 1996-2011, [that is to say] USD 31.8 billion'). We have chosen to focus on dynamics, factors and business practices. In that respect, we hope to contribute to bridging the gap between asset management and private equity investing by offering some understanding of the major relationship in private equity: the LP-GP partnership.

The purpose of the following chapters is, therefore, to explore further the relationships between LPs and GPs under the light of the search of performance in a context of declining returns. Key questions include how LPs and GPs interact, and what are the dynamics behind this interaction based on their characteristics and motivation. The purpose of the chapters below is to explore both the explicit and implicit parts of this interaction and, in the process, to structure an analysis.

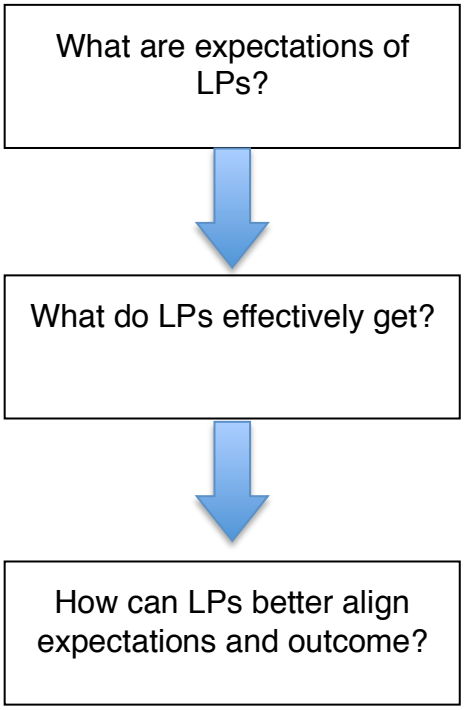
For this analysis, we aim to put quantitative instruments into perspective. To do so, and to deepen the general understanding, we will focus on the qualitative side of the reasoning. This approach does not mean that quantitative input will be set aside, but rather that it will be used as a yardstick to challenge our conclusions, to put them in perspective and to further deepen our understanding.

Given the heterogeneity of LPs, it is crucial to wonder whether there are common endeavors. The obvious answer is that they look for financial returns and they try to diversify risks. Diversification is more holistic, and portfolio construction, as risk management, does not fit the standard model. So returns are the focus of LPs in PE. But it would be foolish to assume that this is the only driver. There are, indeed, other preoccupations, just like there is not one single expected level of returns. Chapter 1 aims

to answer this question concerning priority. The central question of this research is thus:

'How can investors in private equity funds (limited partners) bridge the gap between their expectations and what they actually get from private equity fund managers (general partners)?'

The path of this research could be summed up by the following structure:



This process can be decomposed and refined in the following three research questions:

Research question 1: What happens when limited partners have conflicting explicit and implicit targets while investing in private equity funds? (Chapter 1)

To answer this question, we analyze the specific case of American PEFs investing in minority-owned businesses. Our hypothesis is that the financial and social endeavors of minority-owned businesses and enterprises (MBE) financing have implicit conflicting goals. Should the conflict of financial and social objectives be confirmed, one should prevail over the other. Our hypothesis is that as the social endeavor is not explicitly and clearly formulated, the official financial goals will prevail. Thus, MBE-PE has to finance for-profit minority-owned businesses, along the lines of standard private equity expected returns. However, the investment strategy set up and marketed by MBE-PE GPs refers to social returns, compensating for market distortions (notably in access to equity and debt) notably documented by academic literature. GPs will

accordingly follow a path of generating social and financial returns, hence sacrificing the maximization of the latter.

A specific phenomenon should emerge in this analysis: PEFs are structurally sub-optimal financially. Assuming that this is confirmed, these funds would suffer from a lack of attractiveness for LPs who expect financial returns 'at par or close to' (this will be further discussed in Chapter 1) standard private equity returns. The source of this supposed disaffection should be further visible when factoring in the risk born by MBE-PE strategies, due to the social goals and the specific strategy put in place as well as from other phenomena such as the possible adverse selection of investment targets.

In this process, we will seek to demonstrate how the lack of explicit communication between LPs and GPs affects fund performance, capital allocations from LPs and the reactions of GPs. Assuming the identification of a sub-optimal private equity strategy, we should be able to identify both factors of failure as well as potential solutions based on the background of the Introduction of this research.

Research question 2: Assuming financial returns are am LP's top and prevailing aim when investing in private equity, what performance do GPs generate and what do LPs actually earn? (Chapter 2)

Having mapped the LP landscape - their motivations, their constraints and their expectations (Section 0.2) - and having assessed their expectations (Chapter 1), it is necessary to reconcile this output with the actual returns generated by GPs (gross returns) and those earned by LPs (net returns). Our hypothesis is that while officially serving the interests of the principal (LPs), agents (GPs) have a clear interest in keeping the interests of LPs divided, so as to maximize their own profit. The dynamic is complex, because GPs also have to provide returns to LPs – or at least several of them, which are used by GPs as 'signals' to the LP community. These signals are a proxy assertion of quality and serve to enhance the attractiveness of funds further raised by GPs.

The identification of a gap (our assumption) in the alignment of interests between LPs and GPs interests should appear in analyzing net and gross returns, and the split of the proceeds from investments. While exploring this hypothesis, we should be able to identify several of the reasons for this gap and the resultant course of action for GPs. The analysis should also help to identify whether there are currently any solutions to bridge the gap between the LP's expectations and the GPs' course of action – and how it could be implemented. Assuming that there are solutions to bridge a certain number of the gaps, we would try to identify the limitations of any of these possible solutions.

The purpose of Chapter 2 is to analyze the performance of PEFs based on their reported net and gross (modeled) cash-flows, so that we can identify the aggregated alpha generated by PEF managers and characterize it, in order to clarify the debate on fee levels and to identify potential sources of higher alignment of interests. The purpose of this analysis is to reconcile the mapping of LPs with return expectations, allocation strategy, and results and understand what they can achieve and what they cannot.

Research question 3: Assuming that, on average, GPs have the lion share of profits and LPs a limited upside, how can LPs better understand and forecast returns to actively decide whether to hold or sell their private equity holdings? (Chapter 3)

GPs regularly threaten to exclude LPs who will not accept the terms set for (and only marginally negotiated by) the majority of LPs[3] (though not necessarily with 'signaling LPs'). Assuming that an LP belongs to the majority of LPs, his/her options are limited to 'exit, voice and loyalty', where 'loyalty' might not be rewarded with satisfying returns (Chapter 2 and [Meyer and Mathonet, 2005, p. 20[4]]).

'Voice' is constrained and limited to:

a. Either diplomatic channels: one-to-one communications where the GP mostly has the upper hand, or at annual general meetings where the signaling behavior of LPs is constantly screened by GPs and might lead to exclusion from future funds;
b. Or to specific events such as fund raisings, which often occurs in the middle of the investment period of the previous fund raised by the GP and the end of the investment period of the predecessor fund.

Our hypothesis is that 'Exit' is constrained because LPs do not have enough information to actively manage it. 'Exit' currently happens most often when an LP decides not to re-commit to the new fund raised by a GP. To be more active in 'Exit', LPs need to assess if the underperformance of a given GP is related to macro-economic factors, to industry cycles, to waves of performances, or to the fact that the GP belongs to a low performance category[5]. Applying this criterion to active funds and forecasting their outcomes is a difficult exercise. Net asset values provided quarterly by GPs are notoriously unreliable, especially in a context of fund raising [Brown, Gredil and Kaplan, 2013].

[3] The lack of organisation of LPs, and diverging interests despite the rise of the ILPA, does not help solve the PE funds governance puzzle. The signalling impact of belonging to the ILPA could indeed lead to a sanction from GPs.

[4] who indicate that 'most top funds give priority allocations to their previous investors, but may also allocate a share of the new fund to investors who could add value, such as deal flow, exit opportunities, industry expertise' and so on.

[5] and avoid the trap of 'hedonic editing', where they reallocate their assets from one mental account to another, rather than closing a mental account at a loss [Gross, *in* Shefrin, 2002, pp. 26-27]

The LP might try to use the J-Curve affecting PEFs, as a predictor of future performance. This cash-flow-based instrument could be analyzed to identify certain J-Curve shapes related to certain categories of returns (ideal-types) and then to test the attribution of current funds to these categories. The LP could benefit from an 'early detection system' and potentially exit early on the secondary market, hence minimizing the downside of its PEF investment. They might thus avoid the 'lemon problem' described by Cornelius *et al.* [2013, p. 50]: they will know beforehand if a fund on the secondary market is good or bad as the asymmetry of information will be substantially reduced.

0.2. Methodology[6]

This research is organized as a series of three academic papers (representing each a Chapter), which are autonomous in their contents, and connected by their respective findings and the overall purpose stated in Section 0.2. The research is a combination of a theoretical and explorative method, combined with a quantitative and confirmatory approach.

Chapter 1 is based on third-party quantitative (for the lack of access to the underlying raw data) and qualitative findings for MBE PE, and the risk-return analysis of mainstream PE. We confront these findings with empirical data, as well as with a structured reasoning on a quantitative and qualitative basis. The aim is to gather quantitative and qualitative assessments in a unified framework, in order to answer the question of the motivation of LPs when investing in MBE PE and to a more general extent in mainstream PE.

Chapter 1 is based on the agency theory, on efficient capital markets and on value creation frameworks. It hence uses a combination of:

i) Third-party case and academic studies,
ii) Basic quantitative reasoning to compare the case studies with the standard approach of private equity (described in Chapter 1 as the explicit expectation of LPs, focusing on returns),
iii) Qualitative reasoning (discovery of regularities, identification of patterns through critical research).

Chapters 2 and 3 are based on raw aggregated return and cash-flow data from a commercial database (net returns from PEFs). Chapter 2 is based on the agency theory, corporate governance and incentive management frameworks. It uses data to compute gross returns from a model that we have designed. Once these gross returns are computed, we benchmark net and gross returns thanks to a Public Market

[6] This Section draws on Miles and Huberman, 1994.

Equivalent method, adjusted with a Distribution to Paid-In coefficient. In that process we aim to identify the source of performance (if any) of GPs, as well as the distribution of this performance between LPs and GPs.

Chapter 3 is based on the agency theory, corporate governance and signal theory. It uses the cash-flows in connection with returns to create categories of cash-flows. Once these aggregated categories are built, we test them to assess their reliability with individual vintage years. We then assess at which point in time these categories start to have a predictive power (if any), and how reliable these predictions are. We further complement the analysis by applying the reasoning to active funds.

We thus position this research along the path of leading scholars, without the data these scholars had access to. To do so, we use long-term data from standard private equity providers, and data collected by previous academic studies dedicated to private equity. The two data streams fortunately cover the same period of time and suffer from the same biases (survivor, selection) and have experienced the same business cycles. Thanks to this long-term approach we expect to draw interesting conclusions.

0.3. Links between the papers

As private equity has become increasingly popular, the assets dedicated to it have increased and its returns have decreased. The friction points of the governance of PEFs are thus more visible and raise questions in terms of the preferences of investment and investment strategy that we will explore in Chapter 1.

We will investigate in Chapter 2 if and how LPs effectively capture the performance of PEFs; then analyze our results under the light of the governance in PE as defined in Chapter 0, and finally, explore further the question of the alignment of interests between LPs and GPs. We will demonstrate that, on average, PEFs do not generate a significant outperformance as compared to total market indexes (thanks to the PME-DPI method), either net or gross of fees. As LPs continue to invest in PE despite the lack of outperformance by PEFs, this is related to a lack of reliable data, a certain time-lag of performances communication, and a focus on top quartile returns driven by behavioral biases.

Chapter 3 attempts to address these issues by offering a novel performance attribution method, which is explicitly built on the illiquidity of PE and a unique phenomenon: the ‘J-Curve’. It will offer a novel performance assessment method explicitly built to capitalize on the illiquidity of PE and a unique phenomenon: the ‘J-Curve’.

1. The case of US minority business enterprises investing[7]

Socially responsible investing[8] results have fallen short of expectations [Amenc and Le Sourd, 2008]. The influence of SRI criteria on listed companies is still rather limited as the investment methods used by SRI fund managers rely essentially on stock filtering. The next possible target for SRI guidelines could be small and medium size businesses through PE investing. Investors could ideally use SRI criteria on small businesses thanks to superior corporate governance and shareholder involvement. Direct PE[9] has been identified as a superior investment tool [BVCA, 2008; Gottschalg, Talmor and Vasvari, 2010], by promoting the alignment of interests between investors and managers thanks to efficient governance standards (at the portfolio company level [Chemmanur, Krishnan and Nandy, 2008; Katz, 2008]) and high level of shareholder involvement [Acharya, Hahn and Kehoe, 2010; Meerkatt *et al.* 2008; Quiry and Le Fur, 2010]).

However, applying techniques which have been developed, in theory, for large companies has proven difficult: for example, the 'best-in-class investments' approach (passive investing) is only relevant for stock picking in listed markets. An alternative method, which consists of implementing environmental and social investment (ESG) criteria (active investing), is often too complex to handle for small and medium size businesses. Indeed, PE investments are vulnerable to bureaucratic and administrative burdens once the investment is done (post-investment monitoring process): the extra costs associated with the check-lists and additional reporting to ESG/SRI guidelines cannot realistically be taken on by small and medium size businesses which have scarce human and financial resources.

To circumvent this hurdle, PE investors have applied part or all of the ESG criteria as filtering factors of their investment opportunities (in the pre-investment screening process). Hence, PE and SRI investing intersect in three main areas: venture philanthropy, social PE and minority-related investments. The third area of minority-related investments will be the focus of this chapter.

Venture philanthropy[10] aims to regularly produce social returns. It is structured to use venture capital investment methods to finance *emerging* businesses for which social returns take precedence over financial returns, hence differentiating itself from typical venture capital investments.

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[7] The initial version of this chapter was published in the *Journal of Private Equity*, Fall 2011, Vol. 14, No. 4, pp. 61–72. This paper has been amended (its first part being now in Chapter 0), reviewed and augmented to reflect additional critiques and discussions, reflected in the current chapter.

[8] SRI, also called 'triple bottom line investing', or investing according to environmental, social and governance criteria

[9] Defined as 'investments in equity and quasi-equity in non listed companies in order to generate high risk-adjusted returns over a specific period of time' [Demaria, 2010] and Introduction.

[10] Defined as 'a field of philanthropic activity where private equity / venture capital models are applied in the non-profit and charitable sectors', [EVPA].

Social PE investing aims at producing essentially social return (and possibly financial returns) with existing businesses. The focus of social PE is on creating value for society (as opposed to appropriating value); it seeks to to address public sector and market failure by challenging or disrupting existing rules and institutions and applying market-based solutions in innovative ways [Maretich and Bolton, 2010].

Minority-related PE investing focuses on the due diligence and evaluation of investments. In that respect, it targets financial returns as well as correcting certain social imbalances[11]. This investment philosophy is essentially an American phenomenon. This paper will thus focus on the US, which means that its conclusions will be relevant for this market. Assessing the validity of the conclusions for other markets would require additional research, notably to understand how cultural differences might affect the findings.

Despite its promising endeavour, US minority-related investing is still not part of mainstream PE (that is, it does not qualify in a PE allocation as an investment segment such as venture capital, growth capital, LBO, distressed debt, turn-around capital, mezzanine financing...). This is likely due to the fact that it is largely unknown by potential LPs [Alphonse, Hellmann and Wei, 1999], though this would not hold back the most sophisticated LPs (such as US endowments) to invest as they are looking for novel ways to invest. We hypothesize that the main reason is that the risk-return profile of US minority-business enterprise (MBE) PE is sub-optimal.

Defining minority-related PE is a difficult task. Indeed, the American National Association of Investment Companies (NAIC) avoids any mention of minorities when defining the scope of investment of its members. Instead, it refers to 'ethnically diverse businesses'[12]. In fact, the NAIC's main references for its members' field of investments[13] are 'underserved markets' and 'emerging domestic markets' (EDM). This definition echoes the concept of 'inner cities investing' developed by Michael Porter [1995]. Porter stresses the fact that social initiatives did not solve the economic distress of inner cities in the US. A lack of connection with the surrounding economy, businesses of sub-scale dimension and the failure to exploit competitive advantages have, according to Porter, ruined past efforts.

The definition of minority-related PEis a moving target, for at least two reasons:

[11] Rubin (2003) differentiates two types of MBE PE financing: minority-focused venture capitalists and community development venture capitalists. Minority-focused venture capitalists invest 'with the objective of both financial returns and the fostering of economic prosperity within such populations . Community development venture capitalists have several investment targets. In addition to investing in businesses owned by ethnic minority and female entrepreneurs, they also invest in firms that are likely to produce high-quality employment for low – and moderate-income people'. In this paper, we focus on the first category, as the second is more closely related to social PE.

[12] The NAIC does not provide a list of the ethnic backgrounds which are eligible.

[13] The NAIC declares that its members collectively manage 10 bn USD, which as to be compared to the 1,500 managed overall by PEFs according to the data provider Preqin.

1. the target of investing in minority-related businesses is to generate returns, unlike in venture philanthropy or social PE. The NAIC, which gathers PE funds investing in minority-related businesses[14], states that its 'member companies invest in privately-held businesses that have a high probability of growth and the ability to generate significant returns for investors and shareholders[15]' [NAIC]. The definition of 'significant returns' is not provided by the NAIC, but we can infer that is not symbolic (venure philanthropy), nor negligible (social PE).

2. investing in minority-owned or minority-related businesses is an additional criteria to filter out the investment universe, as stated by the NAIC. The way the ethnicity (or gender) criteria is actually used is open to debate. In fact, it could be measured essentially through:

i) the actual ownership of the companies financed. This would limit the intervention of PE funds to the role of minority shareholders. The superior governance of PE investors is related to the level of ownership and the alignment of interests between investors and managers. By giving up the ability to actually own the majority of businesses, PE investors would lose one of their major governance levers. Even if promoting minorities to the status of business owners can be a political and social target, it is unlikely that for-profit investing considers this target as a legitimate one (that is, as mandatory to achieving high returns).

ii) the actual leadership of the companies financed. This criteria is probably more in line with the usual PE investing guidelines (that is, aligning the interests of investors and managers, notably through incentives). However, it is more difficult to assess over time. Even if a business is fully managed by minorities at the time of investment, it is possible that through management changes this situation evolves. It can be sub-optimal to choose managers not on their skills, but on the basis of their gender or ethnicity.

Even though there is no mention of the ethnic or gender background of the entrepreneurs of inner cities in his paper, Porter implicitly refers to the ethnic background of its inhabitants. Reference is made when Porter states that entrepreneurs and managers from inner cities can better target local market demands. According to him, inner cities entrepreneurs and

[14] With the exception of Asian businesses.

[15] The NAIC also states that its 'mission is to empower women and minorities to succeed as investment managers, and to encourage wealth creation in underserved markets through private equity investments. […] Since NAIC's inception, its member firms have invested in more than 20,000 ethnically diverse businesses. […] Today, member firms manage more than $10 billion in capital and cover the full spectrum of private equity investment activity, including early stage venture, later stage venture, expansion, buyout, mezzanine, distressed and secondary fund investments.'

managers understand local customers as they share the same specific 'characters[16]' [Porter, 1995].

Based on this competitive advantage, and also because they are 'trend setters[17]', local entrepreneurs and managers can: capitalize on a strategic location to serve adjacent markets and even 'other similar communities' nationally and internationally; congregate in clusters of companies to create economies of scales; integrate in a regional cluster as providers; and capitalize on specific human resources (community-knowledgeable and at a moderate cost). He, therefore, recommends hiring locally, tailoring products and services to local needs, training the staff and increasing loyalty, as well as giving incentives to equity providers through specific tax breaks (deemed to be more effective than direct financing by public authorities).

1.1. Research question

American minority business enterprises (MBEs) have less access to capital than similarly situated white-owned firms [Bates and Bradford, 2008]. The conclusion of Bates and Bradford is that 'if MBEs indeed experience such restricted access to capital, then this market segment is being underserved and attractive returns may be available to funds choosing to specialize in financing this client group' [Bates and Bradford, 2008, p. 490]. The study refers to investor short-sightedness. We tend to disagree.

The strong increase in capital available for PE would have indeed addressed the investment opportunities that these companies represent, should they present the same risk profile as other opportunities. According to data providers Preqin (2010) and Pitchbook (2009) the volume of funds available to be invested by PE investors is estimated at 400 to 500 bn USD. These PE investors permanently look for the best opportunities in a given market. It is unlikely that they would ignore opportunities on the ground despite the cultural, ethnic, gender or social background of the management. If PE investors are targeting mid-market LBO or even non-high tech venture capital opportunities, they will do so regardless of the ethnicity, gender or social origin of the management.

[16] ' Another important quality of the inner city market is its character. Most products and services have been designed for white consumers and businesses. As a result, product configurations, retail concepts, and personal and business services have not been adapted to the needs of inner city customers. […] Inner city consumers, in fact, represent a major growth market of the future, and companies based in the inner city have a unique ability to understand address their needs. For example, Miami-based, Latino-owned CareFlorida has rapidly expanded its HMO business by tailoring its marketing to Latino customers' [Porter, 1995, p. 59].

[17] 'The tastes and sensibilities of inner city communities are cutting-edge in a number of respects and often become mainstream' [Porter, 1995, p. 60]. This somewhat contradicts the previous statement that inner markets are specific and have to be addressed specifically.

Porter's mention of the necessity of a specific incentive for equity providers through tax breaks means that he implicitly assumes that there is:

i) either a lower return for a certain level of risk associated to minority-related investing (that is, investing in local businesses managed by local people who have and thus leverage a local specific 'character'); or

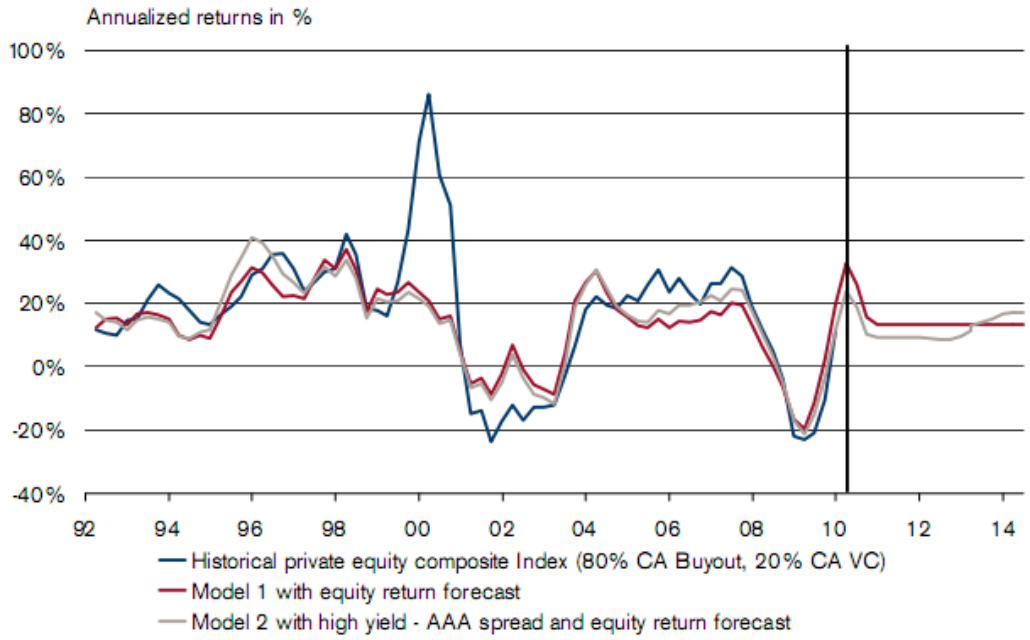
ii) a real or perceived risk associated with inner city investing which is not compensated by additional returns. Hence, the return of inner cities PE investors may not be up to the level of typical PE investors.

The ignorance of 'emerging domestic markets' by PE fund managers may be due to the unusual risk-return profile of the investments in MBEs. PE fund managers have typical expectations: either in a mature market, an average net return of 12.2 percent [JP Morgan, 2007; and Figure 1, Crédit Suisse, 2010], or in an emerging market, a higher risk with a substantially higher return potential (as represented in Figure 2).

If 'domestic emerging markets' were providing a similar profile as these two extreme cases, they would attract capital from PE investors. As the results would have already shown, MBE-related funds would attract capital from LPs who usually rely on the persistence of returns in PE [Kaplan and Schoar, 2005] to allocate their assets going forward.

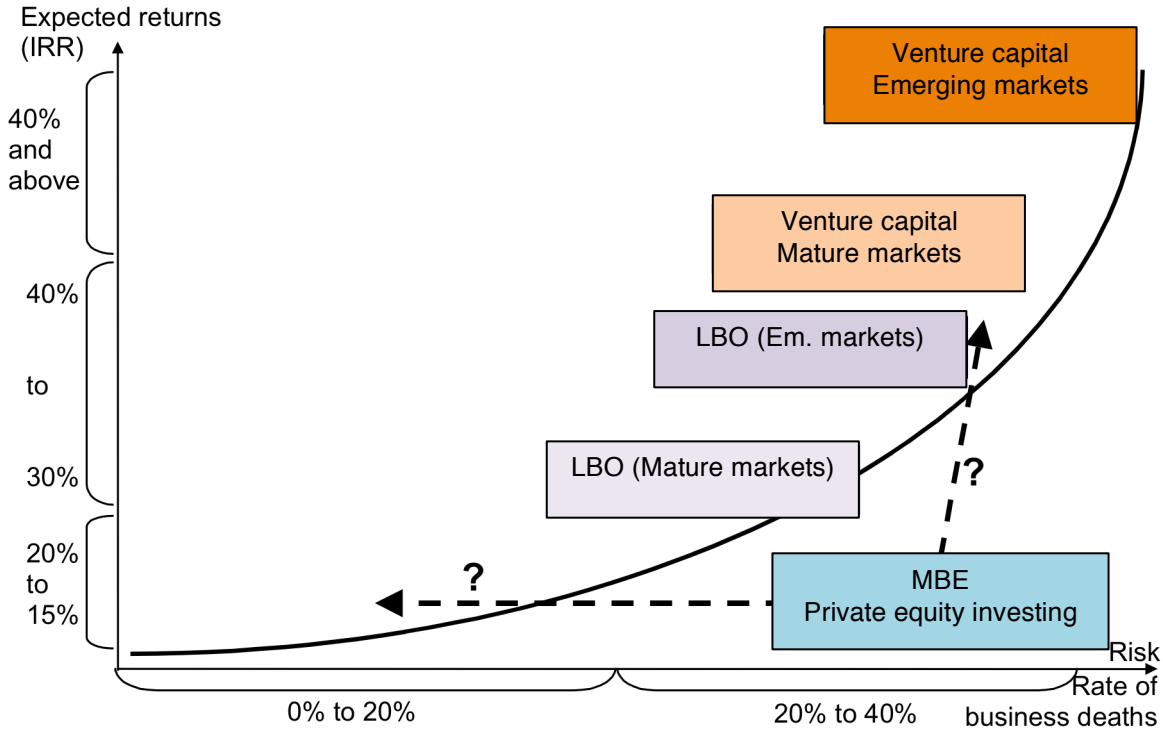
By suggesting tax breaks, Porter assumes that the level of returns of inner-city PE investing is close to the usual returns associated with PE investing (the difference between traditional and minority-related PE being compensated by tax breaks). This remains to be proven. The difference could indeed be rather significant.

Figure 1 – Compared actual and projected annual net performance



Source: Crédit Suisse, 2010.

Figure 2 – Stylised curve of risks and returns profiles



Source: Author.

As a matter of fact, Bates and Bradford report a 17.7 percent internal rate of return (IRR) net of certain fees[18] in the US for NAIC members. Bates and Bradford focus on

[18] The calculation method remains puzzling, as Bates and Bradford explain: 'we adjusted the cash flows for the minority funds to reflect payment of 2 percent of the fund's assets for management fees, plus 20 percent of

'venture capital' MBE investing, even though their definition[19] covers the full PE spectrum[20]. This overall return should be at least comparable, if not superior, to the average net PE returns in the US[21] as shown by Figure 3 over a 20-year period. The 17.7 percent MBE-related PE returns fall short of competing with the 19.9 percent returns for the overall PE sector over 20 years [Table 1], or the 14 percent witnessed in the US by Capital Dynamics [2010] in Figure 4. As an example, the gross IRR of ICV[22]'s investments was 'well above 20 percent', but 'all positive returns realized by ICV' came from investments done out of inner cities, while all inner cities investments were unprofitable.

Table 1 – Average risk and net returns for US LBO, VC and PE (1980-2000)

	Average net IRR (in %) **Return**	**Standard deviation (in %)** **Risk**
Venture Capital	23.17	19.66
LBO	18.21	12.78
Private Equity	19.87	10.63

Source: Thomson Venture Economics, Ibbotson Associates.

Emerging domestic market investment returns fall short of comparing with the overall US PE returns over 20 years. It is also very likely that emerging domestic markets present a higher risk than the usual PE investments sector. Otherwise, emerging domestic markets would have attracted a significant portion of the pool of capital from non-MBE PE, as its average net returns are declining (from 19.9 percent on average in 1980-2000 [Table 2] to a projected mere 12 percent, based on the Crédit Suisse figures [Figure 4]).

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the net cash flow return on investment (carried interest) to the fund's managers'. In fact, the management fees are two percent **per year**, so it should be an adjustment of two percent of the fund's assets per year, over ten years (actually two percent of the fund's size over five years of investment period, and two percent of the fund's portfolio value over the five years of divestment period). Bill Bradford further explains in correspondence that he took '2 percent off the actual IRR, then multiplied that by 80 percent to estimate the IRR for the fund that goes to the limited partners. (…) Of course, these adjustments are only approximations. (…) We only adjusted for these two fees.'

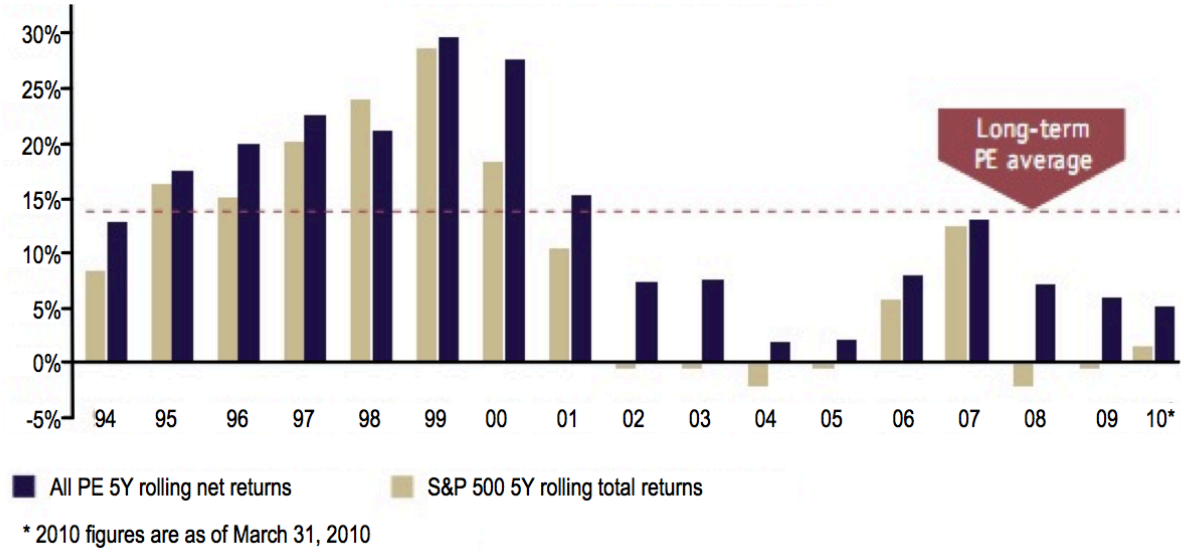
[19] Bates and Bradford describe venture capital as 'intermediaries between investors and entrepreneurs, providing financing to privately held companies typically in the form of equity and/or convertible debt, with an active involvement in the development of the company'. The lack of focus on early and late stage development of businesses means that Bates and Bradford actually refer to the full PE spectrum. The fact that Bates and Bradford have 'surveyed all funds operated by active members of the NAIC' [Bates and Bradford, 2008, p. 491], though excluding debt-focused or social funds, confirms that conclusion.

[20] Early and late stage financing, growth capital, LBO and possibly other sub-segments barring debt-related investments such as mezzanine.

[21] On average, traditional leveraged buy-out investing multiplies the initial equity investment by 2.72 over 3.5 years in Europe. These LBO produce an average internal rate of return of 48 percent. The median IRR is of 33 percent. Half of this performance is due to operational improvements, a third to the leverage effect and 17 percent to a change of valuation multiple increase [Achleitner *et al.* 2010; Acharya, Hahn and Kehoe, 2010; Meerkatt *et al.* 2008]. This means that once the leverage effect is discounted, the IRR of LBO investments is 31 percent, and net of fees, it is of 25 percent [Quiry and Le Fur, 2010]. It has to be noted that even if the three studies are conducted over three different periods and geographical areas (1999-2006 in Europe for Achleitner *et al.* ; 2000-2007 in the UK for Acharya *et al.* ; 1979-2002 worldwide for Meerkatt *et al.*), they reach the same conclusions.

[22] ICV was a fund co-created by Michael Porter with an initial mandate to invest in inner-city ventures, a positioning that was subsequently abandoned.

Figure 3 – US private equity 5-year rolling IRR



Source: Capital Dynamics (2010) based on ThomsonOne and Bloomberg.

This not the case. Pooled together, NAIC members today manage 10 bn USD (the NAIC was created in 1971). As a comparison, PE funds manage 1,500 bn USD worldwide[23] (according to Preqin), of which 60 percent are based in the US. Modern PE emerged in the 1970s [Demaria, 2010], so the evolution of usual PE and MBE PE is comparable, on the same timeline. However, the success of MBE-related PE has been very limited. Some funds even switched from MBE-backing PE to usual PE, as illustrated by ICV [Bates, 2010].

Consequently, if returns are disappointing, it is due to the level of risks. Hence, it is important to ask:

i) what is the risk profile of minority-related private equity funds?

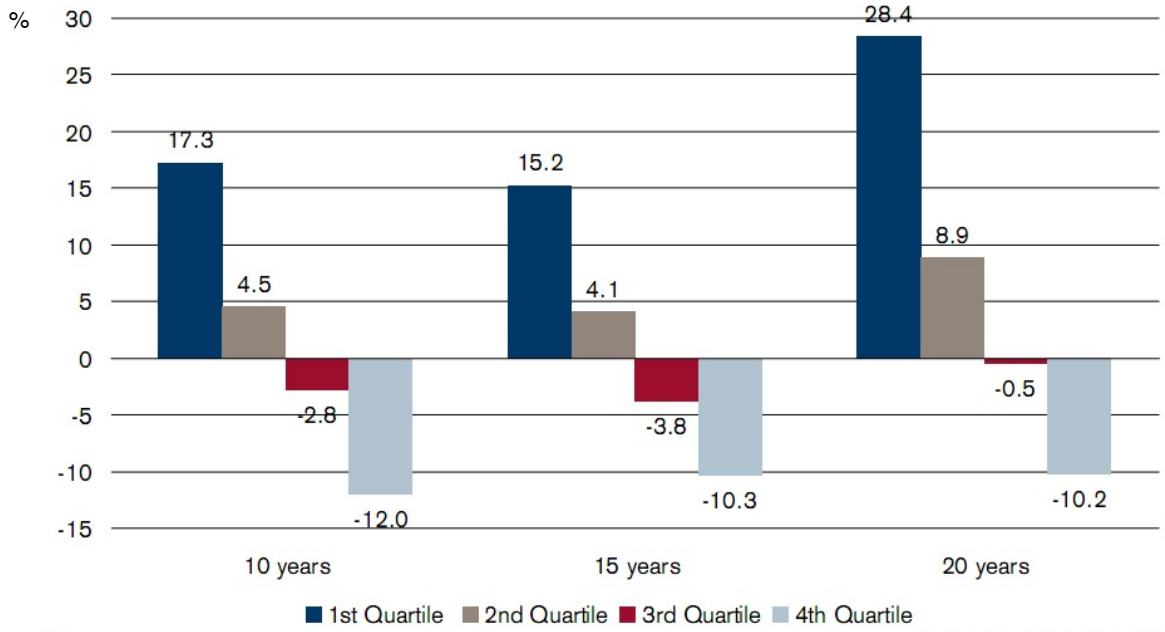
ii) what can explain its lack of success in terms of fund raising from limited partners?

1.2. Method

The dispersion of returns of US LBO and mezzanine PE funds (see Figure 4) hint that only a detailed analysis of the returns of MBE funds could provide a relevant answer. Unfortunately, commercial databases do not provide this information and the NAIC has not answered our request to access its data.

[23] According to D'Angelo [2010], this represents less than five percent of the USD 35 tn of worldwide listed equity market capitalization.

Figure 4 – Annualised net returns of US LBO and mezzanine funds



Source: Thomson VentureXpert, Credit Suisse, IDC (2010).

Consequently, we decided to work with available data. We used the data put forward by Bates and Bradford to compare it with the PE performance data that we gathered. They assumed that the survivor bias should be the same in both instances, though we have no way to verify it. We retrieved data from Thomson ONE Banker (PE section), for venture capital, LBO and all PE for the same period as Bates and Bradford (1989 – 2003). This avoids the bias of short-term performance and of the J-curve impact. The difference in size of the samples is partly compensated by the fact that the performance analysis is based on a long time frame and reflects the overall performance of the PE sector, as well as the MBE-oriented PE sector.

1.3. Results and discussion

An analysis of the data from Bates and Bradford [2008] shows a standard deviation of 21 percent which gives the following Table.

Table 2 – Risk and returns for US LBO, VC, PE and MBE-PE (1989-2003)

	Average net IRR (in %) **Return**	**Standard deviation (in %)** **Risk**
Venture capital (VC US) 1989-2003	17.2	14.1
Leveraged buy-out (LBO US) 1989-2003	9.8	12.7
Private equity (VC + LBO US) 1989-2003	14.2	13.5
MBE-related private equity 1989-2003	**17.7**	**21.1**

Source: Thomson Venture Economics, Bates and Bradford.

Comment: due to a lack of access to the underlying data, we can only indirectly validate the comparison thanks to three series of arguments:

- the purpose of the comparison is to analyse the risk-return profiles over the long term of the four categories. In that respect, 14 years (three business cycles) provide a sufficiently long time-frame to assess the risk-return couples;
- the difference of strategies between the VC, LBO, 'all PE' and 'MBE-related PE' cannot be circumvented as we do not have the details of the strategies adopted in the sample. However, by offering a high (VC) and a low (LBO) risk-return profile to be compared with, this table puts in perspective MBE-related PE. For close average returns (17.2 percent for VC and 17.7 percent for MBE-related, hence exhibiting a 50 basis points difference), the risk profile of the MBE-related strategy is far higher (21.1 percent) than for a usual VC (14.1 percent). The difference is 700 basis points.
- the difference of samples cannot be circumvented, but there is no reason to assume that there is a significant unreported bias in either sample.

The extra risk born by MBE PE investors comes from the additional criteria applied to filter out opportunities from the investment universe. This risk is applicable regardless of the number of opportunities: it is a qualitative approach which is applied in PE. Being an MBE as such does not provide significant extra return as compared to the pool of usual PE opportunities. In fact, the pool of MBE opportunities may even bear a substantially higher statistical risk than the pool of usual PE opportunities:

i) either an opportunity, whether an MBE or not, is a PE-class potential investment (that is, promising a certain level of return for a given level of risk) and hence will be targeted by both MBE PE investors and usual PE investors.

ii) or the opportunity is not a PE-class potential investment, but an MBE, and then could be a target for a MBE-focused PE fund. To qualify as such, the fund manager must have a specific know-how which can unlock a certain potential of the MBE to reach the risk-return profile of a typical PE investment.

iii) or the opportunity does not qualify for any PE investment, whether MBE or not, and should not be targeted by MBE or usual PE investors.

The first case means that there could be competition between MBE-focused and usual PE investors for the best MBE opportunities. To win auctions or compete efficiently for investing in top opportunities, investors need a certain knowledge that may not be among the skill set of MBE-focused investors. In that case, it would mean that usual PE investors are 'cherry picking' the top MBE opportunities[24], leaving

[24] Indeed, ICV tried to apply this strategy and did not even succeed, as explained by Bates [2010]: 'none of the six companies ICV had chosen to invest in between late September 2001 and early 2004 was predominantly

MBE-focused with opportunities which would normally not be eligible to PE investments. In that sense, the 'underserved niche' of MBEs [Bates and Bradford, 2008] is not really one, as it would not be financed in an open market.

This scenario would argue that there is an anti-selection for MBE-focused PE investors where they collect the opportunities that would not be financed in an open market, likely with a higher risk and probably with more resources and time needed to mitigate this risk and generate returns. The fact that MBE-focused funds have substantially smaller sizes (median size of under 30 million USD [Bates and Bradford, 2008]) than usual PE funds means that these resources may be insufficient to deal with the challenge.

Our definition of minority-related investing is hence: 'investing in equity and quasi-equity in non-listed companies ***managed significantly or in majority by underprivileged populations*** in order to generate ***positive*** risk-adjusted financial returns ***as well as other returns*** over a specific period of time'.

This definition emphasizes:

1. 'Investing in equity and quasi-equity in non listed companies': we suggest covering the full PE spectrum and not limiting the definition to venture capital. Not only entrepreneurs, but also managers of businesses, are discriminated against while trying to raise equity for their companies. The fact that they have trouble raising equity means that they also have a significantly lower access to debt [Bates and Bradford, 2008]. Being able to raise equity signals to debt-providers that the business has been evaluated and judged to be investment-grade by PE investors[25]. This should apply at every stage of the development of a company.

2. 'Managed significantly or in majority by underprivileged populations': this deliberately bars any distinction based on ethnicity (non-Caucasian), gender (female) or social status (poor or marginalized social categories) of a given national population[26]. Underprivileged refers not only to a given social status, but

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minority owned, several were inner-city businesses. Half of the ICV portfolio firms clearly exemplified profit-oriented ventures actively utilizing Porter's competitive advantages of the inner city, although they most often targeted national markets rather than serving an inner-city customer base. The other companies ICV invested in neither exploited inner-city competitive advantages nor targeted clients who were residents of those communities. […] Yet, the financial returns generated by ICV's equity investments in inner-city companies lagged far behind the returns earned on its other investments. A comparison of returns from ICV's investments in ventures utilizing inner-city competitive advantages versus its other investments revealed that the former were unprofitable through the end of 2006; all positive returns realized by ICV came from the latter. ICV's success was generated entirely by its investments in companies other than inner-city ventures. […] In light of [its] investing experience […] its decision to abandon its previous focus on investing in inner-city companies was not surprising' (pp. 355-356).

[25] An example is given by the description of ICV's support to its portfolio companies by Bates [2010] 'in hiring key executives, arranging debt financing, planning marketing strategy, enhancing information technology systems and occasionally engaging in actual day-to-day management decision making' (p. 355).

[26] Hence avoiding arbitrary choices, such as focusing on 'persons other than non-Hispanic whites, and includes people of black, Asian and Hispanic origin' [Bates and Bradford, 2008], whereas 'despite the proliferation of

also to education, social and cultural capital, as well as abilities (physical or mental handicap for example). Underprivileged populations fit with Porter's argument of the value as examples of community-based initiatives, as well as their ability to understand and serve specific market needs.

This segment of definition nevertheless presents the advantage of:

i) avoiding considerations related to ethnicity, gender or social mixes at the helm of a company[27];
ii) recognizing that equity access discrimination is not necessarily operated on a purely geographical base;
iii) recognizing that white, male, underprivileged populations should be granted an access to a equity provision as much as other categories;
iv) and finally, acknowledging that inner cities are not homogeneous on an ethnicl, gender or social basis.

The concept of 'underprivileged populations' presents the advantage of taking into account the fact that certain minorities are actually financed (notably by the diasporas not only abroad [Terrazas, 2010], but also locally), while some white populations are not financed at all. This categorization does not necessarily refer to the population of the group considered, but to the stigmas attached to belonging to a specific group or category[28].

'Underprivileged populations' also refer to a relative scale: a given population can be underprivileged in a certain geographical area while it could be considered as mid-class in another. That does not prevent this given population from being excluded from the debt and equity financing circuits in that specific area. This concept can also be applied out of the USA, notably in European countries where it is illegal to record the ethnicity/gender/origin of individuals.

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specialty fund strategies, funds which focus on gender and ethnic-specific entrepreneurs and markets have remained relatively undercapitalised in the universe of institutional capital. For example, 40 percent of all small businesses are women-owned, yet less than 10 percent of early-stage venture funding, and 1 percent of total private equity funding goes directly to companies run by women' [Alphonse, Hellmann and Wei, 1999].

[27] For example, in the case of managers who are of mixed origins.

[28] For an example, see Reddy (B.), 'I don't want to be a diversity candidate', TechCrunch. The CEO of MyLikes explains : 'When we were raising our angel round, I had a phone conversation with a prominent Silicon Valley investor who did not have time to meet me face-to-face but was interested in investing in MyLikes because I was a female entrepreneur—aka the "diversity candidate. […] I felt insulted and unhappy. I felt that I was competent enough to raise money and build a successful business regardless of my gender, not because of it. In all fairness, this angel and many other supporters of women in technology have good intentions. However, they don't realize that by calling out someone's gender they make the system less meritocratic. […] We are still far from that perfect world. Women tend to get paid less than men even if they perform equally well and there is no denying that there are still many biases against women even in professions that they are likely to be better at. While I do think we should do what we can to foster gender equality, I don't believe preferential treatment or having diversity quotas is the answer. […] Worst of all it does a real disservice to the women who are simply better at their jobs.'

This distinction is of importance when considering what makes a group a minority or not. Some geographical areas in the USA actually have a majority Hispanic population. De facto, non-Hispanic whites are a minority in these areas. Moreover, being Hispanic does not necessarily imply poverty. It is true for other minorities as well.

3. 'In order to generate positive risk-adjusted financial returns': the target is to emphasize the return generation, away from social PE. The know-how of the investor is to be able to identify those promising entrepreneurs and managers, provide them with equity and behave as an active investor offering specific support as needed.

As getting access to financing relies on the aptitude of an entrepreneur/manager to build a trust relationship with the debt/equity provider, cultural aspects are paramount as they relate to mutual understandings. This is probably where the due diligence operated by a PE investor can be a determining success factor.

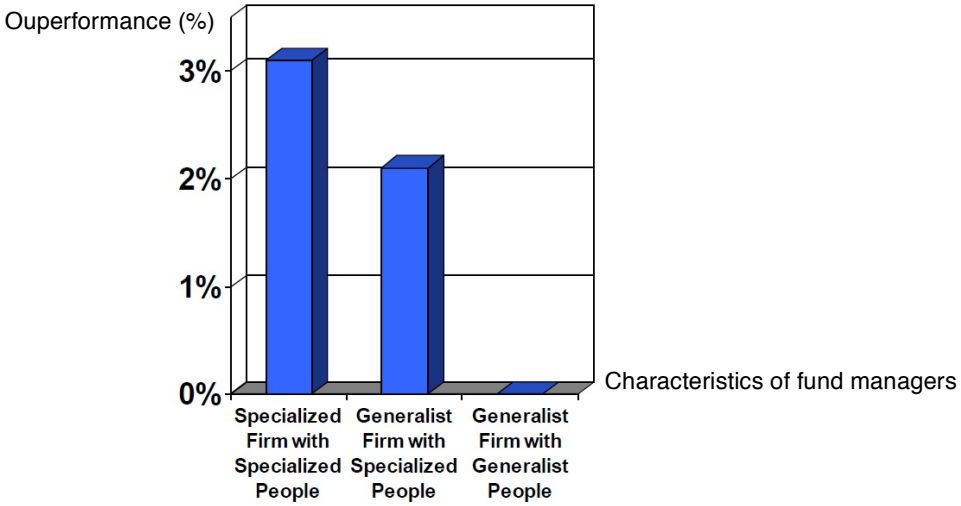
In fact, the performance of companies is related to strong corporate governance and the alignment of interests as determined by investors. Fund managers tend to outperform [Acharya, Hahn and Kehoe, 2010; Meerkatt *et al.* 2008; Quiry and Le Fur, 2010] when:

i) the fund managers are specialized in a certain number of economic sectors that they know very well, hence transforming them into industry experts. According to Bates and Bradford [2008], this is not the case for MBE PE investors as 'portfolios reveal equity investments in a diverse range of industries'. This is confirmed by Alphonse, Hellmann and Wei [1999][29] and Gompers, Kovner and Lerner [2010] (see Figure 5);

ii) the fund managers are focused, hence reducing their learning curve and increasing their competitive advantage. Again, this is not systematically the case for MBE PE investors. Indeed, successful MBE investors make investments 'well above the sector's average' [Bates and Bradford, 2008];

[29] who state that 'minority-oriented venture funds often lacked an industry or functional specialization because the background of the entrepreneurs defined their investment focus. Consequently, it was more difficult for minority focused funds to establish a competitive position in any particular area of expertise and in turn, provide that aspect of added value to prospective entrepreneurs' (p. 12).

Figure 5 – Specialist firms are more likely to have successful deals



Source: Gompers, Kovner and Lerner, 2010.

iii) the fund managers have an edge for detecting attractive opportunities and negotiating them rapidly and at favourable terms.

The label of MBE-focused PE investor may not provide any reputational edge but rather could be an anti-selection factor, as there could be a stigma attached with the idea of being financed by MBE PE investors[30]. Just as benefiting from affirmative action programs in the US can be seen as a stigma (up to the point that sometimes being potentially eligible for such programs is seen already as negative), it is possible that the best opportunities, in fact, deliberately choose to avoid MBE-focused investors.

It could also mean that MBE-focused PE investors could be excluded from investors syndicates (hence pushing MBE-focused PE investors to co-invest with each other but not with the rest of the industry). Such concentration reduces the risk diversification of a given portfolio through syndications. It also means that should a portfolio company need additional capital and the MBE-focused investors have allocated the maximum equity they could, the company could simply not raise additional capital[31].

[30] Indeed, Alphonse, Hellmann and Wei [1999] note that one of the reasons 'minority investment companies [PEFs investing in MBEs] encountered problems raising capital was the perception that these funds were less profit-oriented and were actually more focused on "social investing"' (p. 14).

[31] This case is not theoretical. Small firms raise capital in multiple successive rounds. MBE-focused PE investors 'commonly buy into firms that are small and young' in 'a diverse range of industries unlike the broader VC industry, which heavily concentrates its investments in several high-tech fields' [Bates and Bradford, 2008]. This means that besides the MBE criteria attached to a given investment opportunity, the sector of activity itself may disqualify it to be a target for a mainstream PE investor (such as trade and services, see Bates and Bradford, 2008]).

The reputation effect on a business of its equity investor's name and nature is crucial. Reputation is so important that in the past, entrepreneurs have accepted a discount on the valuation of their companies, as high as 30 percent, so as to attract specific investors [Hsu, 2004];

iv) the fund managers have a real competence in operational improvements of portfolio companies (including being hands-on in the company itself). According to Bates and Bradford [2008], the most successful MBE investors take 'a highly active role in the affairs of their portfolio companies'.

This confirms that the rules of success that apply to usual PE investors also apply to MBE PE investors. However, they might not be sufficient to transform MBE investment opportunities in successes. A few possible ideas can be put forward:

0. Being a local investor without adding a stigma to the financed company is probably a necessary step to the success of MBE financing. Being local is essential for alleviating the asymmetries of information (notably while buying and selling businesses) [Gompers and Xuan, 2008], while a strong connection with the usual PE community is necessary for achieving a high performance. Actually, as soon as MBE-investing proves to be successful, other usual PE investors will invest in the cluster[32]. A branding and communication effort will be necessary to build bridges between the MBE-investing PE community and the usual PE community. Designing a way to work together will also be necessary, notably by attributing different tasks to the members of the financing syndicates.

   MBE-related PE investors may provide better monitoring and soft information as they are local investors, while usual PE investors will request high-powered contracts as geographic distance increases [Chen *et al.,* 2009]. Usual PE investors will provide an industry expertise; while MBE-related investors provide cultural, linguistic and social expertise[33]. This knowledge is necessary as 'underserved communities [are not] interchangeable [as] they differ in important ways in the nature and causes of their capital constraints' [Rubin, 2010].

1. Building a critical mass of funds to be focused will be necessary to MBE financing. This means that fund managers will have to merge and pool higher amounts of capital. The current size of MBE PE funds (see Bates and Bradford [2008]) is insufficient to amortize the high level of fixed costs (which are included in the management fees paid by the fund to the general partner).

[32] 'One of the most important determinants of the number of VC offices in a region is the success rate for all previous VC investments in that region [and] much of the VC outperformance in these venture capital centres arises from their non-local investments. ' [Chen, Gompers, Kovner, Lerner, 2009].

[33] Diverting from this mission, notably under the pressure of investors to go mainstream, means that MBE PE have shown lower returns [Bates and Bradford, 2009].

2. By being a bridge between the MBE-world and the usual PE world, MBE PE investors will be able to have an edge which is missing today to support underserved segments of the PE market. It also means that they need to analyse the reasons for past failures and then build a strategy to reduce risks and improve their risk-return profile. The fact that MBE are '36 percent more likely to go out of business than similar firms located in White neighbourhoods selling to White clients' [Bates, 2010] means that a specific strategy has to be set up. It should target, at the very least, three main areas: intensive executive and management trainings, specific hiring and advisory techniques, outsourcing patterns and industrial and commercial partnerships.

Certain successful PE investors, such as The Blackstone Group in LBO, Catterton Partners in growth capital and LBO, or Sequoia in venture capital, have developed specific business models to support their portfolio companies. Such strategies can include the setting up of industrial partnerships (Cisco for Sequoia in past funds, for example), the setting up of a purchasing and service business unit for portfolio companies (Blackstone), or the setting up of industry workshops, industry events and partnerships (Catterton Partners).

MBE PE investors have to design their own specific strategies to answer the particular needs of underprivileged entrepreneurs, by targeting their lack of training, of cultural capital, of social capital and any other need that may arise. Robb, Fairlie and Robinson [2009] mention notably credit scoring as being a high hurdle to the success of black business along with lower level of initial capital, once results are controlled for credit quality, human capital and firm characteristics. This is probably a higher effort than the support provided by usual PE investors. As this is not a standard support, MBE PE firms will have to shoulder higher costs, which is a problem as the size of their funds is small, which means that the ratio fee per dollar invested is high compared to the PE industry standards. This is probably where a specific compensation mechanism (for example a social impact bond) could kick in.

1.4. Conclusion and further discussions

The risk-return profile of US MBE PE still has to convince institutions to increase their capital allocation to MBE investing[34]. Current data suggest that applying typical PE methods to MBE investing is insufficient to mitigate the specific risks associated to this activity. To reduce risks, MBE PE firms have to undertake significant actions that their resources may not be able to match. Past experiences through the Minority Enterprise Small Business Investment Corporation (MESBIC [Bates 2010]) or public

[34] Institutional investors, such as public pension funds, invest in MBE PE 'seeking to fund only those […] likely to generate high returns. Although they attempt to pick the winners, […] they have failed to do so. The influence of public pension funds upon [MBE PE] is nonetheless real, skewing away from traditional practices and toward those of the […] mainstream' [Bates and Bradford, 2009].

initiatives [Porter, 1995] prove that direct involvement of public authorities on the field or as investors in MBE PE funds is counter-productive.

However, setting up a mechanism that compensates the effort of MBE investors for the production of positive externalities could make sense. Indeed, whether a venture was successful or not, training the management of an MBE, increasing the social capital of this management by building ties between communities, and improving its cultural capital by setting up specific advisory and services deliver value to the public.

1.4.1. Anecdotal confirmation of the conclusions

Since the publication of this Chapter as a paper, two empirical elements have comforted the conclusions that MBE PE alone is not financially viable:

i) on November 30, 2011[35], Parish Capital, the main fund of funds manager dedicated to the MBE-related PE sector[36] with USD 2 bn under management, 'after consideration of a number of strategic opportunities', was acquired by StepStone. In the announcement, no mention of the US EDM is made, StepStone willing to reorient the use of the Parish resources to 'grow its investment capabilities in the European market, and particularly small European funds'. Indeed, David Jeffrey is the Head of StepStone's European business and focuses on distressed investments, infrastructure and co-investments; while the two other founders (Charles Merritt and James Mason) left the firm.

ii) CalPERS stated publicly in October, 2012 via a letter of Joe Dear[37], its Chief Investment Officer that though 'CalPERS retained an "unwavering continued commitment to emerging and diverse investment manager strategies", he bemoaned the performance of CaPERS's emerging managers generally. "CalPERS"s emerging managers have underperformed their respective asset classes in almost all circumstances." […] since inception, private equity emerging managers returned an average of 7.0 percent, compared with 11.0 percent overall. "At the end of the day, what matters most is the risk adjusted return", Dear wrote.' This came out as CalPERS reduced its commitment to emerging managers from USD 475 and 500 mn per program (Capital Link Funds I and II) to USD 100 mn (Capital Link Funds III), and announced that it was phasing out its USD 1 bn California Initiative program[38] dedicated to invest

[35] http://www.businesswire.com/news/home/20111130005435/en/StepStone-Group-Acquires-Parish-Capital, (last accessed: 19/8/2013).

[36] http://www.pehub.com/2011/11/29/parish-capital-hands-keys-to-stepstone/ (last accessed: 19/8/2013).

[37] http://www.pehub.com/2012/10/04/calpers-says-it-still-supports-emerging-managers/ (last accessed: 19/8/2013).

[38] http://www.gsif.com/pdf/calpers-initiative.pdf (last accessed: 19/8/2013): the program 'seeks to have a meaningful impact on the economic infrastructure of California's underserved markets by: providing capital

in California's disadvantaged areas[39], which 'has not met CalPERS investment return expectations'. Hence, one of the major LPs invested in MBE-backed funds (USD 3 bn out of the 9.7 bn allocated to about 300 emerging managers) has voted with its feet.

1.4.2. Empirical confrontation of the conclusions, and rebuttal

Two studies by the NAIC/KPMG [2012] and Jackson and Bates [2013] confront our conclusions. According to the NAIC/KPMG [2012], over 1998-2011 (hence, a different period than Bates and Bradford [2008]), NAIC funds outperformed 'all US PE' and US LBO funds (though 14 percent of the funds are in VC, 22 percent in growth and 7 percent in special situations investing, these are not benchmarked separately and as such).

A few elements tend to invalidate the results of this study. First, it covers mostly unrealised funds (some of them being too young to be representative), that is to say, PEFs still active. This means that their current value is subject to caution as it relies on NAVs which are calculated by GPs, based not only on different assumptions, but also on different methods. Notably, the fact that VC funds use the historical cost/prudent valuation, while LBO and growth funds use the fair market value might introduce a significant difference in the assessment on the remaining value of the portfolios. As there is no indication of their use of valuation methods, there is a risk of significant bias in the considered data.

Second, the NAIC uses capital weighted indicators, which are rather misleading, notably as the sample is small (14 GPs[40] and 26 funds). If it is split between a few big players with large funds (due to a good track record) and numerous small players recently created[41], then the capital weighted comparison might, in fact, favour the first category while not being representative of the overall behaviour of the market segment. This bias does not necessarily affect the benchmark (Thomson Reuter's performance report) in the same way and in the same proportion.

Third, it is peculiar that the NAIC does not include the pre-1998 funds, notably as the institution was established in 1971. The reason might be that the GPs did not survive over time, due to a lack of attractiveness of their track record – hence eliminating an important factor of performance analysis from the results. This tends to be confirmed by NAIC's statement that the majority of the firms were launched between 2003 and 2010. Hence, the EDM sector might be confronted by a high level of GP mortality.

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to areas that have historically had limited access to institutional equity capital; employing workers who reside in economically disadvantaged areas; supporting women and minority entrepreneurs and managers'.

[39] http://www.pionline.com/article/20120807/DAILYREG/120809910 (last accessed: 19/8/2013).

[40] 82 percent of the NAIC members.

[41] which tends to be confirmed by the report which states that 'NAIC AUM ranged from USD 100 million to USD 2.5 billion with a median AUM of USD 330 million' and an average of USD 156.3 mn. The average number of funds raised by NAIC firms is 2.4, 60 percent having raised one or two funds).

Fourth, the performances reported by the NAIC might be misleading. In particular, the NAIC used the 2011 audited year end performances of the financial statements of GPs. These might not be net of all fees, or even be gross of carried interest. Therefore, the results would not be comparable with Thomson Reuters's database which only reports 'net to LP' figures.

There is no indication of dispersion of returns, nor of the risk profile of these funds. Unfortunately, the report does not provide any access of the breakdown of figures, and our request for information has remained unanswered.

The NAIC/KPMG study states that 70 percent of the capital came from funds of funds (36 percent) and pension plans (34 percent), hence Parish Capital and CalPERS (either directly or through programs managed by Citadel Capital Partners and Hamilton Lane).

Jackson and Bates [2013, p. 3] confirm the 'substantial decline in the average returns generated by the minority-oriented VC funds in recent years', contradicting the NAIC/KPMG study[42]. Their definition of 'venture capital' is not provided in their study but seems to be constant with previous definitions from Bates[43] (that is, 'intermediaries between investors and entrepreneurs, providing financing to privately held companies typically in the form of equity and/or convertible debt, with an active involvement in the development of the company'). As previously stated, the lack of focus on early and late stage development of businesses means that Jackson and Bates actually refer to the full PE spectrum. As a result, it is **PE** that is covered by Jackson and Bates on the MBE financing side. However**, they compare MBE PE with traditional venture capital** (the emphasis on the high tech sectors and the 1999-2000 bubble, without any mention of the LBO excesses of 2006-2010, tends to confirm this interpretation). 24 GPs (called 'funds' by Jackson and Bradford) answered their surveys in 2001, 2004 and 2007 (out of an universe of 41 MBE-focused GPs). Data details are not provided.

When describing the approach of PE financing MBEs, Jackson and Bates state that (i) they syndicate widely their investments (notably because of a lack of capital to invest alone); (ii) they actively participate in the affairs of their portfolio companies; and (iii) instead of focusing on a single industry, they diversify their sectors of investment.

Though the first two elements point to a strong similarity with traditional PE, the third is actually contradictory with the specialization of mainstream VC GPs sector-wise

[42] The study also acknowledges our critique of Footnote 12.

[43] see Footnote 13, and page 10 of the study: 'surveyed funds […] are therefore profit-oriented funds actively investing equity capital in small businesses, the majority of which are minority business entreprises'.

and with mainstream LBO GPs target size-wise. This generalization might limit the expertise of the GP and its aptitude to provide a higher contribution to the success of its portfolio companies, as its network is less dense and its expertise more diffuse. This is implictly what Jackson and Bates investigate in their study, as they try to identify the elements predicting high returns for MBE-focused PE. Their conclusions are that high IRRs (with all the limitations associated with this performance measure, see Chapter 2; and comparing PE at large with only traditional VC) depend on investing in MBEs (as opposed to white-owned businesses), being an active investor, and investing in a large number of companies (which is a function of the fund size, and of its resources[44]). Low IRRs and declining returns are associated, according to the authors, with 'mirroring mainstream investing practices' and notably:

i) investing in white-owned businesses. This is, according to the authors, under the pressure of institutional investors (namely funds of funds and public pension funds) which 'prefer to provide investment capital to minority-oriented [PE] funds that emulate mainstream VC industry investing practices'.

ii) 'being an older [PE] fund'. The authors state that the newer PE funds are run by GPs with a better work experience 'in investment banking' as opposed to GPs of older funds who 'rarely possessed such mainstream work experience' (this, once again, confirms that they refer to MBE growth/LBO investments as investment banking experience is only relevant in this segment of the PE universe). More specifically, Jackson and Bates state (p. 22) that the 'old generation' of NAIC GPs focused first on the minority-owned business aspect, and then on potential profits. The 'new generation' of NAIC GPs focuses first on profit generation, and then on the minority-owned factor;

iii) participating in syndicated investments. Syndication is reserved for the 'less promising deals' according to the authors;

iv) investing at the top of the cycle (1999-2000);

v) investing in high-tech companies (this confirms that they compare MBE PE with traditional mainstream VC as this was the main investment area of the 1999-2000 top of the cycle).

This study is unfortunately flawed in its definitions and hence the resulting comparisons are inconclusive. However, two insights are worth noting. The first one

[44] Jackson and Bates state (p. 18) that 'several of the minority VC funds under consideration are very small by industry standards, possessing less than USD 10 million in total assets. These small funds often have to struggle with a lack of depth in managerial resources.'

is that Jackson and Bates confirm that MBE PE is witnessing declining returns, and this despite the fact that the new generation of GPs is better at investing than the previous one (according to them). The second is that GPs with a more adequate training deliver better results. Though investment banking training for GPs are actually pushing MBE PE FPs closer to the traditional mainstream PE GPs, the acknowledgement that the relationship between GPs and entrepreneurs generates most of the value creation tends to validate our conclusion. If GPs have integrated the best practices from mainstream PE, it remains that MBE have specific input needs and that GPs, as well as MPE entrepreneurs, might benefit from specific input (see section below for an illustration).

1.4.3. Further discussion: investing in underprivileged markets

This paper focused on the US, which means that its conclusions will be relevant for this market. Assessing the validity of the conclusions for other markets would require additional research, notably to understand how cultural differences might affect the findings.

While discussing PE investments in emerging markets, Brooks and Penrice [2009, pp. 208-14] highlight how the non-profit organisation Endeavor focused on solving the limitations of micro-finance in Latin America. Endeavor used venture capital[45] to create jobs on a large scale and to build a middle class in an environment lacking institutional, social and cultural support for entrepreneurship. According to Brooks and Penrice, the creation of a venture capital industry had to be preceded by 'the creation of an entrepreneurial class'. To do so, Endeavor supported 'high impact entrepreneurs' notably for their ability to inspire others to follow through. They also worked on changes in laws, regulations, education and capital markets. Endeavor specifically provided entrepreneurs with management advice, mentoring and also services specifically designed for their local needs (in Latin America, a network of contacts for fund raising at affordable costs and with acceptable terms).

Endeavor did not replace the standard VC investor, but complemented the efforts of the latter – bridging a gap that market forces did not. The difference between Endeavor's "venture catalyst model" in Latin America and the US inner cities lies in the fact that Endeavor did not face any competition in its screening and selection of entrepreneurs in Latin America. Moreover, there is no adverse selection in its process, neither any negative signal attached to be supported by Endeavor for the venture community at large.

[45] Brooks and Penrice mention that as of the end of 2007, 17,000 entrepreneurs were screened, 400 were supported (in 266 companies) and over 86,000 jobs were created in companies generating USD 2.5 bn in revenues. The survival rate of companies after 10 years is 95 percent.

Brooks and Penrice also mention the ability to adapt the venture capital to local conditions as a success factor of TA Associates and Advent International (both founded by Brooks) and subsequently at Endeavor (that he co-chaired and advised). This is done through efforts from "local champions in each new market" to raise money from local business leaders. These business leaders support local entrepreneurs. These local entrepreneurs commit, in case of success, to give a percentage of their profits or revenues back to Endeavor.

1.5. Summary and contribution to the research

The purpose of this Chapter was to confront the explicit targets (financial and social returns) of LPs. MBE PE is one of the few strategies explicitly focusing on financial returns, while at the same time, interested in correcting social imbalances. As a result, it is an interesting field of observation for confronting two potentially conflicting targets, financial returns and social improvements, since both endeavours are declared as MBE PE's main targets.

However, we identified an implicit hierarchy: financial returns prevail over social returns for LPs allocating to MBE PE. The fact that MBE PE is still not part of mainstream PE despite being offered for more than 40 years to LPs[46] is a first clue about the reasoning of LPs and the prevalence of financial returns. These expectations are fuelled by the GPs of MBE PEF. According to the World Economic Forum [WEF, 2013, p. 8], 30 percent of the 176 impact investment funds assessed in April 2013 ***targeted*** a net IRR below 10 percent, 35 percent targeted a net IRR between 11 and 20 percent and 35 percent targeted a net IRR above 20 percent. 70 percent of social impact fund managers hence promise mainstream PE returns to their LPs.

The challenge is not only that these returns *expectations* might fall short of these goals, but that they do not factor in the risk born by investors (Cadogan [2013] estimates that in banking, the minority risk is of 1.96 percent). The lack of attractiveness of MBE PE for mainstream LPs is related to a lack of financial returns compensating the extra risks that LPs bear. The risk-return profile of MBE PE is thus sub-optimal. Cadogan [2013] confirmed this for the minority banking sector. While analysing the risk-return profile of of the different minority groups, he generated the following risk-return curve [Figure 6].

If institutional investors do not invest in this sector, it is not due to short-sightedness: 40 years of experience would have corrected it. The disaffection of LPs towards MBE PE is the proof that their main and essential goal is to generate measurable returns.

[46] Michael Drexler and Abigail Noble estimate that 'impact investing' ('an investment approach intentionally seeking to create both financial return and positive social impact that is actively measured') represents 'less than USD 40 billion of capital committed' out of 'the tens of trillions in global capital' [WEF, 2013, p. 3].

Financial returns are easy to measure, unlike the social returns that MBE PE might generate.

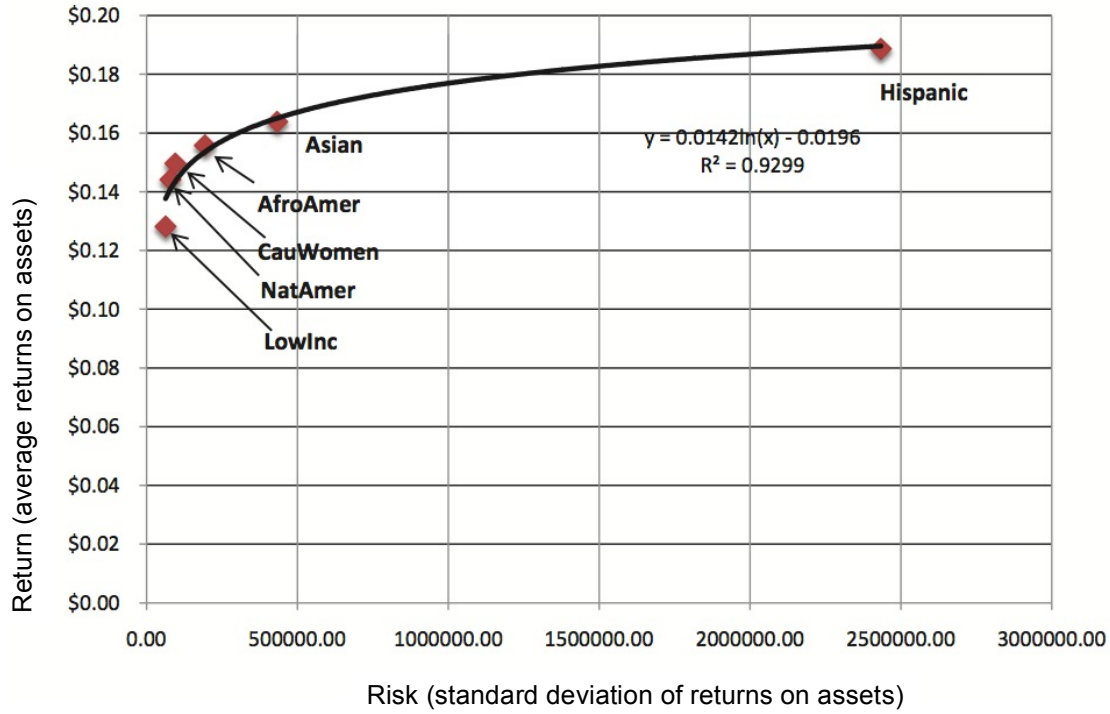
Indeed, social returns are difficult to measure and to capture by LPs. Assuming that they are generated, they become a positive externality of MBE PE investing which benefits the community. The community becomes a 'free rider' of MBE PE as it does not have to support the costs of the action, but nevertheless reaps the benefits.

Porter suggests tax breaks to compensate investors for these costs, though this measure might not be sufficient to compensate for the overall additional risks that investing in MBE entails. In particular, an adverse selection mechanism might be at stake in the case of MBE PE. In that case, MBE-focused PE investors invest in opportunities that would not be financed in an open market, as they represent a higher risk and probably require more time and resources to mitigate this risk so as to generate returns. MBE-focused funds being small, their resources may be insufficient to deal with this challenge.

Part of the solution is to broaden the scope of MBE investing (an argument supported by the findings of Cadogan [2013] summed up in Figure 6 above). Our definition of minority-related investing is: 'investing in equity and quasi-equity in non-listed companies ***managed significantly or in majority by underprivileged populations*** in order to generate ***positive*** risk-adjusted financial returns ***as well as other returns*** over a specific period of time'.

This definition not only broadens the investment opportunities, but also focuses on two aspects of MBE PE: the social returns that have to be compensated; and the extra work entailed by working with underprivileged populations to bring them to a level playing field. Mainstream GPs provide an industry expertise, while MBE GPs provide cultural, linguistic and social expertise. This is probably where a specific compensation mechanism (for example, a social impact bond) could kick in.

Figure 6 – Concave risk-return tradeoff function of minority banks (log scale)



Source: Cadogan, 2013. Note: « AfroAmer » refers to African-American, « CauWomen » refers to Caucasian Women, « NatAmer » refers to Native American, « LowInc » refers to Low Income Americans.

2. Fee levels, performance and alignment of interests[47]

At the core of the success of private equity lies an efficient model of corporate governance driven by the discipline imposed by financial leverage [Jensen, 1991]. This success has been demonstrated by the financial performance of private equity funds over the cours of the last 30 years (see below). However, as the asset class was attracting an increasing number of investors and higher volumes of capital, marginal returns have declined.

In a context of declining returns [Higson and Stucke, 2012; Harris, Jenkinson and Kaplan, 2012], PE fees are under fire[48]. As assets under management of PE funds have increased from USD 10 bn in 1991 to 180 bn in 2000 [Kaplan and Schoar, 2005] and an estimated three tn in 2012[49], the question of the performance measurement of PEF returns is a recurring debate [Gompers and Lerner, 2000a; Kaplan and Schoar, 2005; Gottschalg, Phalippou and Zollo, 2004; Lerner, Schoar and Wongsunwai, 2007; Phalippou and Gottschalg, 2009; Aigner *et al.*, 2008; Higson and Stucke, 2012; Harris, Jenkinson and Kaplan, 2012], fed by the lack of transparency [Higson and Stucke, 2012]. PEFs' performance assessment is a determining stake for PEF fund raising and activity in PE. However, it remains difficult for at least three reasons.

First, data covers, at best, only 30 years of PE activity [Demaria, 2010, Ch. 1 and 2], and is dominated by US figures, which still represent 60 percent of documented investment activity [Table 3].

Second, the actual performance of PEFs is known only once these funds are liquidated, usually after 10 to 12 years of activity. Only data from fully liquidated funds is reliable, but subject to a significant time-lag.

[47] This chapter is to be published in a modified version in the *Journal of Alternative Investments* (forthcoming) and presented at 21st Global Financial Conference in Dubai (April 2014) and the European Financial Management Aassociation (EFMA) 2014 Annual Meetings in Rome (June 2014). It has been amended, reviewed and augmented to reflect additional critiques and discussions, reflected in the current chapter.

[48] For anecdotal evidence, see: Private Equity International, 'LPs slam critical study on management fees', 10/7/2013 (http://www.privateequitymanager.com/Article.aspx?article=73519, last accessed 11/7/2013).

[49] See: 'Private equity assets record USD 3 trillion' (http://www.preqin.com/item/private-equity-assets-hit-record-3-trillion/102/5477, last accessed 18/4/2013).

Table 3 – Repartition of investments

Company location by region	Nb. of investments	Fraction of investments (%)	Nb. of Companies	Fraction of companies (%)	Sum of Equity Invested (USD Mn)	Fraction of equity invested (%)
Americas	42 663	59.58	21 213	51.01	616 164	60.98
Europe	18 659	26.06	12 764	30.69	231 017	22.86
Asia	8 657	12.09	6 483	15.59	140 900	13.95
Pacific	1 241	1.73	773	1.86	17 934	1.77
Africa	383	0.53	354	0.85	4 381	0.43
TOTAL	71 603	100.00	41 587	100.00	1 010 398	100.00

This table sums up all PE investments (excluding real estate) done between 1 January 2005 and 31 December 2010, as reported by Thomson ONE Banker[50]. All monetary numbers are in nominal U.S. dollars.

This time-lag is problematic because of three phenomena:

i) PEFs returns are subject to 'waves' [for US LBO: Higson and Stucke, 2012; for US VC: Robinson and Sensoy, 2011]: an increase in capital raised leads to an increase in investments volumes and in company valuations, which then leads to a decrease of returns [Higson and Stucke, 2012; Harris, Jenkinson and Kaplan, 2012], which leads to a contraction of the sector and a reverse movement of the increase in returns.

ii) PEFs performances exhibit a strong volatility within a given vintage year (VY) and from one VY to the other [Kaplan and Schoar, 2005]. According to Higson and Stucke [2012], more than 60 percent of PEFs returns exceed the S&P 500's.

Third, there is a persistence of returns in PE: fund managers outperforming their peers with a given fund are likely to outperform with the next one(s) [Kaplan and Schoar, 2005]. The individual composition of top PEF managers is the source of the performance [Ewens and Rhodes-Kropf, 2013]. The retirement of successful principals heading PEF managers (generational change) could change this persistence of performance[51].

[50] At the time of writing, only figures as of 30 September 2011 are known. In order to deliver complete years, we chose to limit our five-year summary to the period as of 31 December 2010.

[51] As hinted at by Meyer and Mathonet [2005, p. 19]: 'as the [private equity] industry is quite young and associated with certain personalities, its is difficult to build up a brand identity detached from certain individuals. A fund management company [that is a GP] only becomes a brand it it outlives those people associated with it by setting up structures and processes. So far this has been rather a US phenomenon.'

The purpose of this Chapter is to analyze the performance of PEFs based on their reported net and gross (modeled) cash-flows, so that we can identify the aggregated alpha generated by PEF managers and characterize it, in order to clarify the debate on fee levels and identify potential sources of higher alignment of interests.

To do so, we first set an empirical framework, including a literature review (Section 2.1), then present the data and methodology adopted (Section 2.2), demonstrate our results (Section 2.3), and finally conclude with a discussion on the limits of the findings and perspectives for further research (Section 2.4). We will then summarize the findings and put them in perspective (Section 2.5).

2.1. Empirical Framework and Literature

PEFs organization and processes are detailed in Chapter 0.

2.1.1. Private equity returns: measures

2.1.1.1. Absolute measures of performances

To study PE performances, two main sources are available:

i) data from a unique source, usually a single LP [Ljungqvist and Richardson, 2003; Lerner, Schoar and Wongsunwai, 2007; Robinson and Sensoy, 2012] or commingled LP through harmonized databases maintained by their service providers (Cambridge Associates [Table 4] and Burgiss). Data gathered is coherent, as a direct result of the investment monitoring by investors. However, PE returns data depend on the identity of the investors, with such differing characteristics as: legal structure and tax status, regulatory constraints, organization, size, localization (home-investing bias), number of years of experience, know-how, preferences and approach to PE investing [Chapter 0]. For example, as stated by Harris, Jenkinson and Kaplan [2012], 60 percent of the Burgiss LPs are public and corporate pension funds, and 20 percent are endowments and foundations. Ljungqvist and Richardson [2003] note that there is a high percentage of first-time funds in their sample, because the corporate parent of the LP offers services that these funds may purchase (implicitly, placement and/or middle and back office services). Hence, the portfolio of the LP is not built purely with a risk-return approach, which covers only partially the LPs landscape. Ljungqvist and Richardson [2003] conclude that PEFs exhibit excess annual returns of 500 to 800 bps vs. the S&P 500. Higson and Stucke [2012] confirm these findings (based on Cambridge Associates, a fund administrator and consultant for LPs[52]).

[52] Our request to access this data was rejected.

ii) A second panel of studies uses commercial data from providers such as Thomson [Table 4] as well as collecting public information and voluntary disclosure from fund investors, and from mandatory public disclosures (Preqin). These sources provide data on an aggregated basis to preserve the confidentiality of the underlying sources but offer only a partial perspective on PE returns, as there is no mandatory disclosure of performance (except for public pension funds in the US) and not every LP wants to disclose its investments voluntarily. Commercial databases are affected by biases [Higson and Stucke, 2012; Harris, Jenkinson and Kaplan, 2012] as funds sometimes provide incomplete cash-flows. One of the issues is the treatment of funds with no cash flow while still active (presumably the source stopped reporting) and Thomson maintained them on record. IRRs of these funds declined as a result, mechanically lowering the returns [Stucke, 2011]. Consequently, studies using this data conclude that PEFs provide returns below the S&P 500 [Kaplan and Schoar, 2005, Phalippou and Gottschalg, 2009]. Higson and Stucke [2012] state that VYs 1980 to 1993 are reliable[53]. Any remaining bias should be downwards [Harris, Jenkinson and Kaplan, 2012].

Of nine PEF return studies, six identify the outperformance of PEFs [Table 5]. The average PEF return was 12.4 percent between 1969 and 2004 [Hobohm, 2010].

[53] though we have flagged 43 inconsistencies in Thomson's database, further amended by Thomson between August and November 2012.

Table 4 – Net returns of VC, 'private equity' and LBO funds (US and EMEA)

Average and median IRRs, and TVPIs of VC, 'PE' and LBO funds for VYs 1980 to 2010, as reported by CA (as of 30/6/ 2012) and ThomsonONE Banker (as of 31/12/2011).

		US Venture Capital								US LBO							
		Cambridge Associates				Thomson One				Cambridge Associates**				Thomson One			
	Vintage year	Sample	Average IRR (%)	Median IRR (%)	TVPI	Sample	Average IRR (%)	Median IRR (%)	Average TVPI	Sample	Average IRR (%)	Median IRR (%)	TVPI	Sample	Average IRR (%)	Median IRR (%)	Average TVPI
Fully Realized*	1980	-	-	-	-	14	13.34	13.35	2.30	-	-	-	-	-	-	-	-
	1981	9	9.01	7.87	1.76	21	7.81	9.60	1.81	-	-	-	-	-	-	-	-
	1982	11	7.20	7.92	1.79	28	2.63	3.79	1.39	-	-	-	-	-	-	-	-
	1983	28	9.55	8.72	2.01	58	5.37	5.03	1.71	-	-	-	-	-	-	-	-
	1984	32	7.74	6.27	1.76	63	4.99	3.54	1.57	-	-	-	-	7	32.45	18.02	3.61
	1985	26	11.70	12.86	2.69	46	8.19	8.63	2.02	-	-	-	-	8	41.68	29.57	2.76
	1986	30	8.82	9.43	2.90	38	7.19	5.97	1.70	11	12.82	11.13	3.41	10	18.27	14.92	3.21
	1987	34	14.53	15.65	2.72	64	7.55	7.15	2.02	12	13.15	10.82	1.86	24	8.49	9.22	2.02
	1988	26	14.32	11.87	2.50	45	12.16	9.22	2.03	17	14.02	12.30	2.00	16	9.85	10.11	1.78
	1989	37	17.05	13.31	2.59	50	12.68	10.83	2.11	18	20.31	20.51	2.58	25	13.08	12.34	2.15
	1990	17	24.07	21.54	3.15	23	17.11	13.67	2.22	8	15.00	15.06	1.84	10	6.40	9.21	1.48
	1991	16	23.10	17.61	3.06	17	14.58	14.10	2.12	11	31.21	38.85	3.27	5	20.26	20.45	2.74
	1992	23	28.67	20.99	3.13	28	27.63	14.37	3.43	15	26.24	18.63	2.88	14	19.96	18.38	2.12
	1993	37	29.53	18.81	4.13	41	21.89	12.02	2.92	25	18.30	21.74	2.29	20	19.30	16.25	2.02
	1994	42	34.25	26.45	5.40	36	25.92	23.74	3.22	21	13.60	9.68	2.41	25	13.83	11.03	1.51
	1995	36	54.83	38.50	5.98	48	41.09	20.33	3.84	33	16.15	10.91	1.95	25	11.66	10.01	1.59
	1996	41	61.19	40.87	5.01	38	63.31	28.15	4.43	37	9.59	7.94	1.57	25	6.14	0.47	1.28
	1997	71	53.74	9.65	3.11	61	52.55	19.97	2.61	51	5.52	7.45	1.41	40	5.97	2.98	1.21
	1998	82	16.47	(0.45)	1.49	80	25.09	1.65	1.66	54	10.49	9.64	1.42	55	4.91	3.16	1.31
	1999	115	(3.59)	(3.41)	0.95	106	(4.27)	(5.12)	0.87	54	12.18	11.84	1.83	38	3.59	3.33	1.25
	2000	154	(3.00)	(2.40)	1.01	122	(2.74)	(2.66)	0.91	75	12.94	12.38	1.78	51	11.19	10.92	1.63
	2001	53	(1.14)	(0.21)	1.12	60	2.78	1.27	1.17	24	23.86	21.48	2.06	27	13.54	10.65	1.57
Active	2002	34	1.43	1.80	1.01	19	(0.42)	(1.49)	0.96	33	15.82	16.61	1.89	19	13.24	13.64	1.52
	2003	37	(0.45)	0.62	1.32	21	2.71	1.08	1.10	36	15.08	12.91	1.75	17	7.59	10.61	1.62
	2004	66	2.42	0.69	1.43	28	2.37	1.56	1.32	64	11.16	9.97	1.52	21	14.38	10.62	1.54
	2005	61	1.54	2.86	1.20	23	4.90	4.32	1.26	87	8.10	8.48	1.30	33	7.19	6.47	1.26
	2006	76	4.22	5.14	1.25	44	0.25	0.78	1.03	77	9.79	8.29	1.21	35	5.15	3.90	1.15
	2007	61	11.04	7.91	1.36	24	8.09	8.15	1.33	83	8.48	8.97	1.21	37	9.13	7.47	1.25
	2008	54	6.58	5.63	1.25	20	6.87	6.29	1.14	66	10.49	9.79	1.19	29	13.19	12.73	1.26
	2009	19	5.14	10.11	1.32	13	7.14	5.35	1.08	24	10.97	9.59	1.04	10	8.84	1.26	1.12
*****	Fully Real. Av.	43.81	19.91	13.42	2.77	49.40	16.68	9.94	2.18	29.13	15.96	15.02	2.16	23.61	14.48	11.72	1.96
	Active Fds Av.	51.00	3.99	4.35	1.27	24.00	3.99	3.26	1.15	58.75	11.24	10.58	1.39	25.13	9.84	8.34	1.34
	All Funds Av.	45.79	15.52	10.92	2.36	42.63	13.29	8.15	1.91	39.00	14.39	13.54	1.90	24.08	13.05	10.68	1.77

* Vintage years 2000 and 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.
** Cambridge Associates mixes LBO, growth, energy and mezzanine funds in the same benchmark.
*** Source: Worldbank, annual GDP growth rate at market prices, based on local constant (2000) currency.
**** Source: Eurostat, real GDP growth rate (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database - accessed July 12th, 2012).
***** Simple average only

Table 4 (cont.) – Net returns of VC, 'private equity' and LBO funds (US and EMEA)

		EMEA VC				EMEA LBO			
		Thomson One				Thomson One			
	Vintage year	Sample	Average IRR (%)	Median IRR (%)	Average TVPI	Sample	Average IRR (%)	Median IRR (%)	Average TVPI
Fully Realized*	1980	-	-	-	-	-	-	-	-
	1981	3	7.08	6.44	1.84	-	-	-	-
	1982	-	-	-	-	-	-	-	-
	1983	4	9.69	9.61	2.02	-	-	-	-
	1984	6	5.83	7.84	1.68	4	14.69	12.96	2.67
	1985	16	0.94	4.65	1.45	-	-	-	-
	1986	10	7.36	5.68	1.54	5	15.24	9.98	2.19
	1987	8	4.71	3.69	1.41	7	8.55	4.76	1.62
	1988	11	(5.50)	2.98	1.21	15	9.42	10.47	1.49
	1989	20	1.66	4.65	1.75	10	6.76	9.90	1.34
	1990	14	10.78	8.10	2.51	12	7.19	6.46	1.37
	1991	11	2.12	1.97	1.34	15	11.96	10.77	1.62
	1992	6	12.30	15.56	1.91	7	19.95	21.07	2.14
	1993	11	4.78	0.21	1.45	8	21.58	8.75	1.81
	1994	16	6.48	6.67	1.85	14	25.83	23.71	2.03
	1995	13	1.31	(0.11)	1.05	11	22.47	8.78	1.91
	1996	18	25.33	5.27	2.04	18	11.29	9.04	1.52
	1997	35	11.01	2.53	1.60	26	16.04	7.43	1.76
	1998	33	6.72	(0.19)	1.46	25	7.02	6.71	1.45
	1999	57	5.01	(0.70)	1.02	36	12.90	13.12	1.74
	2000	93	(0.58)	(0.62)	0.98	35	17.40	17.53	2.24
	2001	62	(0.13)	(0.82)	1.05	21	17.77	18.85	1.84
Active	2002	34	(2.05)	(2.13)	0.88	23	22.35	13.61	1.87
	2003	41	(0.82)	(3.16)	0.98	19	11.23	6.91	1.52
	2004	45	0.98	(0.65)	1.03	18	14.12	6.08	1.48
	2005	38	(2.04)	(1.38)	1.03	34	2.17	1.99	1.06
	2006	39	0.15	(2.63)	1.12	38	(0.36)	1.54	1.03
	2007	54	(6.08)	(5.72)	0.86	31	(1.70)	(2.25)	1.00
	2008	55	(3.88)	(5.13)	0.95	26	0.36	(2.99)	1.01
	2009	36	(7.62)	(8.22)	0.89	13	6.38	2.35	1.16
*****	Fully Real. Av.	22.35	5.90	4.20	1.57	15.82	14.47	11.78	1.81
	Active Fds Av.	42.75	(2.67)	(3.63)	0.97	25.25	6.82	3.41	1.27
	All Funds Av.	28.18	3.36	1.94	1.39	18.84	12.02	9.10	1.63

Table 4 (cont.) – Net returns of VC, 'private equity' and LBO funds (US and EMEA)

GDP growth rates are provided for USA and EU 15, as well as total market indexes for the US (STOXX US, Wilshire 5000 and Nasdaq Composite), and Europe (STOXX EU, STOXX Tech and STOXX Healthcare combined).

	GDP growth (%)		Indexes						
			USA			Europe			
Vintage year	USA***	EU 15****	STOXX US Total Market Index (TMI)	Wilshire 5000 Total Market Full Cap Index	Nasdaq Composite	STOXX EU Total Market Index (TMI)	STOXX Europe TMI Techno.	STOXX Europe TMI Healthc.	Combined STOXX Europe TMI Tech & HC
1980	(0.3)	-	-	100	100	-	-	-	-
1981	2.5	-	-	136	122	-	-	-	-
1982	(2.0)	-	-	130	116	-	-	-	-
1983	4.5	-	-	152	154	-	-	-	-
1984	7.2	-	-	189	166	-	-	-	-
1985	4.1	-	-	194	172	-	-	-	-
1986	3.4	-	-	259	208	-	-	-	-
1987	3.2	-	-	307	242	-	-	-	-
1988	4.1	-	-	319	213	-	-	-	-
1989	3.6	-	-	361	248	-	-	-	-
1990	1.9	-	-	477	257	-	-	-	-
1991	(0.3)	-	-	437	256	100	-	-	-
1992	3.4	-	-	591	383	100	100	100	100
1993	2.9	-	-	644	431	135	107	102	105
1994	4.1	-	-	715	495	122	144	124	134
1995	2.5	-	-	715	467	138	124	117	121
1996	3.8	3.1	-	985	655	164	149	172	161
1997	4.5	2.5	-	1178	853	229	170	209	189
1998	4.4	1.5	-	1562	1001	274	276	310	293
1999	4.9	2.2	-	1921	1549	355	344	377	360
2000	4.2	2.8	-	2359	2436	338	773	380	576
2001	1.1	1.6	-	2046	1714	279	653	475	564
2002	1.8	2.3	100	1893	1196	200	390	420	405
2003	2.6	0.5	81	1538	817	222	181	303	242
2004	3.5	2.3	100	1960	1277	243	234	327	281
2005	3.1	1.8	109	2190	1275	300	226	334	280
2006	2.7	2.1	116	2388	1426	358	276	427	352
2007	1.9	2.2	131	2723	1523	348	292	444	368
2008	(0.4)	(0.5)	137	2841	1478	197	278	391	335
2009	(3.5)	(1.0)	90	1861	913	249	146	323	235
2010	3.0	2.0	111	2376	1328	271	181	369	275
Av. 1980-2001	3.24	2.28							
Av. 2002-2010	1.63	1.30							
Av. 1980-2010	2.76	1.69							

*** Source: Worldbank, annual GDP growth rate at market prices, based on local constant (2000) currency.

**** Source: Eurostat, real GDP growth rate (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database - accessed July 12th, 2012).

Table 5 – Empirical studies on performances of US LBO funds

	Author(s)	Pub. date	Time period	Data as of	Data source	Benchmarking method	Yearly difference	Out-performance?
1.a	Harris, Jenkinson and Kaplan	2012	1984-2008	31/03/2011	Burgiss	PME Multiple	1.20 to 1.27	Yes
1.b	Harris, Jenkinson and Kaplan	2012	1984-2008	31/03/2011	Burgiss	Long-Nickels methodology	3.70 %	Yes
2.a	Higson and Stucke	2012	1980-2008	30/06/2011	CA	IRR spread	3.90 %	Yes
2.b	Higson and Stucke	2012	1980-1989	30/06/2011	CA	IRR spread	3.70 %	Yes
2.c	Higson and Stucke	2012	1990-1999	30/06/2011	CA	IRR spread	3.00 %	Yes
2.d	Higson and Stucke	2012	2000-2005	30/06/2011	CA	IRR spread	10.00 %	Yes
3	Diller and Wulff	2012	1980-2008	31/03/2011	Thomson	PME Multiple	1.24	Yes
4	Robinson and Sensoy	2011	1980-2007	31/12/2010	Thomson	PME Multiple	1.19	Yes
5	Cornelius	2011	1986-2006	30/09/2009	CA	Median IRR	5.74 %	Yes
6	Phallipou and Gottschalg	2009	1980-1993	31/12/2003	Thomson	IRR spread	-3.0%	No
7	Phallipou, Gottschalg and Zollo	2004	1980-1993	31/12/2003	Thomson	Profitability Index	-3.83 %	No
8	Kaplan and Schoar	2005	1980-1995	31/12/2001	Thomson	PME Multiple	0.98	No
9	Ljungqvist and Richardson	2003	1981-1993	30/09/2002	Thomson	Excess-IRR	5.71 %	Yes

2.1.1.2. Relative measures of performances

In addition to the much-criticized IRR [Kocis *et al.*, 2009, Ch. 7; and Gottschalg, 2012], EDHEC [2010] sums up the three main methods of measuring performance used in the literature:

i) the Index Comparison Method [Kocis *et al.*, 2009, Ch. 11];

ii) the public market equivalent (PME) [Ljungqvist and Richardson, 2003; Kaplan and Schoar, 2005]. The PME method discounts the distributions of a PEF by using the S&P 500 total return as a discount rate. The discounted distributions are summed up, and then divided by the sum of all the discounted capital calls of the fund. This method compares the investments made by a PEF to investments timed equivalently in the public markets. The ratio is the PME, which is the return (theoretically net of fees and carried interest) of the fund relative to that of the S&P 500. A PME greater than one indicates that the PE fund under consideration outperformed the public market and can function as a 'market-adjusted multiple of invested capital' [Harris, Jenkinson and Kaplan, 2012]. Robinson and Sensoy [2012] computed a 'tailored PME' which is

calculated as the regular PME, using different benchmark indexes depending on the type of the fund;

iii) and the PME+ [Rouvinez, 2003], which adjusts distributions by using a scale factor applied to the entirety of the distributions.

As commercial data is anonymous and aggregated, it is not possible to trace which distribution corresponds to which capital call (or not, in the case of management fees). Access to detailed and proprietary data might enable analysts to do just that, but other biases appear (see Section 2.1.1.1.(i)). Consequently, the first two methods can sometimes show that the final value of the equivalent investment in the index is negative while the NAV (that is, the interim valuations of PEFs) of the PEF is still positive [EDHEC, 2010]. NAV calculations are defined by the professional associations in the International PE and Venture Capital Valuation Guidelines (IPEV) that the EVCA co-authored [2012], and the accounting standards such as IFRS (SFAS 157) and US GAAP (FASB 820, IAS 39). The NAV is the residual value of a PEF; related to the total invested capital, it provides a 'residual value to paid-in' (RVPI) ratio, which decreases as investments are realized (and hence are accounted as 'distribution to paid-in' (DPI)). The sum of DPI and RVPI forms the 'total value to paid-in' (TVPI), which is the multiple of the investment of the fund. As NAVs are estimated by GPs themselves, using them to assess PEFs leads to an inflation of 450 basis points per annum [Higson and Stucke, 2012].

We will build on the latter method for our own approach. Though Robinson and Sensoy [2012] also state the PME method does not measure the true risk-adjusted returns to PEFs, we believe that it provides a rather good proxy as we will demonstrate in this research.

2.1.2. Private equity risks assumptions

The probability of total loss of a PEF is one percent, and the probability of a partial loss is 30 percent [Weidig and Mathonet, 2004]. Kaplan and Schoar [2005] and Harris, Jenkinson and Kaplan [2012] do not adjust for differences in systematic risk. Robinson and Sensoy [2012] state that PEFs with higher compensation do not take more systematic risks to earn back their fees. Instead, they find evidence that these fund managers add more value. Ljungqvist and Richardson [2003] state that the return on invested capital from their fund sample falls from 25 percent on average assuming a beta of one with the market to 24 percent when discounting cash-flows at the risk-adjusted cost of capital. We will hence assume a beta of one, as confirmed by Jegadeesh, Kräussl and Pollet [2009] which show that listed PE funds-of-funds have a market beta of one.

2.1.3. Limits of current benchmarking methodologies and indexes chosen

Surprisingly, the pertinence of the S&P 500 as a PE benchmark is barely discussed[54]. This index focuses on large American companies in mature markets[55]. Its relevance for benchmarking European companies as well as growth and VC investments (for which the size of companies and their sectors are defining components) is questionable. It is of limited use for small and mid-caps LBOs[56], in volume and numbers [Table 6].

Using the S&P 600 reduces the outperformance by over 300 bps compared to the S&P 500 [Higson and Stucke, 2012]. The average PME of PEFs measured against the S&P 500, the Russell 3000 and the NASDAQ are respectively 1.20, 1.18 and 1.17, and are lower using the Russell 2000 (1.11) and the Russell 2000 Value (1.07) [Harris, Jenkinson and Kaplan, 2012]. Thirteen hundred basis points (out of 2000) appear or do not appear, depending on the index chosen.

The purpose of benchmarking PE returns with listed indexes is to assess the value created by PEF managers. For that purpose, these indexes have to include all the companies listed. We use an 'all shares index' to differentiate the alpha of PEF managers while aligning the beta of private and public markets, eliminating the biases associated with the S&P 500.

PEF returns are usually reported net of fees. The difference between gross and net returns is due to management fees, the carried interest of the GP, and additional fees and expenses necessary to the functioning of the fund. Thomson does not provide details about the treatment of these flows as it does not receive gross cash-flows. As a result, errors and biases on reporting net cash-flows cannot be assessed by Thomson. If the detail is not provided, it is impossible to separate investment from expenses flows in the overall cash-flows of a fund.

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[54] EDHEC [2010] analyses listed PE indexes and concludes on their irrelevance. They are hence excluded from the reasoning.

[55] According to Standard & Poor's, 'the S&P 500 has been widely regarded as the best single gauge of the large cap U.S. equities market since the index was first published in 1957. […] The index includes 500 leading companies in leading industries of the U.S. economy' (www.standardandpoors.com/indices/sp-500/en/us/?indexId=spusa-500-usduf--p-us-l-- (accessed 12/3/2012)).

[56] According to the European Commission, 'small and medium-sized enterprises (SMEs) are those businesses which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million' (http://www.evca.eu/toolbox/glossary.aspx?id=982, accessed 23/3/2012, entry 'SME'). EVCA [2010, p. 62], defines small, mid, large and mega buy out as follows:

LBO breakdown by deal size	Equity value (€ m)	Transaction value (€ m)
Small	< 15	< 50
Mid-market	15 <= X < 150	50 <= X < 500
Large	150 <= X < 300	500 <= X < 1,000
Mega	>= 300	>= 1,000

Table 6 – Breakdown of LBO investments

This table describes yearly investments done between 1 January 2007 and 31 December 2010, as reported by Thomson ONE (as of 30 September 2011). Monetary numbers are in nominal U.S. dollars.

	2010	%	2009	%	2008	%	2007	%	**Av.**	***Av. (%)***
Americas										
Small LBO										
Nbr of invest.	2 156	*88.58*	1 709	*92.58*	2 631	*90.82*	2 972	*88.56*	**2 358**	***89.94***
Sum deal value[57]	4 589	*2.72*	3 030	*4.86*	5 971	*3.45*	5 059	*0.98*	**4 251**	***1.80***
Medium LBO										
Nbr of invest.	210	*8.63*	115	*6.23*	204	*7.04*	238	*7.09*	**185**	***7.07***
Sum deal value	34 189	*20.25*	17 213	*27.59*	33 311	*19.22*	40 413	*7.81*	**30 636**	***12.97***
Large LBO										
Nbr of invest.	42	*1.73*	14	*0.76*	27	*0.93*	63	*1.88*	**37**	***1.41***
Sum deal value	28 081	*16.64*	8 241	*13.21*	16 582	*9.57*	42 923	*8.29*	**24 562**	***10.40***
Mega LBO										
Nbr of invest.	26	*1.07*	8	*0.43*	35	*1.21*	83	*2.47*	**41**	***1.57***
Sum deal value	101 945	*60.39*	33 904	*54.34*	117 464	*67.77*	429 326	*82.93*	**176 755**	***74.83***
Total										
Nbr of invest.	2 434	*100*	1 846	*100*	2 897	*100*	3 356	*100*	**2 621**	***100***
Sum deal value	168 803	*100*	62 388	*100*	173 329	*100*	517 721	*100*	**236 204**	***100***
Europe										
Small LBO										
Nbr of invest.	1 216	*90.34*	948	*92.04*	1 630	*86.75*	1 843	*86.81*	**1 466**	***88.53***
Sum deal value	4 589	*6.41*	2 294	*10.00*	4 560	*3.49*	4 411	*1.84*	**3 654**	***2.96***
Medium LBO										
Nbr of invest.	92	*6.84*	74	*7.18*	178	*9.47*	170	*8.01*	**130**	***7.86***
Sum deal value	15 142	*21.15*	11 629	*50.71*	32 475	*24.83*	29 761	*12.43*	**23 004**	***18.64***
Large LBO										
Nbr of invest.	23	*1.71*	5	*0.49*	37	*1.97*	50	*2.36*	**30**	***1.82***
Sum deal value	16 142	*22.55*	3 403	*14.84*	24 885	*19.03*	35 986	*15.03*	**20 682**	***16.76***
Mega LBO										
Nbr of invest.	15	*1.11*	3	*0.29*	34	*1.81*	60	*2.83*	**30**	***1.79***
Sum deal value	35 711	*49.89*	5 606	*24.45*	68 878	*52.66*	169 225	*70.69*	**76 068**	***61.64***
Total Europe										
Nbr of invest.	1 346	*100*	1 030	*100*	1 879	*100*	2 123	*100*	**1 656**	***100***
Sum deal value	71 584	*100*	22 932	*100*	130 798	*100*	239 383	*100*	**123 408**	***100***

[57] The total 'sum deal value' is inferior to the total 'sum equity invested' which is technically impossible. According to Thomson, the reason is the following: 'because of undisclosed deal values. […] If only the equity portion is disclosed, the deal value is not populated […]'.

Nor is it possible to differentiate between distributions to investors and to the fund manager. Certain fees[58] (such as transaction fees) or distributions (Board attendance compensations, which can be split between the investors and the fund manager, or can be fully allocated to the investors or to the fund manager) are difficult to estimate. Assuming a certain fee structure, it is possible to approximate gross returns from net returns provided by commercial databases (gross returns are 60 to 80 percent higher than net returns according to Higson and Stucke [2012]).

LPAs[59] are increasingly negotiated between LPs and GPs[60] resulting in a higher diversity of the PEF's terms and conditions [Banal-Estañol and Ippolito, 2012]. Some LPs are offered a choice between a one percent management fee and a 30 percent carried interest, and a classical two percent-20 percent; others maintain a progressive carried interest, or other solutions to lower[61] their marginal cost of investing in PE. To prevent certain biases, it is methodologically more rigorous to work on the gross returns level.

2.2. Data and Methodology

We have extracted the cash-flows of US and European VC and LBO funds over different periods. Data is available on a quarterly basis and aggregated. Our *first step* is to follow the drawdowns and distribution patterns of PEFs to mimic their behavior and to extract the potential alpha generated by PEF managers as compared to market indexes (gross and net). We will then rebuild the impact of management fees, in order to compare data gross of fees for both categories of funds.

2.2.1. Drawdowns

From the data provided, we are unable to differentiate drawdowns for fees from actual investments (only the latter are reported). For each drawdown, we 'buy the index'. PEFs can be invested up to their fund size minus the capital reserved for the payment of management and other fees, or GPs are entitled to reinvest some of the distributions to reach an investment level of 100 percent. We do not have to choose between the two options as we follow the cash outflows related to investments. This assumes an actual use of the capital, which is methodologically correct.

Kaserer and Diller [2004] state that average European PEFs draw down 23 percent of total committed capital in the first year, and 60 percent within the first three years. By year 10, on average, funds are called at 93.6 percent. One of the reasons why the

[58] See Chapter 0 for more elements and debates about fees.
[59] See Chapter 0 for more elements about LPAs.
[60] See for example: D. Primack, 'Random Ramblings', Term Sheet, *Fortune*, 5/6/2012 (http://finance.fortune.cnn.com/category/term-sheet/ - accessed 5/6/2012)
[61] Some fund managers offer co-investment programs to investors: see *Private Equity International*, 'The "trouble" with preferential treatment', The Friday Letter, 3/7/2012 (http://www.privateequityinternational.com/Article.aspx?aID=0&article=68163 - accessed 9/7/2012)

committed capital is not 100 percent called after five years is that capital is called to pay management fees (or to participate in follow-on financings in the case of VC).

2.2.2. Distributions

From the proceeds of liquidity events, funds return the capital and then distribute capital gains (the reinvestment of capital gains is handled by the LPA (see Chapter 0), and usually restricted) to investors. These distributions are largely in the form of cash distributions, though stock distributions can happen (distributions in-kind). Using only cash distributions can lower the outcome of the PEFs considered. As we exclude NAVs from our reasoning, our results are not affected by so-called 'zombie funds' (funds with assets in their portfolio which are kept at a value though the outcome is a sale at a significant or at a full loss).

Unlike Ljungqvist and Richardson, we do not assume a single, full distribution from the index in year ten. As explained by Higson and Stucke [2012], the consequence of the distribution assumptions of Ljungqvist and Richardson are that the spread between the PE funds and their corresponding index investments is very high (570 to 750 basis points). Higson and Stucke re-estimate the performance spread from the Ljungqvist and Richardson model to 210 basis points, in favor of PE, which is in line with the Robinson and Sensoy [2011] findings of a 250 basis points performance spread in favor of LBO funds.

Our *second step* is to work on gross cash-flows. As performances of PEFs are benchmarked with passive indexes, it is logical to compare *gross* PE cash flows with these indexes. Benchmarking net returns of PEFs would require adding the total costs (transaction costs and management fees, such as for exchange traded funds) associated with investing to the evolution of the indexes itself.

We will approach the outcome for GPs through modeling, as we cannot split distributions between refund and profits, nor identify the distributions to the GP (refund of the 1 percent; and catch-up and carried interest, if any), as we are only provided with distributions net to LPs (refund of the 99 percent; then hurdle rate and profits, if any). Surprisingly, studies with one LP as data source do not separate these flows. Ljungqvist and Richardson [2003] state that 'much of the "capital gain" is thus generated from year 7 onwards'. This is not the case empirically: each investment generates its own profits or losses. PEFs distribute cash-flows by stating explicitly which portion corresponds to capital refund and which to profit distribution. Hence, an investment done in year one of a given fund and sold in year four would refund part of the fund and generate a profit or a loss. Funds can book profits even when they are not fully refunded. Studies which do not track the details of distributions underestimate the performance of funds. The same conclusion applies to Metrick and Yasuda [2010] and Robinson and Sensoy [2012], who assume an average five-year

holding period. If this assumption were held to be true, PEFs would not distribute before Year six of their existence. The average reported time to exit for European PE deals is 3.7 years; in the case of an IPO, it is 3.3 years [Schwienbacher, 2005] (time to IPO for US VC-backed companies is three years [Cumming and Johan, 2010]; the median time to exit is 36 months for LBOs in the UK [Jelic, 2011]), and 3.4 years in the case of trade sales [Cumming, 2008]). 2.9 percent of PE investments are exited within the 12 months following the original transaction [Strömberg, 2008], with the percentage increasing to 5.1 percent for LBOs in the UK [Jelic, 2011].

One could argue that proceeds distributed before the assumed five-year holding period are dividends. However, this is very unlikely: VC funds do not distribute dividends nor do LBO and mezzanine funds, as dividends are not tax efficient. The very purpose of LBOs is to actually transform dividends into capital gains. Distributions associated with 'dividend recaps' in the case of an LBO are, in fact, an LBO-bis structured by a GP to make early profit distributions while still holding the portfolio company. This is one of the few cases when a distribution to the fund investors is a partial realization, otherwise distributions are full realizations.

We use distributions as a distinct and separate source of information, and 'sell the index' when PEFs distribute. To avoid under or over-selling the fund, we use the DPI as the indicator of the ratio between the refund and proceeds. We set as a rule that the profit or loss realized by the fund will be pro-rata of each distribution. Though this distribution mechanism does not reflect reality, it is methodologically more relevant than assuming first a refund of the full amount of the committed capital, and then a pure distribution of profits. In actuality, we build a quasi-ETF to benchmark PEFs (net of fees) to determine if there is an alpha generated by PEF managers as compared to the proxy of indexes of listed companies, while accounting for the illiquid nature of PEFs. As we use quarterly cash-flows, our IRR will hence differ from Thomson's.

2.2.3. Data description

From Thomson ONE, we retrieve VC and LBO data for the USA and for Europe, Middle-East and Africa (EMEA)[62]. Cambridge Associates provides data only for the US, and separating VC from 'PE' (that is LBO, mezzanine, energy and growth funds), we will use it as a support. Table 4 (above) sums up sample sizes, average IRRs, median IRRs and average TVPIs. If there are fewer than three funds in the sample, data is not provided. Fully liquidated funds were created prior to 2001.

Over 1981-2001, the simple average IRR for US VC funds is from 16.7 percent (Thomson, 1,087 funds) to 19.9 percent (Cambridge Associates based on 920

[62] Unfortunately, Thomson does not provide the breakdown between Europe and Middle-East and Africa, nor the breakdown of performances within Europe. PE activity in Middle-East and Africa started after 2001 and should not bias our results.

funds). Over the same period, median IRRs are respectively 9.9 percent and 13.4 percent; while average TVPIs are respectively 2.2x and 2.8x. Including more recent vintages to 2009, average IRRs, median IRRs and TVPIs respectively are from 13.3 percent, 8.2 percent and 1.9x (Thomson, 1,279 funds) to 15.5 percent, 10.9 percent and 2.4x (Cambridge Associates, 1,328 funds).

For US LBO / 'PE', the average IRRs, median IRRs and average TVPIs for 1984-2001 are from 14.5 percent, 11.7 percent and 2.0x (Thomson, 425 funds) to 16.0 percent, 15.0 percent and 2.2x (Cambridge Associates, 466 funds). With VYs through 2009, figures are from 13.1 percent, 10.7 percent and 1.8x (Thomson, 626 funds) to 14.4 percent, 13.5 percent and 1.9x (Cambridge, 936 funds).

For EMEA VC funds (1981 and 1983-2001), figures are 5.9 percent, 4.2 percent and 1.6x (Thomson, 447 funds). With VYs through 2009, figures are 3.4 percent, 1.9 percent and 1.4x (789 funds).

For EMEA LBO funds (1984 and 1986-2001), figures are 14.5 percent, 11.8 percent and 1.8x (Thomson, 269 funds). With VYs until 2009 figures are 12.0 percent, 9.1 percent and 1.6x (471 funds).

2.2.4. Selection of indexes

For US LBO funds benchmarking, we have selected the Wilshire 5000 Total Market Full Cap Index. For US VC funds, we have selected the NASDAQ Composite, as it is the closest index to the sectors funded (information technologies and life sciences, and more recently environmental technologies). For European LBO, we have selected the STOXX EU Total Market Index (TMI). For European VC, we have built an index composed, of equal weighting, of STOXX Europe TMI Technology and STOXX Europe TMI Healthcare (we have labeled it 'Combined STOXX Europe TMI Tech and Healthcare').

2.2.5. Data processing and methodology

As there is no real PE benchmark, and as it is impossible to assess *ex ante* the annual return of a PEF to further compare it with an equivalent of an index based on listed shares, we proceed in successive steps.

The *first step* was to gather the cash-flows of PEFs funds aggregated by VY. We retrieved raw index data from STOXX, Wilshire and NASDAQ websites[63], and then filtered and sorted them to have the quarterly evolution of each index. We then

[63] STOXX EU TMI (symbol: BKXP), STOXX Healthcare TMI (symbol: BPHP) and STOXX Technology TMI (symbol: BTHP) are available from 31/12/1991 onward. The Wilshire 5000 Total Market Full Cap Index is available daily from 30/11/1979 onward. The NASDAQ Composite index is available from 30/04/1992 onward.

retrieved from the PE section of Thomson ONE the quarterly cash-flows ('cash-flow summary') of VC and LBO funds in USA and EMEA[64], for all funds in each separate VY available until 2009 (after that date, funds are not mature enough to provide meaningful cash-flows). We repeated the operation filtering out the top quartile funds (some VY counting less than three funds reported, performance is unavailable) Thomson provides sample sizes, funds capitalization (cumulate fund sizes), 'takedowns' (capital calls), total distributions and NAVs (necessary to compute management fees). We retrieved quarterly 'cumulative returns' from inception, which provide us with the IRR (average, capital weighted average, pooled average) calculated by Thomson (to cross-check our own calculations).

Table 7 provides the average net performance from Thomson: sample size, capital-weighted average IRR and the capital weighted average TVPI. Based on the cash-flows provided, we calculated a quarterly capital-weighted average IRR as well as a capital-weighted average DPI. This is done for each VY for US VC (1981-2009) and LBO (1984-2009), and EMEA VC (1981-2009) and LBO (1984-2009). We repeated the operation with top quartile funds[65] [Table 8]. We separated realized (up to 2001) from unrealized funds (2002-2009). For the realized funds, DPI equals the TVPI. If this is not true, assets have a higher likelihood of being realized at a full loss (and hence ignored[66]).

The *second step* was to benchmark these cash-flows with our PME+. To do so, we replicated the aggregated cash-flows by 'buying' and 'selling' indexes according to the cash-flows of the VC and LBO funds. With this process, we will be able to factor in the illiquidity of the funds, precisely benchmark them and measure their relative performance. As a result, we can gauge the returns of PEFs with a virtual fund built on listed equivalents. For each VY, we computed a cumulated DPI. We then reported the index's raw data matching the quarters considered for each VY. We bought the index pro-rata of every takedown, followed by the computing of the 'normalized distributions' by dividing each distribution by the DPI. We then sold the index pro-rata of every distribution and calculated the DPI of the index and the average IRR. These calculations provide us with the gross performance of the total market index. It cannot (yet) be compared with the *net* average performance of each of the strategy on each of the two geographical markets [Tables 7 and 8 for average and top quartile funds].

We then proceeded to calculating the gross returns for each VY, each strategy, each region, for both average and top quartile funds. We applied different scenarios to calculate the annual management fees of funds (1.5 percent, 2 percent and 2.5 percent on the committed capital during an investment period of five years, then the

[64] For the purpose of consistency, all flows are retrieved in USD. See Conclusion for the consequences of this choice.

[65] An outlier appears with the vintage year 1995 for EMEA VC (the DPI is at 0.29, but Thomson reports a TVPI of 1.66 and an IRR of 10.44 percent). This discrepancy and the subsequent non-matching IRR and DPI of the benchmark results signals potentially missing cash-flow streams in Thomson's database.

[66] This simplification affects only vintages which could have witnessed an extension of their divestment period. Theoretically, VY 1999, 2000 and 2001 are potentially affected; considered as fully realized, they might still be active under a divestment period extension.

same thresholds on the paid-in capital, and finally the same thresholds on the NAVs over a divestment period of five years. If there is no NAV, then there is no management fee), and a carried interest of 20 percent. We then added management fees and carried interest to determine the full compensation of GPs. Distributions to LPs are reported as a basis of comparison. With the calculated management fees and carried interest, we reconstituted the gross returns of average and top quartile funds of each VY, for each strategy, in each region. We then applied the fees applied by standard market ETFs for each index selected (0.3 percent of the paid-in capital for the NASDAQ composite ETF, 0.13 percent for the Wilshire 5000 index, 0.46 percent for the mixed STOXX healthcare and technology index, and 0.74 percent for the STOXX TMI). We computed the net performance of the index based on the results of the first step. Table 7 provides the results for average US VC, US LBO, EMEA VC and EMEA LBO funds. We repeated the operation for top quartile funds [Table 8]. We skipped the calculation of hurdle rates, as those can be defined as simple interest rates on the paid-in, or as compounded interest rates, or as actual IRRs. Moreover, cash-flows have to be identified not only as a paid-in but also as a corresponding paid-out (each investment has to be timed exactly). As we did not have this degree of details, we could not proceed further. Table 9 provides the gross and net performances of average funds and their PME; Table 10 provides the equivalent for top quartile funds. Once the performance of funds (gross or net of fees) was known, we were able to analyze it.

Table 7 – Performance of US VC, US LBO, EMEA VC and EMEA LBO funds

This table provides capital-weighted average IRRs and TVPIs of US/EMEA VC and LBO funds, for VYs 1980 to 2010, as reported by Thomson ONE (as of 31 December 2011). IRRs and DPIs are calculated from the net cash-flows provided by Thomson ONE on a quarterly basis (the 'quarterly net performance'). An index's gross performance is calculated by applying PEFs drawdowns and distribution patterns. Indexes used are the NASDAQ Composite for US VC; the Wilshire 5000 TM Full Cap for US LBO; a combined STOXX EU Tech and STOXX EU Healthcare for EMEA VC; and the STOXX EU TMI for EMEA LBO.

		US Venture Capital							US LBO						
		Thomson One net performance			Quarterly net performance		Quarterly gross performance		Thomson One net performance			Quarterly net performance		Quarterly gross performance	
	Vintage year	Sample	Capital-weighted average IRR (monthly)	Capital-weighted average TVPI	Capital-weighted average IRR	Capital-weighted average DPI	Index for Average IRR (based on Nasdaq Composite)	Index for Average DPI (based on Nasdaq Composite)	Sample	Capital-weighted average IRR (monthly)	Capital-weighted average TVPI	Capital-weighted average IRR	Capital-weighted average DPI	Index for Average IRR (based on Wilshire 5000 TM Full Cap)	Index for Average DPI (based on Wilshire 5000 TM Full Cap)
Fully realized*	1981	21	10.33	1.94	10.63	1.88	10.45	1.96	-	-	-	-	-	-	-
	1982	28	4.32	1.46	4.46	1.39	12.19	2.86	-	-	-	-	-	-	-
	1983	58	6.67	1.82	7.81	1.75	12.12	2.85	-	-	-	-	-	-	-
	1984	63	6.02	1.59	5.64	1.45	12.13	2.40	7	28.02	4.10	26.86	3.96	15.78	3.45
	1985	46	9.17	2.08	9.77	1.95	13.10	2.94	8	34,47	2.57	34.45	2.54	14.40	2.13
	1986	38	12.04	2.84	13.58	2.82	14.64	3.44	10	20.32	4.29	24.41	4.37	14.35	3.61
	1987	64	12.88	2.39	13.85	2.25	16.40	3.01	24	11.16	2.02	11.49	1.97	14.22	2.68
	1988	45	19.72	2.58	20.45	2.52	18.33	2.61	16	10.01	1.74	11.31	1.64	15.72	2.30
	1989	50	16.57	2.45	18.05	2.37	21.17	3.02	25	24.95	2.75	21.61	2.34	15.63	2.13
	1990	23	22.18	2.63	25.21	2.60	20.81	2.41	10	10.74	1.81	13.07	1.80	18.77	2.57
	1991	17	16.24	2.15	15.28	1.91	22.13	2.63	5	23.24	2.92	23.99	2.99	18.45	2.56
	1992	28	31.24	3.43	35.78	3.31	23.35	2.45	14	23.39	2.04	20.23	1.81	18.58	1.84
	1993	41	28.64	3.32	38.23	3.32	24.70	2.35	20	21.11	2.10	18.55	1.87	17.83	1.87
	1994	36	42.03	4.54	46.46	4.28	25.26	2.19	25	16.16	1.52	5.26	1.24	10.73	1.50
	1995	48	46.95	4.11	61.38	3.72	28.51	1.80	25	12.91	1.63	10.08	1.48	7.69	1.34
	1996	38	58.66	4.59	86.46	4.15	30.48	1.64	25	5.99	1.31	1.48	1.06	5.62	1.23
	1997	61	43.84	2.35	45.23	2.21	12.86	1.25	40	9.48	1.42	6.14	1.28	2.91	1.13
	1998	80	24.16	1.74	13.84	1.44	(2.93)	0.91	55	1.07	1.11	(1.65)	0.92	1.57	1.08
	1999	106	(6.15)	0.75	N/A	0.53	(5.01)	0.76	38	5.01	1.31	0.66	1.03	2.67	1.13
	2000	122	(0.46)	1.05	N/A	0.60	0.15	1.01	51	12.88	1.71	9.32	1.37	5.03	1.20
	2001	60	5.13	1.27	N/A	0.77	5.91	1.20	27	15.11	1.66	10.28	1.32	6.67	10.20
Active	2002	19	(2.58)	0.88	N/A	0.46	-	-	19	15.33	1.63	N/A	1.14	-	-
	2003	21	0.99	1.08	N/A	0.40	-	-	17	20.72	190	7.8	1.18	-	-
	2004	28	3.54	1.26	N/A	0.37	-	-	21	14.40	1.58	(7.6)	0.82	-	-
	2005	23	4.56	1.28	N/A	0.32	-	-	33	10.49	1.40	N/A	0.04	-	-
	2006	44	3.23	1.12	N/A	0.21	-	-	35	0.66	1.03	N/A	0.04	-	-
	2007	24	10.52	1.32	N/A	0.21	-	-	37	6.76	1.17	N/A	0.04	-	-
	2008	20	5.19	1.09	N/A	0.05	-	-	29	10.12	1.20	N/A	0.04	-	-
	2009	13	7.50	1.10	N/A	0.04	-	-	10	12.98	1.16	N/A	0.06	-	-
Av. 1981-2001			10.68	1.37	8.19	1.34	8.02	1.44		-	-	-	-	-	-
Av. 1984-2001			-	-	-	-	-	-		10.38	1.36	7.07	1.33	6.97	1.43
Av. 1992-2001			-	-	-	-	-	-		-	-	-	-	-	-

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

Table 7 (continued)

EMEA Venture Capital							EMEA LBO						
Thomson One net performance			Quarterly net performance		Quarterly gross performance		Thomson One net performance			Quarterly net performance		Quarterly gross performance	
Sample	Capital-weighted average IRR (monthly)	Capital-weighted average TVPI	Capital-weighted average IRR	Capital-weighted average DPI	Index for Average IRR (based on STOXX EU TMI Tech & HC)	Index for Average DPI (based on on STOXX EU TMI Tech & HC)	Sample	Capital-weighted average IRR (monthly)	Capital-weighted average TVPI	Capital-weighted average IRR	Capital-weighted average DPI	Index for Average IRR (based on on STOXX EU TMI)	Index for Average DPI (based on on STOXX EU TMI)
3	6.37	1.77	11.74	2.65	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	7.67	1.80	8.24	1.81	-	-	-	-	-	-	-	-	-
6	7.35	1.92	7.67	1.80	-	-	4	11.07	2.18	19.02	2.66	-	-
16	5.49	1.70	7.60	1.66	-	-	-	-	-	-	-	-	-
10	7.81	1.60	12.09	1.88	-	-	5	20.54	2.61	20.48	2.82	-	-
8	3.75	1.39	4.52	1.37	-	-	7	6.47	1.40	7.47	1.46	-	-
11	3.83	1.51	6.12	1.37	-	-	15	10.00	1.54	13.07	1.72	-	-
20	7.27	2.19	10.06	1.74	-	-	10	9.57	1.48	8.86	1.43	-	-
14	15.66	2.41	15.29	1.99	-	-	12	6.12	1.34	1.93	1.08	-	-
11	5.86	1.49	2.17	1.08	-	-	15	11.99	1.58	11.88	1.50	-	-
6	14.62	2.19	12.46	1.87	22.10	3.18	7	19.87	2.32	19.48	2.12	13.87	1.71
11	5.14	1.44	N/A	0.67	26.18	1.92	8	13.40	1.80	25.15	2.04	15.80	1.74
16	10.28	2.96	9.15	1.60	16.03	1.88	14	36.30	2.44	34.78	2.61	13.95	1.55
13	(8.75)	1.32	N/A	0.27	6.08	1.03	11	41.64	2.44	49.53	2.14	16.14	1.32
18	6.45	1.73	(8.98)	0.78	15.08	1.29	18	13.19	1.57	13.50	1.54	7.35	1.26
35	27.39	2.08	(0.32)	0.99	4.62	1.10	26	15.73	1.75	11.51	1.61	(0.07)	1.00
33	(1.91)	1.05	(10.20)	0.62	(2.07)	0.93	25	13.22	1.79	11.53	1.60	(2.06)	0.91
57	(1.60)	0.95	N/A	0.38	(7.15)	0.68	36	13.29	1.74	11.85	1.55	0.96	1.04
93	(2.94)	0.85	N/A	0.34	(4.81)	0.78	35	21.55	2.12	20.85	1.92	1.81	1.07
62	(3.84)	0.89	N/A	0.42	(0.73)	0.97	21	27.69	2.03	27.43	1.84	9.77	1.26
34	(2.36)	0.88	N/A	0.36	-	-	23	29.38	1.93	22.68	1.44	-	-
41	1.15	0.98	N/A	0.31	-	-	19	11.70	1.57	3.44	1.09	-	-
45	8.82	1.33	N/A	0.53	-	-	18	18.26	1.47	7.48	1.11	-	-
38	(2.75)	0.95	N/A	0.28	-	-	34	(0.15)	1.01	N/A	0.39	-	-
39	1.49	1.18	N/A	0.07	-	-	38	(2.25)	0.98	N/A	0.17	-	-
54	(5.96)	0.88	N/A	0.13	-	-	31	0.99	1.07	N/A	0.19	-	-
55	0.70	1.07	N/A	0.05	-	-	26	27.49	0.90	N/A	0.13	-	-
36	(11.16)	0.89	N/A	0.01	-	-	13	(22.33)	1.63	N/A	0.06	-	-
	-	-	-	-	-	-		-	-	-	-	-	-
	-	-	-	-	-	-		-	-	-	-	-	-
	(0.17)	0.50	N/A	0.47	(0.09)	1.00		19.70	1.76	16.83	1.73	2.48	1.10

Table 8 – Performance of top quartile US VC, US LBO, EMEA VC and EMEA LBO funds

This table provides capital-weighted average IRRs and TVPIs of top quartile US/EMEA VC and LBO funds for VYs 1980 to 2010, as reported by Thomson ONE (as of 31 December 2011). IRRs and DPIs are calculated from the net cash-flows provided by Thomson ONE on a quarterly basis (the 'quarterly net performance'). An index's gross performance is calculated by applying PEFs drawdowns and distribution patterns. Indexes used are the NASDAQ Composite for US VC and the Wilshire 5000 TM Full Cap for US LBO; a combined STOXX EU Tech and STOXX EU Healthcare for EMEA VC; and the STOXX EU TMI for EMEA LBO.

		US Venture Capital							US LBO						
		Thomson One net performance			Quarterly net performance		Quarterly gross performance		Thomson One net performance			Quarterly net performance		Quarterly gross performance	
	Vintage year	Sample	Capital-weighted top quartile IRR (monthly)	Capital-weighted top quartile TVPI	Capital-weighted Top quartile IRR	Capital-weighted average Top quartile DPI	Index for Top quartile IRR (based on Nasdaq Composite)	Index for Top quartile DPI (based on Nasdaq Composite)	Sample	Capital-weighted top quartile IRR (monthly)	Capital-weighted top quartile TVPI	Capital-weighted Top quartile IRR	Capital-weighted average Top quartile DPI	Index for Top quartile IRR (based on Wilshire 5000 TM Full Cap)	Index for Top quartile DPI (based on Wilshire 5000 TM Full Cap)
Fully realized*	1981	6	16.80	2.44	16.59	2.47	10.07	1.81	-	-	-	-	-	-	-
	1982	7	10.32	2.00	11.12	1.98	11.83	2.61	-	-	-	-	-	-	-
	1983	15	14.51	2.85	14.49	2.85	13.05	3.36	-	-	-	-	-	-	-
	1984	16	15.37	2.45	15.45	2.39	11.81	2.18	-	-	-	-	-	-	-
	1985	12	19.54	3.02	19.18	2.94	12.63	2.38	-	-	-	-	-	-	-
	1986	10	17.24	3.90	17.24	3.90	14.87	3.67	3	30.99	6.58	35.1	8.28	14.18	3.73
	1987	16	23.68	3.60	23.56	3.58	16.93	2.97	7	19.28	2.46	23.14	2.47	15.77	2.32
	1988	12	31.01	3.46	31.68	3.49	18.49	2.48	5	20.58	2.63	20.85	2.63	17.13	2.73
	1989	13	38.79	4.34	40.08	4.25	18.58	2.09	7	44.69	3.87	42.29	3.99	15.43	2.25
	1990	6	44.05	4.48	47.64	4.50	21.62	2.20	N/A	N/A	N/A	-	-	-	-
	1991	4	31.62	3.55	32.62	3.55	22.37	2.56	N/A	N/A	N/A	-	-	-	-
	1992	7	63.62	6.34	65.68	6.34	24.10	2.41	4	53.15	2.62	53.04	2.64	15.89	1.62
	1993	11	59.24	6.28	66.69	6.26	25.66	2.45	6	36.97	2.84	39.07	2.71	17.43	1.78
	1994	9	57.85	5.89	58.79	5.64	25.81	2.19	7	32.88	1.92	23.71	1.93	10.48	1.37
	1995	12	113.92	8.38	129.45	8.31	33.13	2.07	7	32.62	2.27	31.83	2.24	11.27	1.38
	1996	10	187.89	13.58	181.98	12.49	32.99	1.73	7	19.44	1.94	18.96	1.81	5.26	1.20
	1997	16	144.11	5.03	150.90	4.87	27.24	1.37	10	17.57	1.70	14.43	1.60	3.19	1.13
	1998	20	112.29	4.16	140.92	3.16	3.23	1.05	15	20.05	2.12	18.55	1.99	1.77	1.08
	1999	27	9.39	1.51	4.82	1.25	(2.14)	0.89	10	16.83	1.87	15.55	1.68	2.85	1.12
	2000	31	9.63	1.64	2.96	1.12	1.47	1.06	14	23.87	2.27	23.73	2.12	5.10	1.21
	2001	15	13.72	1.70	7.80	1.26	6.31	1.21	7	34.59	2.47	32.72	2.19	7.41	1.22
	Av. 1981-20	275	34.18	3.00	38.85	2.57	12.02	1.62	-	-	-	-	-	-	-
	Av. 1986-20	-	-	-	-	-	-	-	118	25.25	2.24	23.27	2.09	7.79	1.40
	Av. 1993-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

** In bold, the higher DPI for a given vintage year is highlighted between the funds DPI and the index DPI

Table 8 (continued)

EMEA Venture Capital							EMEA LBO						
Thomson One net performance			Quarterly net performance		Quarterly gross performance		Thomson One net performance			Quarterly net performance		Quarterly gross performance	
Sample	Capital-weighted top quartile IRR (monthly)	Capital-weighted top quartile TVPI	Capital-weighted Top quartile IRR (annual)	Capital-weighted average Top quartile DPI	Index for Top quartile IRR (based on STOXX EU TMI Tech & HC)	Index for Top quartile DPI (based on on STOXX EU TMI Tech & HC)	Sample	Capital-weighted top quartile IRR (monthly)	Capital-weighted top quartile TVPI	Capital-weighted Top quartile IRR	Capital-weighted average Top quartile DPI	Index for Top quartile IRR (based on on STOXX EU TMI)	Index for Top quartile DPI (based on on STOXX EU TMI)
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	18.35	2.39	29.29	1.61	46.08	1.62	3	23.72	2.48	23.11	2.52	14.13	1.92
4	18.63	2.82	20.80	2.75	13.43	1.82	4	48.48	2.96	46.25	2.95	14.40	1.49
4	10.44	1.66	N/A	0.29	41.45	1.03	3	69.57	3.79	108.74	3.31	17.07	1.36
4	23.55	3.42	35.08	1.42	21.88	1.25	5	19.86	2.17	27.26	2.29	6.05	1.23
9	76.03	2.58	50.25	2.06	3.21	1.05	7	41.02	2.47	30.47	2.45	1.88	1.08
8	31.15	2.90	33.57	2.52	(3.57)	0.89	7	18.12	2.03	16.79	1.93	(1.83)	0.92
14	10.75	1.82	3.05	1.19	(5.81)	0.71	10	26.43	2.52	26.04	2.48	0.95	1.04
22	5.90	1.43	(9.46)	0.68	(6.03)	0.77	9	32.24	3.01	30.75	2.77	2.55	1.10
15	12.80	1.73	7.35	1.30	(0.43)	0.98	6	32.96	2.19	32.95	2.02	10.26	1.26
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
83	21.66	2.03	9.89	1.29	2.17	1.06	54	30.14	2.24	28.21	2.25	5.73	1.37

2.3. Analysis and Findings

2.3.1. Analysis of the paid-in to committed capital ratios

We have based our calculations and analysis on Table 4 (above), Tables 7 and 8:

- For US VC: 1,073 realized funds (1981-2001), amounting to USD 181.7 bn committed and 164.4 bn called. The net paid-in/committed capital (PICC) ratio is 0.90 (the gross PICC is 1.09). The average fund size is 169.3 mn (minimum is 33.4 mn in 1981, maximum 470.6 mn in 2001). Including VYs 2002-2009, fund size increases to USD 197.6 mn (totaling 1,265 funds, 249.9 bn committed, 213.9 bn called).

- For US LBO: 425 realized funds (1984-2001), amounting to USD 292.2 bn committed and 266.8 bn called. The net PICC is 0.91 (gross is 1.00). The average fund size is 687.7 mn (minimum is 171.5 mn in 1985, maximum 1.16 bn in 2001). Including VYs 2002-2009, fund size increases to USD 1.17 bn (626 funds, 735.3 bn committed, 612.1 bn paid-in).

- For EMEA VC: 447 realized funds (1981-2001), amounting to USD 29.1 bn committed and 22.7 bn called. The net PICC is 0.78 (gross is 1.02). The average fund size is 65.2 mn (minimum is 15.6 mil. in 1981, maximum 99.3 mn in 2000). Including VYs 2002-2009, fund size increases to USD 69.7 mn (789 funds, 54.9 bn committed, 41.5 bn paid-in).

- For EMEA LBO: 269 realized funds (1984-2001), amounting to USD 88.9 bn committed and 77.6 bn called. The net PICC is 0.87 (gross is 1.05). The average fund size is 330.4 mn (minimum is 16.0 mn in 1984, maximum 809.9 mn in 2001). Including VYs 2002-2009, fund size increases to USD 691.0 mn (471 funds, 249.9 bn committed, 213.9 bn paid-in).

The comparatively small number of EMEA funds accounted for calls for a certain caution in our analysis. There are significant differences between the US and EMEA regions:

i) either because of different fund covenants or of longer investment periods, EMEA VC funds have a lower PICC (whether net or gross): 0.90 net in the US, 0.78 in EMEA. This might be a source of explanation of lower EMEA VC funds performances compared to the US, which might have a more active reinvestment policy of early proceeds. US and EMEA LBO funds have rather similar PICC (US net: 0.91 and EMEA net: 0.87), which tends to confirm that the reinvestment policy is a stake in the case of EMEA VC.

ii) US average fund sizes are more than the double of EMEA's. The relative weight of fixed costs is, therefore, higher for EMEA funds. A significant share of the EMEA funds may not have reached the critical mass to be economically viable.

We looked for atypical behaviors that could affect our results. The rationale is to identify VYs which might not be properly accounted for in terms of paid-in (hence introducing biases in our cash-flow analysis). Management fees have very little chance to exceed 20 percent of the fund size. As a fund can only be invested up to 100 percent, then net PICC the brackets should be 0.8 to 1.0. The gross PICC that we have calculated should exceed 1.2, as theoretically management fees account for a maximum of 20 percent (assuming a two percent per annum management fees). However, some funds might have a higher management fee level. Unless there is a flagrant discrepancy, we do not use this criterion to filter vintage years. Average US VC fits within these brackets: the average net PICC is 0.90 (1.09 gross) for realized funds and 0.86 (net) for unrealized funds. This is consistent with Ljungqvist and Richardson [2003] who found a 0.94 PICC over 1981-1992. For US VC top quartile funds, the net PICC of two vintages years (1981 and 1991) are above 1.00. These two years have to be treated with caution.

US LBO 1987, 1993 and 1995 are above 1.0 while US LBO 2000 is at 0.76. These vintages should be handled with caution. The average net PICC is 0.91 (1.0 gross) for realized funds and 0.83 (net for unrealized funds) [consistent with Ljungqvist and Richardson, 2003]. For top quartile US LBO funds, the net PICC is below 0.8 for 1989 and 1995; and above 1.00 for 1987 and 1997. These vintages should be handled with caution.

Table 9 – PICC ratios, and gross profit to paid-in, for US/EMEA VC and LBO funds

This table provides the committed capital, average fund size, paid-in and paid-in/committed (PICC) ratio for US/EMEA VC and LBO funds from Thomson ONE database (1981-2009); as well as the calculated gross PICC, gross profit/paid-in, and calculated net DPI for PEFs and net and gross DPI from the index.

		US Venture Capital										US LBO									
		Thomson One data					PE funds			Index		Thomson One net performance					PE funds			Index	
	Vintage year	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross
Fully realized*	1981	21	701.44	33.40	690.47	0.98	1.19	**1.88**	**2.30**	1.96	1.96	-	-	-	-	-	-	-	-	-	-
	1982	28	1 119.72	39.99	963.48	0.86	1.05	1.39	1.67	**2.86**	**2.86**	-	-	-	-	-	-	-	-	-	-
	1983	58	2 521.04	43.47	2 405.00	0.95	1.17	1.75	2.15	**2.85**	**2.85**	-	-	-	-	-	-	-	-	-	-
	1984	63	2 553.13	40.53	2 397.38	0.94	1.14	1.45	1.76	**2.40**	**2.40**	7	1 662.43	237.49	1 660.00	**1.00**	**1.27**	**3.96**	**4.96**	3.45	3.45
	1985	46	1 441.36	31.33	1 390.30	0.96	1.18	1.95	2.41	**2.94**	**2.94**	8	1 372.09	171.51	1 285.25	0.94	1.15	**2.54**	**3.13**	2.13	2.13
	1986	38	2 621.64	68.99	2 505.89	0.96	**1.23**	2.82	**3.55**	**3.44**	3.44	10	1 876.57	187.66	1 750.44	0.93	**1.25**	**4.37**	**5.54**	3.61	3.61
	1987	64	2 816.49	44.01	2 710.84	0.96	1.16	2.25	2.76	**3.01**	**3.01**	24	12 454.11	518.92	13 306.89	**1.07**	**1.35**	1.97	2.48	**2.68**	**2.72**
	1988	45	2 400.35	53.34	2 318.40	0.97	1.17	**2.52**	**3.09**	2.61	2.61	16	8 448.70	528.04	8 156.23	0.97	1.16	1.64	1.99	**2.30**	**2.30**
	1989	50	3 989.77	78.95	3 891.16	0.98	1.20	2.37	2.94	**3.02**	**3.02**	25	5 628.12	335.12	5 274.41	0.90	1.08	**2.34**	**2.85**	2.13	2.13
	1990	23	1 433.08	62.31	1 299.16	0.91	1.10	**2.60**	**3.18**	2.41	2.41	10	2 652.26	265.23	2 401.37	0.91	1.08	1.80	2.16	**2.57**	**2.57**
	1991	17	836.28	49.19	838.54	1.00	**1.23**	1.91	2.36	**2.63**	**2.63**	5	1 439.98	288.00	1 292.66	0.90	1.05	**2.99**	**3.63**	2.56	2.56
	1992	28	2 488.25	88.86	2 438.39	0.98	1.17	**3.31**	**4.08**	2.45	2.45	14	4 378.17	312.73	4 171.24	0.95	1.13	1.81	**2.18**	**1.84**	1.84
	1993	41	3 234.06	78.88	2 949.31	0.91	1.10	**3.32**	**4.08**	2.35	2.35	20	9 688.50	484.42	10 017.64	**1.03**	**1.24**	1.87	**2.29**	**1.87**	1.87
	1994	36	4 660.01	129.44	4 427.88	0.95	**1.23**	**4.28**	**5.38**	2.19	2.19	25	10 855.95	434.24	9 831.23	0.91	1.09	1.24	1.48	**1.50**	**1.50**
	1995	48	4 594.92	95.72	4 205.92	0.92	1.11	**3.72**	**4.59**	1.80	1.80	25	18 913.27	756.53	19 033.33	**1.01**	1.18	**1.48**	**1.78**	1.34	1.34
	1996	38	4 988.69	131.28	4 671.07	0.94	1.14	**4.15**	**5.15**	1.64	1.64	25	11 451.85	458.07	11 077.51	0.97	1.15	1.06	**1.26**	**1.23**	1.23
	1997	61	9 426.45	154.53	8 868.91	0.94	1.10	**2.21**	**2.67**	1.25	1.25	40	32 537.01	813.43	31 653.02	0.97	1.16	**1.28**	**1.52**	1.13	1.13
	1998	80	18 606.36	232.58	17 158.86	0.92	1.18	**1.44**	**1.81**	0.91	0.91	55	54 065.35	978.99	50 014.37	0.93	1.09	0.92	**1.10**	**1.08**	1.08
	1999	106	32 793.82	309.37	29 684.69	0.91	1.05	0.53	0.70	**0.76**	**0.76**	38	30 638.44	806.27	27 561.62	0.90	1.07	1.03	**1.21**	**1.13**	1.13
	2000	122	50 267.59	412.03	43 065.30	0.86	1.03	0.60	0.80	**1.01**	**1.01**	51	53 778.32	1 054.47	51 075.29	**0.76**	**0.92**	**1.37**	**1.59**	1.20	1.20
	2001	60	28 234.16	470.57	25 514.20	0.90	1.05	0.77	0.96	**1.20**	**1.20**	27	31 359.25	1 161.45	27 303.40	**0.87**	**0.94**	**1.32**	**1.45**	1.20	1.20
Active	2002	19	4 531.11	238.48	3 030.98	**0.67**						19	17 448.74	918.35	15 289.60	0.88					
	2003	21	5 177.48	246.55	4 864.27	0.94						17	20 669.31	1 215.84	19 633.17	0.95					
	2004	28	9 256.61	330.59	7 907.48	0.85						21	21 407.18	1 019.39	18 262.24	0.85					
	2005	23	6 829.59	296.94	4 795.89	0.70						33	50 379.02	1 526.64	45 943.77	0.91					
	2006	44	25 174.61	572.15	19 618.60	0.78						35	114 324.79	3 266.42	109 205.67	0.96					
	2007	24	6 174.40	257.26	4 002.40	0.65						37	121 534.01	3 284.70	86 226.24	0.71					
	2008	20	7 572.94	378.65	3 747.58	0.49						29	73 481.07	2 637.27	38 743.69	0.51					
	2009	13	3 495.83	268.91	1 601.26	0.46						10	20 757.54	2 075.75	11 943.46	0.58					
Total realiz.		1073	181 698		164 394							425	292 281		266 865						
Av. realiz.				169.33		0.90	1.09	1.34	**1.70**	**1.40**	1.44			687.72		0.91	1.00	1.33	**1.62**	**1.37**	1.43
Total all		1265	249 911		213 963							626	735 283		612 113						
Av. all				197.56		0.86								1 174.57		0.83					

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

** In bold, the higher DPI for a given vintage year is highlighted between the funds DPI and the index DPI

Table 9 (continued)

EMEA Venture Capital										EMEA LBO									
Thomson One net performance				PE funds				Index		Thomson One net performance				PE funds				Index	
Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross
3	46.78	15.59	26.16	**0.56**	**0.77**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	88.55	22.14	84.11	0.95	1.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	152.37	25.39	114.38	**0.75**	**0.95**	-	-	-	-	4	64.04	16.01	38.86	**0.61**	0.84	-	-	-	-
16	402.49	25.16	323.81	0.80	1.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	250.23	25.02	227.24	0.91	1.15	-	-	-	-	5	176.08	35.22	178.25	**1.01**	**1.23**	-	-	-	-
8	477.29	59.66	458.68	0.96	1.16	-	-	-	-	7	416.29	58.47	402.44	0.97	1.14	-	-	-	-
11	556.22	50.57	499.45	0.90	1.06	-	-	-	-	15	1 878.17	125.21	859.24	**0.46**	**0.59**	-	-	-	-
20	780.17	39.01	688.32	0.88	1.08	-	-	-	-	10	2 155.84	215.58	1 803.48	0.84	0.99	-	-	-	-
14	673.91	48.14	624.48	0.93	1.16	-	-	-	-	12	2 067.93	172.33	2 359.01	**1.14**	**1.35**	-	-	-	-
11	484.27	44.02	422.19	0.87	1.06	-	-	-	-	15	1 204.21	80.28	1 114.01	0.93	1.08	-	-	-	-
6	193.76	62.29	211.48	**1.09**	**1.31**	1.87	2.31	**3.18**	**3.18**	7	799.96	114.28	654.46	0.82	1.01	**2.12**	**2.57**	1.71	1.71
11	294.34	26.76	280.14	0.95	1.16	0.67	0.89	**1.92**	**1.92**	8	874.44	109.31	695.95	0.80	0.99	**2.04**	**2.48**	1.74	1.74
16	689.52	43.09	476.45	**0.69**	**0.93**	1.60	1.98	**1.88**	**1.88**	14	2 789.64	199.26	2 411.51	0.86	1.04	**2.61**	**3.17**	1.55	1.55
13	1 280.91	98.53	1 055.00	0.82	1.01	0.27	0.49	**1.03**	**1.03**	11	1 917.14	174.29	1 398.64	**0.73**	**0.89**	**2.14**	**2.55**	1.32	1.32
18	749.92	41.66	599.63	0.80	1.06	0.78	1.11	**1.29**	**1.29**	18	6 510.89	361.72	3 765.82	**0.58**	**0.73**	**1.54**	**1.81**	1.26	1.26
35	1 722.36	49.21	1 290.63	**0.75**	**0.96**	0.99	1.27	**1.10**	**1.10**	26	10 567.48	406.44	9 220.75	0.87	1.07	**1.61**	**1.95**	1.00	1.00
33	2 367.35	71.74	2 178.28	0.92	1.18	0.62	0.91	**0.93**	**0.93**	25	13 726.14	549.04	10 490.83	**0.76**	**0.94**	**1.60**	**1.90**	0.91	0.91
57	3 785.90	66.42	2 214.46	**0.58**	1.16	0.38	0.38	**0.68**	**0.68**	36	11 550.83	320.86	11 325.81	0.98	1.18	**1.55**	**1.89**	1.04	1.04
93	9 238.53	99.34	7 500.55	0.81	0.99	0.34	0.56	**0.78**	**0.78**	35	15 166.83	433.34	13 743.23	0.91	1.09	**1.92**	**2.33**	1.07	1.07
62	4 893.96	78.93	3 413.11	**0.70**	**0.86**	0.42	0.65	**0.97**	**0.97**	21	17 007.99	809.90	17 156.29	**1.01**	1.18	**1.84**	**2.23**	1.26	1.26
34	931.56	27.40	867.97	0.93						23	9 865.95	428.95	9 809.75	0.99					
41	2 549.62	62.19	2 245.47	0.88						19	8 505.63	447.66	6 844.40	0.80					
45	2 616.93	58.15	2 142.14	0.82						18	16 066.74	892.60	12 520.40	0.78					
38	3 295.32	86.72	2 675.88	0.81						34	47 455.08	1 395.74	18 257.95	**1.02**					
39	6 566.79	168.38	4 365.75	0.66						38	49 269.89	1 296.58	10 493.83	0.82					
54	5 937.23	109.95	4 439.83	0.75						31	44 7088.86	1 444.80	34 162.80	0.76					
55	3 070.35	54.37	1 619.31	0.53						26	47 046.15	1 809.47	24 355.05	0.52					
36	866.94	24.08	511.51	0.59						13	13 592.36	1 045.56	4 398.47	0.32					
447	29 127		22 688							269	88 873		77 618						
		65.16		0.78	1.02	0.50	0.87	**1.00**	**1.00**			330.38		0.87	1.05	**1.76**	**2.13**	0.99	0.99
789	54 962		41 556							471	325 464		258 461						
		69.66		0.76								691.01		0.79					

Table 10 – PICC ratios, and gross profit to paid-in, for top quartile US/EMEA VC and LBO funds

This table provides the committed capital, average fund sizes, paid-in and paid-in/committed (PICC) ratio for top quartile US VC and LBO funds; and EMEA VC and LBO funds from Thomson ONE Banker database (1981-2009); as well as the calculated gross PICC, gross profit/paid-in, and calculated net DPI for PEFs and net and gross DPI from the index.

		US Venture Capital										US LBO									
		Thomson One data					PE funds			Index		Thomson One net performance					PE funds			Index	
	Vintage year	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross
Fully realized*	1981	6	335.52	55.92	356.64	**1.06**	**1.27**	**2.47**	**3.06**	1.81	1.81	-	-	-	-	-	-	-	-	-	-
	1982	7	341.78	48.82	313.38	0.92	1.12	1.98	2.43	**2.61**	**2.61**	-	-	-	-	-	-	-	-	-	-
	1983	15	735.77	49.05	719.24	0.98	**1.24**	2.85	3.58	**3.36**	**3.36**	-	-	-	-	-	-	-	-	-	-
	1984	16	729.80	45.61	658.87	0.90	1.10	**2.39**	2.93	2.18	2.18	-	-	-	-	-	-	-	-	-	-
	1985	12	341.77	24.48	341.81	1.00	**1.23**	**2.94**	3.66	2.38	2.38	-	-	-	-	-	-	-	-	-	-
	1986	10	1 592.24	159.22	1 498.80	0.94	1.25	**3.90**	**4.94**	3.67	3.67	3	957.20	319.07	765.15	0.80	**1.21**	**8.28**	**10.55**	3.73	3.73
	1987	16	1 078.08	67.38	1 022.15	0.95	1.14	**3.58**	4.42	2.97	2.97	7	3 371.55	481.65	3 564.26	**1.06**	**1.27**	**2.47**	**3.05**	2.32	2.32
	1988	12	1 294.87	107.91	1 247.77	0.96	1.15	**3.49**	**4.30**	2.48	2.48	5	2 170.40	434.08	2 162.13	1.00	1.20	2.63	**3.24**	**2.73**	2.73
	1989	13	723.48	55.65	706.17	0.98	1.17	**4.25**	5.25	2.09	2.09	7	2 578.35	368.34	1 802.71	**0.70**	0.91	**3.99**	**4.93**	2.25	2.25
	1990	6	551.32	91.88	532.14	0.97	1.17	**4.50**	**5.58**	2.20	2.20	-	-	-	-	-	-	-	-	-	-
	1991	4	200.16	50.04	202.04	**1.01**	**1.25**	**3.55**	4.42	2.56	2.56	-	-	-	-	-	-	-	-	-	-
	1992	7	865.05	123.58	806.48	0.93	1.12	**6.34**	**7.85**	2.41	2.41	4	1 486.53	371.63	1 469.58	0.99	1.14	**2.64**	**3.21**	1.62	1.62
	1993	11	1 251.44	113.77	1 177.31	0.94	1.14	**6.26**	**7.77**	2.45	2.45	6	3 132.00	522.00	3 092.84	0.99	1.20	**2.71**	**3.35**	1.78	1.78
	1994	9	3 029.61	336.62	2 937.48	0.97	**1.29**	**5.64**	**7.12**	2.19	2.19	7	4 894.60	699.23	4 109.56	0.84	0.99	**1.93**	**2.30**	1.37	1.37
	1995	12	1 403.68	116.97	1 329.33	0.95	1.12	**8.31**	**10.31**	2.07	2.07	7	3 820.36	545.77	2 991.35	**0.78**	0.92	**2.24**	**2.65**	1.38	1.38
	1996	10	1 163.00	116.30	1 089.18	0.94	**1.25**	**12.49**	**15.68**	1.73	1.73	7	3 313.57	473.37	3 243.35	0.98	1.15	**1.81**	**2.19**	1.20	1.20
	1997	16	2 329.63	145.60	2 241.63	0.96	1.10	**4.87**	**5.98**	1.37	1.37	10	13 415.82	1 341.58	13 891.97	**1.04**	**1.21**	**1.60**	**1.93**	1.13	1.13
	1998	20	3 704.77	185.24	3 530.35	0.95	**1.27**	**3.16**	**4.02**	1.05	1.05	15	6 092.65	406.17	5 819.36	0.96	1.12	**1.99**	**2.41**	1.08	1.08
	1999	27	7 140.70	264.47	6 402.59	0.90	1.06	**1.25**	1.47	0.89	0.89	10	9 858.40	985.84	9 135.55	0.93	1.09	**1.68**	**2.01**	1.12	1.12
	2000	31	18 856.47	608.27	16 991.42	0.90	1.09	**1.12**	1.33	1.06	1.06	14	20 227.22	1 444.80	16 472.69	0.81	0.97	**2.12**	**2.54**	1.21	1.21
	2001	15	11 910.31	794.02	11 001.16	0.92	1.09	**1.26**	1.49	1.21	1.21	7	7 779.50	1 111.36	7 504.61	0.96	1.13	**2.19**	**2.66**	1.22	1.22
Active	2002	5	723.13	144.63	542.84	0.75						5	3 416.39	683.28	3 609.62	**1.06**					
	2003	6	1 125.02	187.50	1 070.13	0.95						5	9 318.60	1 863.72	7 780.53	0.83					
	2004	7	2 821.82	403.12	2 428.93	0.86						6	6 373.20	1 062.20	5 985.02	0.94					
	2005	6	1 558.83	259.81	1 390.32	0.89						9	19 618.09	2 179.79	18 547.75	0.95					
	2006	11	7 581.20	689.20	6 512.72	0.86						9	12 697.00	1 410.78	12 008.21	0.95					
	2007	6	1 584.55	264.09	1 222.04	0.77						10	19 283.50	1 928.35	13 494.88	0.70					
	2008	5	933.75	186.75	454.32	0.49						7	6 104.01	872.00	3 423.68	0.56					
	2009	4	1 482.30	370.58	832.05	0.56						-	-	-	-	-	-	-	-	-	-
Total realiz.		275	59 579		55 105							109	82 491		76 025						
Av. realiz.				216.65		0.92	1.13	**2.57**	**3.19**	1.56	1.62			756.80		0.92	1.08	**2.09**	**2.57**	1.36	1.40
Total all		325	77 390		69 559							160	159 301		140 874						
Av. all				238.12		0.90								995.64		0.88					

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

** In bold, the higher DPI for a given vintage year is highlighted between the funds DPI and the index DPI

Table 10 (continued)

EMEA Venture Capital											EMEA LBO										
Thomson One net performance					PE funds			Index			Thomson One net performance					PE funds			Index		
Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	PI/C (gross)	DPI net	Gross profit / paid in	DPI net	DPI gross
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	104.21	34.74	94.88	0.91	1.09	1.61	**1.94**	**1.62**	1.62	3	398.83	132.94	278.46	**0.70**	0.87	**2.52**	**3.05**	1.86	1.86
4	212.87	53.22	202.92	0.95	1.15	**2.75**	3.39	1.82	1.82	4	1 271.78	317.94	1 294.52	**1.02**	1.20	**2.95**	**3.63**	1.49	1.49
4	873.13	218.28	738.81	0.84	1.03	0.29	0.51	1.03	1.03	3	1 160.15	386.72	710.68	**0.61**	**0.78**	**3.31**	**4.00**	1.36	1.36
4	192.23	48.06	161.42	0.84	**1.31**	**1.42**	**2.03**	1.25	1.25	5	2 986.81	597.36	1 227.00	**0.41**	**0.55**	**2.29**	**2.64**	1.23	1.23
9	652.04	72.45	489.85	**0.75**	0.94	**2.06**	**2.51**	1.05	1.05	7	2 784.91	397.84	2 545.72	0.91	1.09	**2.45**	**2.98**	1.08	1.08
8	393.66	49.21	369.39	0.94	1.13	**2.52**	**3.09**	0.89	0.89	7	8 114.15	1 159.16	6 822.67	0.84	1.00	**1.93**	**2.30**	0.92	0.92
14	468.43	33.46	306.61	**0.65**	0.86	**1.19**	**1.50**	0.71	0.71	10	2 555.23	255.52	2 182.86	0.85	1.01	**2.48**	**2.99**	1.04	1.04
22	1 119.37	50.88	811.21	**0.72**	0.91	0.68	**0.94**	**0.77**	0.77	9	4 464.39	496.04	4 388.94	0.98	1.18	**2.77**	**3.41**	1.10	1.10
15	676.12	45.07	650.13	0.96	1.15	**1.30**	**1.57**	0.98	0.98	6	11 208.47	1 868.08	12 162.80	**1.09**	**1.25**	**2.02**	**2.44**	1.26	1.26
7	225.81	32.26	224.99	1.00						6	3 932.65	655.44	3 462.05	0.88					
10	578.99	57.90	556.87	0.96						5	2 410.80	482.16	2 701.73	**1.12**					
12	1 340.55	111.71	992.00	0.74						4	2 496.84	624.21	2 773.79	**1.11**					
10	447.99	44.80	419.22	0.94						9	8 549.22	949.91	8 315.50	0.97					
10	4 071.89	407.19	2 787.68	0.68						10	8 725.48	872.55	7 959.61	0.91					
14	1 188.23	84.87	805.66	0.68						8	11 462.32	1 432.79	7 640.69	0.67					
14	1 507.45	101.95	537.40	0.36						5	1 922.72	384.54	1 061.29	0.55					
9	171.73	19.08	95.17	0.55						4	7 862.60	1 965.65	1 952.17	0.25					
83	4 692		3 825							54	34 944		31 613						
		56.53		0.82	1.02	**1.29**	**1.62**	1.04	1.06			647.12		0.90	1.07	**2.25**	**2.72**	1.13	1.14
169	14 224		10 244							105	82 307		67 480						
		84.17		0.72								783.88		0.82					

EMEA VC exhibits one VY above 1.0 (1992) and six below 0.8 (1981, 1984, 1994, 1997, 1999, 2001). The average net PICC for realized funds itself is below 0.8 (0.78, net). The gross PICC stands at 1.02, which tends to confirm that EMEA VC funds do not apply reinvestment policies (hence the gross PICC is 100 percent of the fund). For top quartile funds, the net PICC of three vintages falls below 0.8: 1997, 1999 and 2000. These vintages should be handled with caution.

EMEA LBO funds exhibit three VY with a net PICC above 1.0 (1986, 1990 and 2001), and five VY with a net PICC below 0.80 (1984, 1988, 1995, 1996, 1998). The average net PICC is at 0.87, with a gross at 1.05 (hence raising the question of lower levels of management fees or potential reinvestments before the end of the investment period). Top quartile funds exhibit a net PICC below 0.8 for three VY (1993, 1995 and 1996) and two above 1.00 (1994 and 2001).

Though some of the VYs are to be taken with caution, there is no systematic bias of performance identifiable (out- or under-performance) with net PICC above or below thresholds.

2.3.2. Analysis of the management fees and the carried interest

In order to prepare our analysis of gross and net performance, we needed to calculate the LP and the GP's compensation (management fees and carried interest).

2.3.2.1. US VC

Management fees calculation[67] [Table 11] over a five-year investment period (on committed capital and NAVs) range from 13.2 to 22.0 percent (1.5 to 2.5 percent fee) of fund size (17.6 percent with a two percent management fee assumption). If calculated on the paid-in and NAVs, the range is 9.2 percent to 15.3 percent (12.3 percent with a two percent fee). The difference is significant (537 basis points). An extension of the investment period by one year represents an increase in management fees of 750 bps (with a two percent fee on fund size) or 390 bps (two percent fee on paid-in).

[67] We did not compute divestment period extensions, as they are related to the RVPI and might be treated specifically by the LPA (that is percentage, budget, no fees…).

Table 11 – Compensation for LPs and GPs (US and EMEA VC and LBO)

Calculation of management fees based on committed capital and invested capital, with a five-year investment period and different levels of management fees and carried interest; calculation of the total respective compensation for LPs and GPs by VY, based on the assumption of a 2% management fee on committed capital with a five-year investment period for US VC (1981-2001), US LBO (1984-1993), EMEA VC (1981-1993) and EMEA LBO funds.

Management fees	**US VC**				**US LBO**			
Investment Period (5 years)								
as a percentage of committed capital								
1.5%	13 715.81				21 990.03			
2.0%	**18 287.75**				**29 320.03**			
2.5%	22 859.69				36 650.04			
as a percentage of paid-in capital								
1.5%	6 343.89				9 972.12			
2.0%	**8 458.52**				**13 296.16**			
2.5%	10 573.14				16 620.20			
Divestment Period (5 years)								
as a percentage of NAV								
1.5%	10 480.78				17 051.62			
2.0%	**13 974.38**				**22 735.49**			
2.5%	17 467.97				28 419.37			
Total Investment + Divestment period		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**
as a % of committed capital + % of NAV								
1.5%	24 196.59	13.22%	90.20%	103.42%	39 041.65	13.31%	90.96%	104.27%
2.0%	**32 262.13**	**17.63%**	90.20%	107.82%	**52 055.53**	**17.75%**	90.96%	108.71%
2.5%	40 327.66	22.03%	90.20%	112.23%	65 069.41	22.19%	90.96%	113.15%
as a % of paid-in capital (5 years) + % of NAV								
1.5%	16 824.67	9.19%	90.20%	99.39%	27 023.74	9.22%	90.96%	100.18%
2.0%	**22 432.89**	**12.26%**	90.20%	102.45%	**36 031.66**	**12.29%**	90.96%	103.25%
2.5%	28 041.12	15.32%	90.20%	105.52%	45 039.57	15.36%	90.96%	106.32%

Compensation	**US VC**		**US LBO**	
Variable				
Limited Partners				
Total Profit	55 002.46	*66.1%*	76 591.95	*79.3%*
General Partners				
Carried interest (20%)	28 245.14	*33.9%*	19 942.56	*20.7%*
Total Variable	83 247.59	*100.0%*	96 534.51	*100.0%*
Fees				
General Partners				
Manag. fees (2% CC + NAV)	32 262.13		52 055.53	
% of total GP compensation		*53.3%*		*72.3%*
Total (variable + fees)				
Limited Partners	55 002.46		76 591.95	
General Partners	60 507.26		71 998.09	

ETF	**US VC**	**US LBO**
as a percentage of paid-in capital	2 055.32	1 511.28

Table 11 (continued)

Management fees	EMEA VC				EMEA LBO			
Investment Period (5 years)								
as a percentage of committed capital								
1.5%	2 184.53				6 665.54			
2.0%	**2 912.71**				**8 887.39**			
2.5%	3 640.89				11 109.24			
as a percentage of paid-in capital								
1.5%	870.03				2 685.47			
2.0%	**1 160.04**				**3 580.62**			
2.5%	1 450.05				4 475.78			
Divestment Period (5 years)								
as a percentage of NAV								
1.5%	1 853.05				5 250.61			
2.0%	**2 470.74**				**7 000.81**			
2.5%	3 088.42				8 751.01			
Total Investment + Divestment period		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**
as a % of committed capital + % of NAV								
1.5%	4 037.59	16.01%	75.74%	91.75%	11 916.15	14.73%	87.58%	102.31%
2.0%	**5 383.45**	**21.35%**	75.74%	97.09%	**15 888.20**	**19.64%**	87.58%	107.22%
2.5%	6 729.31	26.69%	75.74%	102.43%	19 860.25	24.55%	87.58%	112.13%
as a % of paid-in capital (5 years) + % of NAV								
1.5%	2 723.08	10.80%	75.74%	86.54%	7 936.07	9.81%	87.58%	97.39%
2.0%	**3 630.78**	**14.40%**	75.74%	90.14%	**10 581.43**	**13.08%**	87.58%	100.66%
2.5%	4 538.47	18.00%	75.74%	93.74%	13 226.79	16.35%	87.58%	103.93%

Compensation	EMEA VC		EMEA LBO	
Variable				
Limited Partners				
Total Profit	-8 117.07		49 539.75	*80.9%*
General Partners				
Carried interest (20%)	477.08		11 722.82	*19.1%*
Total Variable	-7 639.99	*0.0%*	61 262.57	*100.0%*
Fees				
General Partners				
Manag. fees (2% CC + NAV)	5 383.45		15 888.20	
% of total GP compensation		*91.9%*		*57.5%*
Total (variable + fees)				
Limited Partners	-8 117.07		49 539.75	
General Partners	5 860.53		27 611.02	

ETF	EMEA VC	EMEA LBO
as a percentage of paid-in capital	683.93	2 860.31

LP profits amount to USD 55.0 bn with a carried interest of USD 28.2 bn. LPs have collected 66.1 percent of the proceeds, and GPs 33.9 percent, notably because LPs have registered losses in 1999, 2000 and 2001 (carried interest was equal to zero[68]). Reintegrating USD 33.2 bn of management fees (two percent of fund size and NAVs, without extensions), the total compensation of LPs and GPs is respectively USD 55.0 bn and 60.5 bn. The overall compensation of GPs is higher than that of the LPs. Management fees, as calculated, represented 53.3 percent of the compensation over 1981-2001. We then computed the fees for the equivalent of the ETF that we have built: the total fees would have theoretically been USD 2.1 bn (excluding transaction costs).

2.3.2.2. US LBO

We reproduced the same exercise for US LBO funds (1984-2001). A two percent management fee on fund size and NAVs represents 17.8 percent of the fund size (13.3 percent with a 1.5 percent fee; and 22.2 percent with a 2.5 percent fee) and 12.3 percent of the fund size with a two percent fee calculated on the paid-in and then the NAVs (9.2 percent of fund size with a 1.5 percent fee, and 15.4 percent of fund size with a 2.5 percent fee). The difference between the two main scenarios is 546 bps. LPs have collected USD 76.6 bn over the period (75.8 bn excluding outliers[69]), while GPs collected USD 19.9 bn in carried interest. LPs have hence collected 79.3 percent of the proceeds of the funds. Assuming a two percent annual management fee on fund size and then NAVs, GPs have collected USD 52.1 bn (USD 46.9 bn excluding VY 1999). The total compensation is respectively USD 76.6 bn for LPs and 72.0 for GPs (respectively USD 75.8 and 66.9 bn excluding VY 1999). Fees represent 72.3 percent of the compensation of GPs (70.2 percent excluding VY 1999).

We then ran the same calculation with a 1.5 percent management fee on fund size and on NAVs (unreported). Fees collected by GPs amount to USD 39.0 bn (USD 35.2 bn excluding VY 1999). Total compensation is thus USD 89.6 bn for LPs (assuming that the savings on fees from the two percent scenario above all come back to LPs) and USD 60.0 bn for GPs (respectively USD 88.8 and 55.1, excluding VY 1999). Fees represent 66.2 percent (63.8 percent excluding VY 1999) of the total compensation of GPs. This is assuming all else equal (including transaction costs and other deal-related costs), which would not be the case. Assuming that management fees are reduced, the difference would come back to the GP as savings or would be invested and hence generate additional profits and carried interest. The equivalent of ETF fees would have been USD 1.5 bn (excluding transaction costs).

[68] GP are deemed to invest at least 1 percent of the fund size alongside LPs; they hence support a loss on this fraction of their commitment.

[69] Excluding vintage year 1999, which exhibits profits without actually refunding the total commitment. We have excluded this vintage year, as its cash-flows are probably not completely reported.

As a side analysis, we explored the alternatives offered by Bain Capital to LPs during its last fund raising [unreported]:

i) either a one percent management fee on fund size and NAV (without extension) and a carried interest of 30 percent. This option would have generated a profit of 65.8 bn to LPs; a carried interest of 29.9 bn for GPs and fees of 36.6 bn. The total compensation over 1984-2001 (excluding VY 1999) would have been USD 77.5 bn for LPs (reintegrating management fees saved) and USD 66.5 bn for GPs (management fees representing 55.0 percent of their compensation).

ii) or a 1.5 percent management fee and a 20 percent carried interest. This option would have generated USD 75.8 bn of profits for LPs and USD 19.9 bn of carried interest for GPs. The management fees would have amounted to USD 48.3 bn over the period (excluding VY 1999). The total compensation would have been USD 75.8 bn for LPs and USD 68.3 bn for GPs (management fees representing 70.8 percent of their compensation).

In the first scenario (one percent-30 percent), the management fees saved amount to USD 11.7 bn, that is to say 24.3 percent of the fees collected in the second scenario (1.5 percent-20 percent). However, GPs compensate this loss in fees by actually increasing their carried interest by USD 10 bn. Assuming that the management fees saved in the first scenario integrally come back to the LP, the total compensation is USD 66.5 bn for GPs and 77.6 bn for LPs under a one percent-30 percent scenario; and USD 68.3 bn for GPs and 78.8 bn for LPs under a 1.5 percent-20 percent scenario (over 1981-2001, excluding 1999) assuming all else being equal. The one percent-30 percent conditions are hence only marginally more attractive than a 1.5 percent-20 percent scenario: an increase of returns of 2.3 percent over 16 years, or a 0.15 percent increase of return per year.

2.3.2.3. EMEA VC

For EMEA VC (1981-2001), the two percent management fee on fund size and the NAV represent 21.3 percent. With a 2.5 percent fee (which appears frequently as a choice for small institutional VC funds and retail products), the amount represents 26.7 percent of committed capital (this would explain the low level of PICC, assuming a ‘no reinvestment’ policy). In actuality, LPs have lost USD 8.1 bn., while GPs have earned USD 477 mn of carried interest. The overall compensation of GPs over the period is USD 5.9 bn (management fees representing 91.9 percent of it). The equivalent in ETF fees would have been USD 683.9 mn (excluding transaction costs).

2.3.2.4. EMEA LBO

For EMEA LBO (1984-2001), the two percent management fee on fund size and NAVs represents 19.6 percent of committed capital. With 1.5 percent fees (which appears increasingly as the choice for large LBO funds), it represents 14.7 percent of committed capital. Over 1984-2001, LPs have earned USD 49.6 bn[70]. Carried interest was USD 11.7 bn and management fees 15.9 bn, totaling 27.6 bn. 57.5 percent of GP compensation came from management fees. The equivalent of ETF fees would have been USD 2.9 bn (excluding transaction costs).

2.3.3. Top quartile US VC, US LBO, EMEA VC and EMEA LBO funds

We repeated the operation for top quartile funds[71] [Table 12]. In US VC, there is no VY with losses as compared to the full sample considered above. Profits for LPs are higher (USD 83.2 bn) for top quartile funds than for average funds (when including loss-making quartiles) over 1981-2001. This is verified for US LBO in 1986-1989 and 1992-2001 (USD 78.4 bn for top quartile vs. 76.6 bn for the full sample[72]), as well as for EMEA VC (USD 778 mn vs. –10.1 bn for 1993-2001, the only period with available data for top quartile funds for EMEA). The only exception is EMEA LBO, where the full sample generates a higher profit (USD 49.5 bn) than the top quartile funds alone (USD 38.0 bn)[73]. Carried interest represents a higher share of the compensation of top quartile GPs: 63.7 percent (vs. 46.7 percent for full sample) for US VC; 57.9 percent (vs. 25.4 percent) for US LBO; 28.3 percent (vs. 8.1 percent) for EMEA VC; 61.0 percent (vs. 42.5 percent) for EMEA LBO.

2.3.4. Analysis of the performances of funds

Once the fees were calculated, we rebuilt the gross performances of the funds, as well as of their respective indexes. Table 4 provides the performance data for realized funds (1981-2001) and active funds (2002-2009). We reported the capital-weighted average monthly IRR and the capital-weighted average TVPI. We then reported the quarterly net performance calculated on the cash-flows and obtained a quarterly weighted average IRR and a quarterly weighted average DPI. We calculated a quarterly gross performance based on the PME+ method and indexes for US VC, US LBO, EMEA VC and EMEA LBO. We repeated the operation for top quartile funds. At this stage, we cannot yet compare the performances (gross or net)

[70] 46.8 bn excluding vintage years 1988 and 1996. These years provide profits without having refunded the commitments. This is probably related to incomplete cash-flows reported.

[71] Unfortunately, there is no further details than quartile performance in the database. It is, hence, not possible to refine at deciles levels.

[72] Excluding VY 1999, this does not holds true: LPs earnings are USD 72.9 bn for top quartile vs. USD 75.8 bn for the full sample.

[73] Excluding VY 1996, this holds true: LPs earnings are USD 36.4 bn for top quartile vs. USD 46.9 bn for the full sample.

of indexes and PEFs. We integrated the management fees calculated above in the funds and in the equivalent of the ETF (calculated through the PME+ method).

Table 13 provides data for the calculated gross and net performances by vintage and their benchmark for US VC funds (1981-2001), US LBO funds (1984-2001), and EMEA VC and LBO funds (1992-2001). Table 14 reproduces the exercise for top quartile funds.

2.3.4.1. Carried interest: no material impact

Carried interest does not change the overall out- or under-performance of a given VY as compared to its benchmark: when a VY underperforms the index on a net basis, it also underperforms it on a gross basis. The very few exceptions[74] do not invalidate this statement, as they usually concern one of the two performance measurement and not both. Hence, the carried interest does not 'make or break' the performance of a VY either for average or top quartile funds. We confirm the results from Robinson and Sensoy [2012] in that respect.

Robinson and Sensoy [2012] report a median lifetime fee of 21.4 percent of committed capital for VC funds, and 14.2 percent for LBO funds. Assuming five years of investment and five of divestment periods with no extensions, we find an average management fee on fund size (investment period) and then on NAVs (divestment period) of 17.6 percent for US VC (assuming a two percent management fee), and 17.8 percent for US LBO (12.3 percent for US VC and 12.3 percent for US LBO, if the management fees are calculated on the paid-in and the NAV).

2.3.4.2. Average American funds: better IRRs; indexes: better multiples

Overall, US VC and LBO funds perform in line with the calculated benchmarks. US VC funds show an outperformance of 15 IRR bps (net) and 102 bps (gross), while the index shows an outperformance of 0.06x (net) and 0.04x (gross). US LBO funds show an outperformance of 10 (net) and 91 (gross) bps, while the index shows an outperformance of 0.04x (net) and 0.05x (gross). Assuming a simple eight percent hurdle rate on gross returns, at fund level (with all the reserves associated with this reasoning, see Chapter 0), 16 VYs out of the 21 considered show a performance about this threshold on a capital-weighted average basis for US VC. The proportion is 13 vintages out of 18 for US LBO.

[74] VC USA 1981: the net DPI of the benchmark is higher than the net DPI of the funds, whereas all other net and gross elements of performance favor the funds. VC USA 1986: the gross capital-weighted average IRR of the funds is better than that of the benchmark, whereas all other net and gross elements of performance favor the funds. VC USA 1988: the net DPI of the benchmark is higher than the net DPI of the funds, whereas all other net and gross elements of performance favor the funds. LBO USA 1992: the net DPI of the benchmark is higher than the net DPI of the funds, whereas all other net and gross elements of performance favor the funds.

Top quartile funds exhibit a strong outperformance as measured by the IRR and by the multiple of investments, on a gross and net basis, as compared to the index. The index beats US VC top quartile funds only in 1982 and 1983. For US LBO, with the exception of net DPI 1988, funds systematically outperform the index. Top quartile US VC funds show an outperformance of 2,683 bps (net) and 4047 bps (gross). In terms of multiple, the difference is 1.01x (net) and 1.3x (gross). Top quartile US LBO funds show an outperformance of 1,548 bps (net) and 1,796 bps (gross). In terms of multiple, the difference is 0.73x (net) and 0.94x (gross).

2.3.4.3. EMEA funds: very distinct performance

Due to a lack of index data, EMEA VC and LBO funds are benchmarked only over 1993-2001[75]. EMEA VC funds have lost overall on average 50 percent of their value over the period, while the index remained at par on a multiple basis (slightly negative in terms of IRR). EMEA LBO funds exhibit a strong IRR and multiple (net and gross, these unusual figures are confirmed by Cornelius *et al.* [2013, p. 102]) while the index shows a small loss on a multiple and IRR basis. Assuming an eight percent hurdle rate, EMEA VC shows nine VYs (out of 20) with a capital weighted average gross IRR above this threshold. The proportion is 16 out of 17 for EMEA LBO.

Top quartile funds show a significant to strong outperformance for EMEA VC and LBO. The index beats EMEA VC top quartile funds only in 1993 and 2000[76]. Top quartile EMEA VC funds show an outperformance of 772 bps (net) and 783 bps (gross). As for multiples, the difference is 0.25x (net) and 0.26x (gross). Top quartile EMEA LBO funds systematically outperform the index[77]. They show an outperformance of 2,464 bps (net) and 2,766 bps (gross). As for multiples, the difference is 1.12x (net) and 1.39x (gross).

The lack of depth of data for the EMEA indexes, combined with a certain unreliability and heterogeneity coming from the data, limits the interpretations. However, the average fund size of EMEA VC funds for the full sample is higher (USD 65.2 mn) than the average fund size for top quartile of EMEA VC funds (USD 56.5 mn). The lack of performance of EMEA VC funds cannot be attributed to a lack of size (top quartile funds would otherwise be affected).

[75] This might explain why indexes systematically and substantially outperform EMEA VC funds, while EMEA LBO funds systematically and substantially outperform the index [see introduction for the 'wave pattern' phenomenon].
[76] Vintage years 1995 and 1999 are excluded for EMEA VC top quartile funds due to incoherent cash-flows.
[77] Vintage year 1996 is excluded for EMEA LBO top quartile funds due to incoherent cash-flows.

Table 12 – Compensation for LPs and GPs (top US and EMEA VC and LBO)

Calculation of management fees based on committed capital and paid-in capital, with a five-year investment period and different levels of management fees and carried interest; of the total respective compensation for LPs and GPs by VY, based on the assumption of a 2% management fee on committed capital with a five-year investment period for US VC (1981-2001), US LBO (1984-1993), EMEA VC (1981-1993) and EMEA LBO funds (EU STOXX TMI). Also provides the equivalent of the management fees charged by an ETF of the NASDAQ Composite, Wilshire 5000, STOXX indexes.

Management fees	**US VC**				**US LBO**			
Investment Period (5 years)								
as a percentage of committed capital								
1.5%	4 456.46				6 232.36			
2.0%	**5 941.94**				**8 309.81**			
2.5%	7 427.43				10 387.27			
as a percentage of paid-in capital								
1.5%	1 857.41				2 607.29			
2.0%	**2 476.55**				**3 476.38**			
2.5%	3 095.69				4 345.48			
Divestment Period (5 years)								
as a percentage of NAV								
1.5%	4 427.71				4 444.27			
2.0%	**5 903.62**				**5 925.70**			
2.5%	7 379.52				7 407.12			
Total Investment + Divestment period		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**
as a % of committed capital + % of NAV								
1.5%	8 884.17	14.91%	92.48%	107.40%	10 676.63	12.85%	91.49%	104.34%
2.0%	**11 845.56**	**19.88%**	92.48%	112.37%	**14 235.51**	**17.13%**	91.49%	108.62%
2.5%	14 806.95	24.85%	92.48%	117.34%	17 794.39	21.41%	91.49%	112.90%
as a % of paid-in capital (5 years) + % of NAV								
1.5%	6 285.13	10.55%	92.48%	103.03%	7 051.56	8.49%	91.49%	99.97%
2.0%	**8 380.17**	**14.07%**	92.48%	106.55%	**9 402.08**	**11.31%**	91.49%	102.80%
2.5%	10 475.21	17.58%	92.48%	110.07%	11 752.60	14.14%	91.49%	105.63%

Compensation	**US VC**		**US LBO**	
Variable				
Limited Partners				
Total Profit	83 216.29	*80.0%*	78 381.72	*80.0%*
General Partners				
Carried interest (20%)	20 804.07	*20.0%*	19 595.43	*20.0%*
Total Variable	104 020.37	*100.0%*	97 977.15	*100.0%*
Fees				
General Partners				
Manag. fees (2% CC + NAV)	11 845.56		14 235.51	
% of total GP compensation		*36.3%*		*42.1%*
Total (variable + fees)				
Limited Partners	83 216.29		78 381.72	
General Partners	32 649.64		33 830.94	

ETF	**US VC**	**US LBO**
as a percentage of paid-in capital	652.01	382.95

Table 12 (continued)

Management fees	EMEA VC				EMEA LBO			
Investment Period (5 years)								
as a percentage of committed capital								
1.5%	351.90				2 620.85			
2.0%	**469.21**				**3 494.47**			
2.5%	586.51				4 368.09			
as a percentage of paid-in capital								
1.5%	128.82				1 013.73			
2.0%	**171.76**				**1 351.65**			
2.5%	214.69				1 689.56			
Divestment Period (5 years)								
as a percentage of NAV								
1.5%	360.91				1 741.46			
2.0%	**481.21**				**2 321.94**			
2.5%	601.52				2 902.43			
Total Investment + Divestment period		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**		**As a % of committed**	**Paid-in to committed**	**Fees + paid in to committed**
as a % of committed capital + % of NAV								
1.5%	712.81	15.19%	78.96%	94.15%	4 362.31	12.48%	90.47%	102.95%
2.0%	**950.42**	**20.26%**	78.96%	99.21%	**5 816.41**	**16.64%**	90.47%	107.11%
2.5%	1 188.02	25.32%	78.96%	104.28%	7 270.52	20.81%	90.47%	111.27%
as a % of paid-in capital (5 years) + % of NAV								
1.5%	489.73	10.44%	78.96%	89.39%	2 755.19	7.88%	90.47%	98.35%
2.0%	**652.97**	**13.92%**	78.96%	92.87%	**3 673.59**	**10.51%**	90.47%	100.98%
2.5%	816.21	17.40%	78.96%	96.35%	4 591.99	13.14%	90.47%	103.61%

Compensation	EMEA VC		EMEA LBO	
Variable				
Limited Partners				
Total Profit	778.24	*67.5%*	38 002.38	*80.7%*
General Partners				
Carried interest (20%)	374.30	*32.5%*	9 103.91	*19.3%*
Total Variable	1 152.54	*100.0%*	47 106.28	*100.0%*
Fees				
General Partners				
Manag. fees (2% CC + NAV)	950.42		5 816.41	
% of total GP compensation		*71.7%*		*39.0%*
Total (variable + fees)				
Limited Partners	778.24		38 002.38	
General Partners	1 324.72		14 920.32	

ETF	EMEA VC	EMEA LBO
as a percentage of paid-in capital	52.88	795.81

Table 13 – Compared capital-weighted gross and net performance of US/EMEA VC and LBO

This table provides capital-weighted average IRRs and DPIs of US VC, US LBO funds, for VYs 1981 to 2001 (VC) and 1984 to 2001 (LBO); and EMEA VC and LBO funds, for VYs 1992 to 2001, as calculated from the net cash-flows provided by Thomson ONE Banker (as of 31 December 2011), on a quarterly basis (the 'quarterly net performance'). The performances are calculated net of fees and gross of fees. An index's gross performance (IRR and DPI) is calculated by applying the drawdowns and distribution patterns from the PEFs. Indexes used are the NASDAQ Composite for US VC; the Wilshire 5000 TM Full Cap for US LBO; a combined STOXX EU Tech and STOXX EU Healthcare

		US Venture Capital								US LBO							
		Funds				Benchmark (index)				Funds				Benchmark (index)			
		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross	
	Vintage year	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weigh. aver. IRR (%)	Capital-weigh. aver. DPI	Index for average IRR (based on Nasdaq Comp.) (%)	Index for average DPI (based on Nasdaq Comp.)	Index for average IRR (based on Nasdaq Comp.)	Index for average DPI (based on Nasdaq Comp.)	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on Wilshire 5000 TM Full Cap) (%)	Index for aver. DPI (b. on Wilshire 5000 TM Full Cap)	Index for aver. IRR (b. on Wilshire 5000 TM Full Cap) (%)	Index for aver. DPI (b. on Wilshire 5000 TM Full Cap)
Fully realized*	1981	**10.63**	1.88	**12.10**	**2.10**	10.44	**1.96**	10.45	1.96	-	-	-	-	-	-	-	-
	1982	4.46	1.39	4.87	1.44	**12.19**	**2.86**	**12.19**	**2.86**	-	-	-	-	-	-	-	-
	1983	7.81	1.75	8.88	1.92	**12.09**	**2.85**	**12.12**	**2.85**	-	-	-	-	-	-	-	-
	1984	5.64	1.45	6.45	1.55	**12.13**	**2.40**	**12.13**	**2.40**	**26.86**	**3.96**	**29.94**	**4.69**	15.78	3.45	15.78	3.45
	1985	9.77	1.95	11.11	2.18	**13.09**	**2.94**	**13.10**	**2.94**	**34.45**	**2.54**	**37.11**	**2.90**	14.40	2.13	14.40	2.13
	1986	13.58	2.82	**15.26**	3.27	**14.64**	**3.44**	14.64	**3.44**	**24.41**	**4.37**	**26.52**	**5.20**	14.35	3.61	14.35	3.61
	1987	13.85	2.25	15.66	2.55	**16.40**	**3.01**	**16.40**	**3.01**	11.49	1.97	13.11	2.21	**14.21**	**2.68**	**14.22**	**2.72**
	1988	**20.45**	2.52	**22.91**	**2.89**	18.32	**2.61**	18.33	2.61	11.31	1.64	12.87	1.79	**15.72**	**2.30**	**15.72**	**2.30**
	1989	18.05	2.37	20.32	2.71	**21.16**	**3.02**	**21.17**	**3.02**	**21.61**	**2.34**	**24.00**	**2.65**	15.63	2.13	15.63	2.13
	1990	**25.21**	**2.60**	**28.16**	**2.98**	20.81	2.41	20.81	2.41	13.07	1.80	14.78	1.97	**18.77**	**2.57**	**18.77**	**2.57**
	1991	15.28	1.91	17.39	2.14	**22.13**	**2.63**	**22.13**	**2.63**	**23.99**	**2.99**	**26.69**	**3.46**	18.45	2.56	18.45	2.56
	1992	**35.78**	**3.31**	**39.98**	**3.89**	23.35	2.45	23.35	2.45	**20.23**	1.81	**22.81**	**1.99**	18.58	**1.84**	18.58	1.84
	1993	**38.23**	**3.32**	**41.97**	**3.87**	24.70	2.35	24.70	2.35	**18.55**	1.87	**21.24**	**2.09**	17.83	1.87	17.83	1.87
	1994	**46.46**	**4.28**	**51.62**	**5.09**	25.26	2.19	25.26	2.19	5.26	1.24	5.74	1.27	**10.73**	**1.50**	**10.73**	**1.50**
	1995	**61.38**	**3.72**	**67.94**	**4.37**	28.51	1.80	28.51	1.80	**10.08**	**1.48**	**11.66**	**1.60**	7.69	1.34	7.69	1.34
	1996	**86.46**	**4.15**	**95.95**	**4.92**	30.48	1.64	30.48	1.64	1.48	1.06	1.63	1.07	**5.62**	**1.23**	**5.62**	**1.23**
	1997	**45.23**	**2.21**	**51.47**	**2.50**	12.85	1.25	12.86	1.25	**6.14**	**1.28**	**7.12**	**1.34**	2.91	1.13	2.91	1.13
	1998	**13.84**	**1.44**	**15.35**	**1.53**	(2.93)	0.91	(2.93)	0.91	(1.65)	0.92	(1.65)	0.92	**1.57**	**1.08**	**1.57**	**1.08**
	1999	N/A	0.53	N/A	0.53	(5.01)	**0.76**	(5.01)	**0.76**	0.66	1.03	0.66	1.03	**2.67**	**1.13**	**2.67**	**1.13**
	2000	N/A	0.60	N/A	0.60	0.14	**1.01**	0.15	**1.01**	**9.32**	**1.37**	**9.53**	**1.38**	5.02	1.20	5.03	1.20
	2001	N/A	0.77	N/A	0.77	5.90	**1.20**	5.91	**1.20**	**10.28**	**1.32**	**11.13**	**1.37**	6.67	1.20	6.67	1.20
	Av. 1981-2001	**8.19**	1.34	**9.04**	1.40	8.02	**1.40**	8.02	**1.44**	-	-	-	-	-	-	-	-
	Av. 1984-2001	-	-	-	-	-	-	-	-	**7.07**	1.33	**7.88**	1.38	6.97	**1.37**	6.97	**1.43**
	Av. 1992-2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

** In bold, the higher DPI for a given vintage year is highlighted between the funds DPI and the index DPI

Table 13 (continued)

EMEA Venture Capital								EMEA LBO							
Funds				Benchmark (index)				Funds				Benchmark (index)			
Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross	
Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on STOXX EU TMI Tech & HC) (%)	Index for aver. DPI (b. on STOXX EU TMI Tech & HC)	Index for aver. IRR (b. on STOXX EU TMI Tech & HC) (%)	Index for aver. DPI (b. on STOXX EU TMI Tech & HC)	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on STOXX EU TMI) (%)	Index for aver. DPI (b. on STOXX EU TMI)	Index for aver. IRR (b. on STOXX EU TMI) (%)	Index for aver. DPI (b. on STOXX EU TMI)
11.74	2.66	12.45	2.87	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.24	1.81	9.38	2.00	-	-	-	-	-	-	-	-	-	-	-	-
7.67	1.80	8.33	1.91	-	-	-	-	19.02	2.66	19.97	2.91	-	-	-	-
7.60	1.66	8.31	1.77	-	-	-	-	-	-	-	-	-	-	-	-
12.09	1.88	13.55	2.07	-	-	-	-	20.48	2.82	22.92	3.27	-	-	-	-
4.65	1.37	5.39	1.45	-	-	-	-	7.47	1.46	8.58	1.57	-	-	-	-
6.12	1.37	6.89	1.43	-	-	-	-	13.07	1.72	13.07	1.72	-	-	-	-
10.06	1.74	11.04	1.86	-	-	-	-	8.86	1.43	9.58	1.49	-	-	-	-
15.29	1.99	17.24	2.22	-	-	-	-	1.97	1.08	3.05	1.14	-	-	-	-
2.17	1.08	2.17	1.08	-	-	-	-	11.88	1.50	13.42	1.61	-	-	-	-
12.46	1.87	14.46	2.11	**22.10**	**3.18**	**22.10**	**3.18**	**19.48**	**2.12**	**21.12**	**2.34**	13.87	1.71	13.87	1.71
N/A	0.67	N/A	0.67	26.18	**1.92**	26.18	**1.92**	**25.15**	**2.04**	**27.32**	**2.24**	15.80	1.74	15.80	1.74
9.15	1.60	9.46	1.64	**16.03**	**1.88**	**16.03**	**1.88**	**34.78**	**2.61**	**38.04**	**2.97**	13.94	1.55	13.95	1.55
N/A	0.27	N/A	0.27	6.08	**1.03**	6.08	**1.03**	**49.53**	**2.14**	**53.71**	**2.33**	16.14	1.32	16.14	1.32
(8.98)	0.78	(8.98)	0.78	**15.08**	**1.29**	**15.08**	**1.29**	**13.50**	**1.54**	**13.50**	**1.54**	7.34	1.26	7.35	1.26
(0.32)	0.99	(0.32)	0.99	**4.62**	**1.10**	**4.62**	**1.10**	**11.51**	**1.61**	**12.85**	**1.73**	(0.08)	1.00	(0.07)	1.00
(10.20)	0.62	(10.20)	0.62	**(2.08)**	**0.93**	**(2.07)**	**0.93**	**11.53**	**1.60**	**12.34**	**1.67**	(2.06)	0.91	(2.06)	0.91
N/A	0.38	N/A	0.38	(7.16)	**0.68**	(7.15)	**0.68**	**11.85**	**1.55**	**13.69**	**1.68**	0.96	1.04	0.96	1.04
N/A	0.34	N/A	0.34	(4.82)	**0.78**	(4.81)	**0.78**	**20.85**	**1.92**	**23.18**	**2.13**	1.80	1.07	1.81	1.07
N/A	0.42	N/A	0.42	(0.74)	**0.97**	(0.73)	**0.97**	**27.43**	**1.84**	**31.11**	**2.05**	9.76	1.26	9.77	1.26
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N/A	0.50	N/A	0.50	**(0.09)**	**1.00**	**(0.09)**	**1.00**	**17.76**	**1.76**	**19.66**	**1.91**	(0.41)	0.99	(0.45)	0.99

Table 14 – Compared capital-weighted performance of top quartile US/EMEA VC and LBO

This table provides capital-weighted average IRRs and DPIs of top quartile US VC and LBO funds; and top quartile EMEA VC and LBO funds, for VYs 1980 to 2001, as calculated from the net cash-flows provided by Thomson ONE Banker (as of 31 December 2011), on a quarterly basis (the 'quarterly net performance'). The performances are calculated net of fees and gross of fees. An index's gross performance (IRR and DPI) is calculated by applying the drawdowns and distribution patterns from the PEFs. Indexes used are the NASDAQ Composite for US VC; the Wilshire 5000 TM Full Cap for US LBO; a combined STOXX EU Tech and STOXX EU Healthcare for EMEA VC; and the STOXX EU TMI for EMEA LBO.

		US Venture Capital								US LBO							
		Funds				Benchmark (index)				Funds				Benchmark (index)			
		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross	
	Vintage year	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weigh. aver. IRR (%)	Capital-weigh. aver. DPI	Index for average IRR (based on Nasdaq Comp.)	Index for average DPI (based on Nasdaq Comp.)	Index for average IRR (based on Nasdaq Comp.)	Index for average DPI (based on Nasdaq Comp.)	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on Wilshire 5000 TM Full Cap) (%)	Index for aver. DPI (b. on Wilshire 5000 TM Full Cap)	Index for aver. IRR (b. on Wilshire 5000 TM Full Cap)	Index for aver. DPI (b. on Wilshire 5000 TM Full Cap)
Fully realized*	1981	**16.59**	**2.47**	**18.71**	**2.86**	10.06	1.81	10.07	1.81	-	-	-	-	-	-	-	-
	1982	11.12	1.98	12.45	2.21	**11.83**	**2.61**	**11.83**	**2.61**	-	-	-	-	-	-	-	-
	1983	14.48	2.85	16.14	3.31	**13.05**	**3.36**	**13.05**	**3.36**	-	-	-	-	-	-	-	-
	1984	**15.45**	**2.39**	**17.27**	**2.71**	11.81	2.18	11.81	2.18	-	-	-	-	-	-	-	-
	1985	**19.18**	**2.94**	**21.47**	**3.43**	12.63	2.38	12.63	2.38	-	-	-	-	-	-	-	-
	1986	**17.24**	**3.90**	**19.18**	**4.60**	14.86	3.67	14.87	3.67	**35.06**	**8.28**	**37.42**	**10.03**	14.18	3.73	14.18	3.73
	1987	**23.56**	**3.58**	**26.13**	**4.21**	16.92	2.97	16.93	2.97	**23.14**	**2.47**	**25.88**	**2.85**	15.77	2.32	15.77	2.32
	1988	**31.68**	**3.49**	**34.99**	**4.10**	18.48	2.48	18.49	2.48	**20.85**	2.63	**23.44**	**3.03**	17.13	**2.73**	17.13	2.73
	1989	**40.08**	**4.25**	**44.26**	**5.05**	18.58	2.09	18.58	2.09	**42.29**	**3.99**	**45.75**	**4.64**	15.43	2.25	15.43	2.25
	1990	**47.64**	**4.50**	**52.56**	**5.36**	21.61	2.20	21.62	2.20	-	-	-	-	-	-	-	-
	1991	**32.62**	**3.55**	**36.27**	**4.19**	22.36	2.56	22.37	2.56	-	-	-	-	-	-	-	-
	1992	**65.68**	**6.34**	**72.27**	**7.65**	24.10	2.41	24.10	2.41	**53.04**	**2.64**	**58.42**	**3.05**	15.89	1.62	15.89	1.62
	1993	**66.69**	**6.26**	**72.86**	**7.56**	25.66	2.45	25.66	2.45	**39.07**	**2.71**	**43.24**	**3.14**	17.43	1.78	17.43	1.78
	1994	**58.79**	**5.64**	**65.05**	**6.79**	25.81	2.19	25.81	2.19	**23.71**	**1.93**	**25.35**	**2.12**	10.47	1.37	10.48	1.37
	1995	**129.45**	**8.31**	**140.13**	**10.13**	33.13	2.07	33.13	2.07	**31.83**	**2.24**	**34.34**	**2.48**	11.27	1.38	11.27	1.38
	1996	**181.98**	**12.49**	**199.56**	**15.34**	32.99	1.73	32.99	1.73	**18.96**	**1.81**	**21.23**	**2.01**	5.26	1.20	5.26	1.20
	1997	**150.90**	**4.87**	**168.77**	**5.83**	27.24	1.37	27.24	1.37	**14.43**	**1.60**	**16.69**	**1.76**	3.19	1.13	3.19	1.13
	1998	**140.92**	**3.16**	**164.41**	**3.69**	3.23	1.05	3.23	1.05	**18.55**	**1.99**	**20.98**	**2.23**	1.77	1.08	1.77	1.08
	1999	**4.82**	**1.25**	**5.29**	**1.28**	(2.14)	0.89	(2.14)	0.89	**15.55**	**1.68**	**17.29**	**1.84**	2.85	1.12	2.85	1.12
	2000	**2.96**	**1.12**	**3.01**	**1.12**	1.47	1.06	1.47	1.06	**23.73**	**2.12**	**25.96**	**2.35**	5.10	1.21	5.10	1.21
	2001	**7.80**	**1.26**	**8.71**	**1.31**	6.31	1.21	6.31	1.21	**32.72**	**2.19**	**36.25**	**2.48**	7.41	1.22	7.41	1.22
	Av. 1981-2001	**38.85**	**2.57**	**42.49**	**2.92**	12.02	1.56	12.02	1.62	-	-	-	-	-	-	-	-
	Av. 1986-2001	-	-	-	-	-	-	-	-	**23.27**	**2.09**	**25.75**	**2.34**	7.79	1.36	7.79	1.40
	Av. 1993-2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension periods.

** In bold, the higher DPI for a given vintage year is highlighted between the funds DPI and the index DPI

Table 14 (Continued)

EMEA Venture Capital								EMEA LBO							
Funds				Benchmark (index)				Funds				Benchmark (index)			
Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross		Quarterly net		Quarterly gross	
Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on STOXX EU TMI Tech & HC) (%)	Index for aver. DPI (b. on STOXX EU TMI Tech & HC)	Index for aver. IRR (b. on STOXX EU TMI Tech & HC) (%)	Index for aver. DPI (b. on STOXX EU TMI Tech & HC)	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Capital-weight. aver. IRR (%)	Capital-weigh. aver. DPI	Index for aver. IRR (b. on STOXX EU TMI) (%)	Index for aver. DPI (b. on STOXX EU TMI)	Index for aver. IRR (b. on STOXX EU TMI) (%)	Index for aver. DPI (b. on STOXX EU TMI)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29.29	1.61	30.29	**1.74**	**46.08**	**1.62**	**46.08**	1.62	**23.11**	**2.52**	**24.72**	**2.79**	14.07	1.86	14.07	1.86
20.80	**2.75**	**23.25**	**3.18**	13.43	1.82	13.43	1.82	**46.25**	**2.95**	**50.75**	**3.45**	14.39	1.49	14.40	1.49
N/A	0.29	N/A	0.29	41.45	1.03	41.45	1.03	**108.74**	**3.31**	**119.61**	**3.73**	17.07	1.36	17.07	1.36
35.08	**1.42**	**37.69**	**1.47**	21.88	1.25	21.88	1.25	**27.26**	**2.29**	**27.26**	**2.29**	6.05	1.23	6.05	1.23
50.25	**2.06**	**52.47**	**2.24**	3.21	1.05	3.21	1.05	**30.47**	**2.45**	**33.14**	**2.79**	1.87	1.08	1.88	1.08
33.57	**2.52**	**36.76**	**2.89**	(3.57)	0.89	(3.57)	0.89	**16.79**	**1.93**	**18.58**	**2.12**	(1.83)	0.92	(1.83)	0.92
3.05	**1.19**	**3.05**	**1.19**	(5.81)	0.71	(5.81)	0.71	**26.04**	**2.48**	**29.03**	**2.81**	0.94	1.04	0.95	1.04
(9.46)	0.68	(9.46)	0.68	**(6.04)**	**0.77**	**(6.03)**	**0.77**	**30.75**	**2.77**	**34.20**	**3.20**	2.54	1.10	2.55	1.10
7.35	**1.30**	**8.46**	**1.37**	(0.44)	0.98	(0.43)	0.98	**32.95**	**2.02**	**37.66**	**2.29**	10.25	1.26	10.26	1.26
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.89	**1.29**	**10.00**	**1.30**	2.17	1.04	2.17	1.06	**28.21**	**2.25**	**31.24**	**2.53**	3.57	1.13	3.58	1.14

2.3.4.4. Potential explanation of top quartile performance

Interestingly, the performance of the benchmark is also higher for US VC top quartile funds (an IRR of 12.0 percent and a multiple of 1.56-1.62x) than for the average funds (8.0 percent and 1.40-1.44x). Hence, the investment timing of top quartile funds plays a role in their outperformance: 400 supplementary bps are generated thanks to the timing of the cash-flows (a 0.16-0.18x in terms of multiple). Top quartile fund managers may be better at deploying their capital than average fund managers. This is confirmed for EMEA funds: for VC, the difference is 226 supplementary bps (and a 0.04–0.06x in terms of multiple); for LBO, the difference is 398-403 bps (and a 1.14-1.15x in terms of multiple).

This might also be idiosyncratic or merely coincidental; for US LBO only an 82 bps difference appears, thanks to the timing of the cash flows. The multiple is in favor of the benchmark of average funds (1.37-1.43x) as compared to top quartile US LBO funds (1.36-1.40x). Given the low quality of data, the difference of the multiple is not representative. Another possibility is that average US LBO fund managers use more dividend recaps than the top quartile (a practice which is less frequent in Europe), hence explaining this difference.

2.3.4.5. Partial confirmation of performance cycles in private equity

Looking at the relative performances of funds and indexes, cycles appear. The most visible ones are in US VC (the longest period of time and the largest amount of data available). The cycle where funds outperform the index is 1992-1998. The cycles where the index outperforms the funds are 1982-1987 and one starting in 1999. Transition years are 1981, 1988, 1990 and 1991. The picture is less clear for US LBO, either because cycles are shorter (2 to 3 years on average) than for US VC (6 to 7 years), or because data is insufficient to clearly identify them. Dividend recaps might explain the lack of clear equity cycles. EMEA might exhibit longer cycles, considering the performances of EMEA VC for the period 1981-1991 which are all positive. Through strong, performances of EMEA LBO funds might also have been below that of the index for the period 1984-1991.

2.4. Conclusion, Discussion and Limits

This Chapter has several theoretical (2.4.1) and practical (2.4.2) implications. It is nevertheless confronted with limitations (2.4.3).

2.4.1. Use for academic purposes

Though cash-flows are verifiable and much more difficult to manipulate than NAVs[78], there is little prospect in the short term of the emergence of a comprehensive database recording all the PEFs' cash-flows measured consistently and coherently. We have hence to work with the available but imperfect data to assess performance.

On a net basis, over 20 years of US PE does not deliver any significant out- or underperformance. American PE performs slightly better in terms of IRR; and indexes do better in terms of DPI (confirming Robinson and Sensoy [2011], which identifies a positive correlation between PE net cash-flows and public equity valuation). On a gross basis, there is a systematic PE outperformance as compared to the TMI. Fees capture the alpha of GPs [confirming the intuition of Brook and Penrice, 2009, p. 188-189, and also confirmed for VC by Korteweg and Nagel, 2013].

Looking at top quartile fund managers, we have identified a systematic net and gross outperformance as compared to the TMI. Investment timing explains part of their performance. Changing the incentives of GPs to invest earlier (by calculating management fees on the capital invested) might increase the overall performance of a fund. This remains to be assessed more in detail in further research.

Carried interest has no material impact on relative performances [confirming Robinson and Sensoy's [2012] finding that high fees do not have a negative impact on net performance]. We further confirm the existence of performance cycles in PE, and that net cash flows are procyclical [Robinson and Sensoy, 2011].

2.4.2. Use for practitioners

On the practitioners' side (notably LP), the debate might focus on the level to be set for hurdle rates. We could not rebuild the equivalent of gross IRR before carried and management fees (the gross IRR calculated in Table 13 and Table 14 is only gross of fees, not of carried interest). However, given the average net IRR return over the long term for US VC and LBO (respectively 8.2 percent and 7.1 percent), the usual eight percent might reduce the alignment of interest between LPs and GPs. It would seem more efficient to calculate a spread with the PME+ (as we designed) and share the resulting alpha between LPs and GPs. The benefits of this approach are multiple:

i) it would avoid sanctioning GPs when the overall macro conditions are weak, and would maintain the incentives to perform consistently;

[78] Either voluntarily, or due to under valuation method requirements (such as the 'fair market value' and the mark-to-market, which are ill adapted to PE).

ii) it would also eliminate the question of the 'zombie companies' kept alive in the portfolio, notably if management fees are calculated on a budget after the end of the investment period and not as a percentage of the residual portfolio value;

iii) it would reduce the incentive to use 'dividend recaps' in LBO, which are actually increasing the risk of an overall operation without any corresponding alpha.

2.4.3. Limitations

We assumed a certain stability at the helm of GPs, and that the terms and conditions determining fund cash-flows and the behavior of GPs do not change materially (a switch in the calculation of management fees in the investment period from a percentage of the fund size to a percentage of the capital paid in would change this, as the incentive would be to deploy the capital faster and would change the cash-flow patterns).

PE still being largely an American activity, a significant share of our results are drawn from data collected on this market, limiting the generalization of our conclusions. The use of cash-flows labeled in USD for EMEA funds flows collected by Thomson could explain some of the erratic data. As performances exhibit wave patterns, a possible bias in favor of EMEA LBO funds might be cycle-related.

EMEA funds would require further research with more comprehensive and less noisy data to draw more solid conclusions when it comes to the region.

2.5. Summary and contribution to the research

The purpose of this Chapter was to model net and gross PEF cash-flows, benchmark them with total market indexes thanks to a new PME-DPI method to identify the alpha (if any) generated by GPs, and explore further the question of the alignment of interest between GPs and LPs.

The conclusion is that over 1981-2001, the overall compensation of GPs is higher than that of the LPs for US and EMEA VC. For US VC, the total compensation of LPs and GPs is respectively USD 55.0 bn and 60.5 bn**.** Management fees, as calculated, represented 53.3 percent of GPs' compensation over 1981-2001. For EMEA VC, LPs have lost USD 8.1 bn, while GPs have earned USD 477 mn of carried interest. The overall compensation of GPs over the period is USD 5.9 bn (management fees representing 91.9 percent of it).

The compensation of LPs by US LBO funds is only 6.4 percent higher than for GPs. GPs have collected USD 46.9 bn (excluding VY 1999). The total compensation is USD 75.8 for LPs and 66.9 bn for GPs (excluding VY 1999).

The compensation of LPs by EMEA LBO funds is 68.8 percent higher than for GPs. However, data quality is subject to caution.

Top quartile US VC funds generate higher profits for LPs (USD 83.2 bn). This is verified for top quartile US LBO in 1986-1989 and 1992-2001 (USD 78.4 bn for top quartile vs. 76.6 bn for the full sample[79]); as well as for EMEA VC (USD 778 mn vs. –10.1 bn for 1993-2001). The only exception is EMEA LBO, where the full sample generates a higher profit (USD 49.5 bn) than the top quartile funds alone (USD 38.0 bn).

Carried interest represents a higher share of the compensation of top quartile GPs in all strategies. Designed to align interests between GPs and LPs, this mechanism has had no material impact on the relative performance of funds: when a VY underperforms the index on a net basis, it also underperforms on a gross basis. Hence, the carried interest does not 'make or break' the performance of a VY either for average or top quartile funds. Its validity as a tool for the alignment of interests as it is currently designed is unproven.

Average US VC and LBO funds perform in line with the calculated benchmarks. Assuming a simple eight percent hurdle rate on gross returns, at fund level, 16 VYs out of the 21 considered show a performance about this threshold on a capital-weighted average basis for US VC. The proportion is 13 vintages out of 18 for US LBO.
Top quartile funds exhibit a strong outperformance as measured by the IRR and by the multiple of investments, on a gross and net basis, as compared to the index for all strategies and geographies.

The timing of cash-flows can explain part of the performance of top quartile fund managers (US VC, EMEA VC and EMEA LBO): the performance of the benchmark for top quartile funds is higher than for the performance of benchmark for average funds. Top quartile fund managers may be better at deploying their capital than average fund managers.

The consequences of these findings for research are that the carried interest instrument as it is currently designed is not efficient, and that a fixed eight percent

[79] Excluding VY 1999, this does not hold true: LPs earnings are USD 72.9 bn for top quartile vs. USD 75.8 bn for the full sample.

hurdle rate might also prove to be counterproductive[80]. A higher alignment of interests could be achieved if GPs were compensated according to their ability to put the capital to work rapidly, and rewarded on their ability to generate performance as compared to a PME-DPI index. On this basis, a progressive carried interest, which would increase in percentage with the outperformance generated, would provide a higher alignment of interests.

This solution does not solve the debate surrounding management fees and their correct level. This question remains widely debated on a case-by-case basis. It is one of the reasons why LPAs are increasingly negotiated between LPs and GPs, and will probably remain one of the variables to balance the power of GPs and LPs.

[80] Maxwell, quoted by Meyer and Mathonet [2005, p. 33] states that although […] now an accepted standard term [… the hurdle rate] is more confusing than useful [… and] there is no reason why new approaches should not be considered'.

3. The predictive power of the J-Curve[81]

At the core of the success of private equity lies an efficient model of corporate governance driven by the discipline imposed by financial leverage [Jensen, 1991]. This success has been demonstrated by the financial performance of private equity funds over the cours of the last 30 years (see Chapter 2). However, as the asset class was attracting an increasing number of investors and higher volumes of capital, it also crystallized the preoccupation of regulators. As financial institutions increased their exposure to an illiquid asset class, they faced the consequences of the crisis of 2008-2009 which severely tested their liquidity management skills. To strenghten these institutions, regulations evolved towards more stringent solvency and prudential ratio for institutions holding illiquid assets.

Current and future solvency and prudential ratios use historical risk-return profiles of PE Funds (PEF). Resulting ratios are artificially high [for example EDHEC, 2010; Studer and Wicki, 2010 for European insurance groups]. Amending solvency and prudential ratios to take into account the specificities of investing in PE is difficult, for four reasons.

First, the performance of PEFs is only known once these closed-end funds are liquidated, after 10 to 12 years [See Chapter 2]. The temptation to use earlier measures of performance, notably internal rates of return (IRRs), should be avoided [Kocis *et al*, 2009, Ch. 7; and Gottschalg 2012]. IRRs are based on quarterly NAVs, interim valuations of PEFs mixing realized and unrealized returns, the latter being estimated by PEF managers themselves[82]. They are sensitive to early distributions (such as 'dividend recaps[83]' in LBO), and to external events such as portfolio reevaluations to prepare a fund raising [Jenkinson *et al*, 2013]. Higson and Stucke [2012] recommend using data from fully liquidated funds only, which is difficult in practice due to the time-lag involved. To address this difficulty, this research focuses on the profile of cumulated cash-flows of PEFs over their life times: the 'J-curve' [Meyer and Mathonet, 2005]. The definition of a PEF J-Curves is important, as

[81] This chapter is to be presented at the 21st Global Financial Conference in Dubai (April 2014) and at the 14th FRAP Finance, Risk and Accounting conference in Oxford (September 2014), and published in a modified version in the proceedings of the 14th FRAP and in an academic review. The paper has been amended (its first part being now in Chapter 0 and 2), reviewed and augmented to reflect additional critiques and discussions, reflected in the current chapter.

[82] NAV calculations are defined by the professional associations in the International Private Equity and Venture Capital Valuation Guidelines (IPEV) that EVCA co-authored [2012], and the accounting standards such as IFRS (SFAS 157) and US GAAP (FASB 820, IAS 39). The NAV is the residual value of a PEF: related to the total invested capital, it provides a 'residual value to paid-in capital' (RVPI) ratio, which decreases as investments are realized (and hence account as DPI). The sum of DPI and RVPI forms the 'total value to paid-in capital' (TVPI), which is the multiple of the investment of the fund.

[83] LBO fund managers increase the debt of the holding of a given portfolio company to generate an anticipated profit distribution.

misunderstandings on their inputs and signification have led certain practitioners to reject it [Mulcahy *et al*, 2012[84]].

The second reason why amending ratios is difficult is that the analysis of PEFs is affected by a recurring lack of transparency [Higson and Stucke, 2012]. Modern PE investing (that is, through funds) is recent. The activity started in the 1970s in the US for leveraged buy-outs (LBO) and venture capital (VC), in the 1990s for the rest of the developed world, and essentially after 2000 for remaining countries [Demaria, 2010, Chapters 1 and 2]. As a result, geographical markets exhibit different levels of maturity, and performances history is limited to thirty years of activity, at best. Data is dominated by US figures, which represent 60 percent of documented worldwide investments [see Chapter 2]. Ljungqvist and Richardson [2003] note that 91.1 percent of the 73 funds of their sample are based in the US (7.5 percent in Europe, 1.5 percent in Latin America). Though some American institutions, such as public pension funds, have an obligation to disclose the structure and the performance of their PE portfolio under the Freedom of Information Act (and the jurisprudence *CalPERS vs San Jose Mercury News*, 2002), data remains scarce and patchy.

A third reason for complications is that PEFs are subject to activity and performance 'waves' [for US LBO: Higson and Stucke, 2012; for US VC: Robinson and Sensoy, 2011], materialized in an increase in funds raised, in investments and in company valuations, and a decrease of returns [Higson and Stucke, 2012; Harris *et al*., 2012]. However, though fund flows are positively related to past performance, Kaplan and Schoar [2005; confirmed by Higson and Stucke, 2012, and Harris *et al*, 2012] find no significant relation between performances and fund sizes (in LBO). While assets under management have increased from USD 10 bn in 1991 to 180 bn in 2000 [Kaplan and Schoar, 2005] and three tn in 2012[85], PE returns have been decreasing [Higson and Stucke, 2012; Harris *et al*, 2012].

The fourth challenge to amending solvency and prudential ratios is that PE exhibits a strong volatility of fund performances within a vintage year (VY), and from one VY to the other [Kaplan and Schoar, 2005].

To address these challenges, this research capitalizes on the fact that all PEFs exhibit a cash-flow pattern described as a J-curve. This constant will be used to approach PEF performance: illiquidity being a fundamental defining factor of PE investing, this research will use J-curves to deepen the understanding of the sector. The first step is to identify categories of returns among J-curves ('ideal-types') so as to qualify their past, present and future behavior through modeling and projections.

[84] As a matter of fact, these authors have computed IRRs instead of cash-flows to draw their curves, hence leading to a misunderstanding of the use of the J-Curve itself.

[85] See: 'Private equity assets record USD 3 trillion' (http://www.preqin.com/item/private-equity-assets-hit-record-3-trillion/102/5477, last accessed 18/4/2013).

The purpose of this paper is to analyze the behavior and performance of PEFs based on their reported cash-flows, in order to predict the performance of PEFs, and possibly support an effective calibration of solvency and prudential ratios for investors in PE.

After setting the empirical framework and reviewing the literature (Section 3.1), the data and the methodology adopted are presented (Section 3.2). The results (Section 3.3) are then discussed followed by the limits of the findings and perspectives for further research (Section 3.4).

3.1. Empirical Framework and Literature

The organization and processes of PEFs are detailed in Chapter 0. One cannot ignore the problems associated with PE data in published studies [see Chapter 2.1]. To study the PE sector, a first panel of studies worked with data from a single source, usually a PEF investor [Ljungqvist and Richardson, 2003; Lerner *et al*, 2007; Robinson and Sensoy 2012], or with harmonized databases maintained by service providers (Cambridge Associates [Chapter 2, Table 4] and Burgiss) sourced from their clients (LPs). It is difficult to generalize about these findings; though data gathered are coherent, as a direct result of the investment monitoring by LPs, PE investment strategies (and returns) depend on many other factors: the type of investor, their total assets under management, the set-up, the localization (home-investing bias), the number of years of experience and know-how, preferences and approach to PE investing [Lerner *et al*, 2007; Hobohm, 2010], as well as the legal structure, and regulatory constraints. For example, 60 percent of the LPs surveyed by Burgiss are public and corporate pension funds, and 20 percent are endowments and foundations [Harris *et al*, 2012]. Hence, Burgiss and Cambridge Associates cover the LP landscape only partially.

A second panel of studies uses commercial data from providers such as Thomson [Chapter 2, Table 4], which provide only a partial perspective on PE returns. Some database providers collect public information and voluntary disclosure from LPs. Thomson provides data on an aggregated basis to preserve the confidentiality of the underlying source. However, commercial databases are affected by biases [Higson and Stucke, 2012; Harris *et al*, 2012] as funds sometimes provide incomplete cash-flows. One of the issues affecting the quality of data is the treatment of funds with no cash flow while still active (for which presumably the GP failed to report so NAVs were replicated from one quarter to the other). Thomson used to keep them on record, as a result of which the IRRs of these funds declined, hence mechanically lowering the returns [Stucke, 2011]. Higson and Stucke [2012] argue that VYs 1980 to 1993 are reliable. This detail should strengthen our results[86].

[86] We have flagged 43 inconsistencies in Thomson's database, some of which were later removed by the database provider between August and November 2012.

PE returns are usually reported net of fees. The difference between gross and net returns is due to management fees, the carried interest of the GP, and additional fees and expenses necessary to the functioning of the PEF [see Chapter 2]. However, if details are not provided, it is impossible to separate investments from expenses in the cash-flows of a fund, or to differentiate distributions between refund and profits. Thomson ONE does not provide details on operational fees (for example, transaction and monitoring), or on operational distributions (Board compensation, advisory), which can be split between LPs and GPS, or be fully allocated to LPs or to GPs, hence making it difficult to estimate. Only net data provided by LPs is communicated (the database provider does provide gross cash-flows) so errors and biases on reporting net cash-flows cannot be assessed.

Fund terms are increasingly negotiated between LPs and GPs. Given the increased diversity of the PEFs' terms and conditions [Banal-Estañol and Ippolito, 2012], it is methodologically more rigorous to work on gross returns [Chapter 2].

3.2. Data and Methodology

Cash-flows of US and European VC and LBO funds are extracted over different periods to build average cash-flow curves. Data is available on a quarterly basis and aggregated. The first step is to analyze draw-down and distribution patterns of PEFs so as to understand their behavior. The second step is to characterize the evolution of cash-flow curves and assess their predictive power for the future outcome of PEFs. Only liquidated funds are used.

3.2.1. Draw-downs interpretation

Data blends fees and actual investments in draw-downs. This assumes an actual use of the capital, which is methodologically correct as our approach follows cash outflows. Net draw-downs cannot theoretically exceed 100 percent of the fund size.

Robinson and Sensoy [2012], declare that the expected investment pace for VC funds is 39 percent, 18 percent, 15 percent, 16 percent and 12 percent in years one through five, respectively. For LBO funds, it is 22 percent, 22 percent, 20 percent, 19 percent and 17 percent. Ljungqvist and Richardson [2003] state that it takes six years on average for 90 percent of the committed capital to be called, which is coherent with standard investment periods of five years. The pace of draw downs is 16 percent, 20 percent and 20 percent of committed capital called in the first three years of operation. By year ten, on average, funds are called at 93.6 percent. Kaserer and Diller [2004] state that average European PEFs draw down 23 percent of total committed capital in the first year, and 60 percent within the first three years. The payback is after seven years. Differences come from macro-economic conditions.

Committed capital is not called up to 100 percent after five years, as some is needed to pay management fees (and in the case of VC funds, for follow-on rounds in existing investments).

3.2.2. Distributions interpretation

From the proceeds of liquidity events such as trade sales and initial public offerings, funds return the capital and then distribute capital gains to LPs (though stock distributions can happen - 'distributions in-kind' - they are essentially cash distributions). Using only cash distributions can lower the outcome of the considered PEFs. In particular, data from VC funds from the decade 1980 shows substantial tail distributions after year 13. To prevent results from being affected by potential glitches in the data, a limit of fifteen years of PEFs activity has been set.

3.2.3. Data description and cycles identification

Data reported from Cambridge Associates[87] and Thomson ONE [Chapter 2] provide sample sizes, average and median IRRs, and average fund multiples ('total value to paid-in', or TVPI). If there are fewer than three funds in the sample, data are not provided. We have focused on the period prior to 2001 (fully liquidated funds). Thomson ONE provides VC and LBO data for the USA, and for Europe, Middle-East and Africa (EMEA). PE activity in the Middle-East and Africa started recently and should not significantly bias data for Europe. As Cambridge Associates provides data only for the US, and also separates VC from 'PE' (that is to say LBO, mezzanine, energy and growth funds), it is used as a support to identify cycles.

The simple average IRR for US VC funds is 19.9 percent for Cambridge (1981-2001, with 920 funds reporting data) and 16.7 percent for Thomson (1980-2001, 1087 funds). Median IRRs are respectively for the same periods 13.4 percent and 9.9 percent. Average TVPIs are respectively 2.8x and 2.2x. Extending the considered periods to 2009, average IRR, median IRR and TVPI are respectively for Cambridge (1,328 funds) 15.5 percent, 10.9 percent and 2.4x; and for Thomson 13.3 percent, 8.2 percent and 1.9x (1,279 funds). For US 'PE', the average IRR on 466 fully realized 'PE' funds for Cambridge Associates (1984-2001) is 16.0 percent, the median IRR is 15.0 percent and the TVPI is 2.2x. For US LBO, Thomson provides an average IRR on 425 fully realized funds of 14.5 percent, a median IRR of 11.7 percent and a TVPI of 2.0x. With the inclusion of VYs through 2009, the average IRR, median IRR and TVPI are respectively for Cambridge Associates (936 funds) 14.4 percent, 13.5 percent and for Thomson 1.9x; and 13.1 percent, 10.7 percent and 1.8x (626 funds).

[87] While our statistical analysis will rely on Thomson ONE's data, we use Cambridge Associates' data to cross-check our initial analysis.

Based on 447 EMEA VC funds (1981 and 1983-2001), Thomson provides an average IRR of 5.9 percent, a median IRR of 4.2 percent and a TVPI of 1.6x. Extending the period considered to 2009 (789 funds), the average IRR is 3.4 percent, the median IRR 1.9 percent and the TVPI 1.4x. Based on 269 EMEA LBO funds (1984 and 1986-2001), Thomson provides an average IRR of 14.5 percent, a median IRR of 11.8 percent and an average TVPI of 1.8x. Extending the period to 2009 (471 funds), the average IRR is 12.0 percent, the median IRR 9.1 percent and the TVPI 1.6x. Cambridge Associates does not disclose its benchmarks except for the US.

Based on this data and initial background, each VY is attributed to a return category. Table 15 sums up the attribution mechanism.

Some outliers appear:

- In US VC: 'low' return VY have average and median IRRs below average and a TVPI that is lossmaking or below 1.2. 'Medium' return VY have average and median IRRs below average and are profit making (TVPI between 1.4 and 2.1x). 'High' return VY have average and median IRRs above average and are profit making (TVPI between 2.2 and 2.5x). 'Very high' returns VY have average and median IRRs far above average and are profit making (TVPI between 2.6 and 4.4x).
    - VY 1991 would belong to 'medium' returns, but exhibits an above-average median IRR.
    - VY 1998 would belong to 'medium' returns, but exhibits a high average IRR (25.1 percent).
    - VY 1990 is not an outlier but the only VY in the 'high' returns category (around the 1980-2001 average for Thomson). It is either a test case for the 'medium' and 'very high' categories, or will justify its own category.
    - VY 2001 is not an outlier but the only VY generating positive results in the 'low' returns category. It is a test case for the 'low' and 'medium' returns categories.

- In US LBO: 'low' return VY have average and median IRRs below average and a low TVPI (between 1.2 and 1.7x). 'Medium' return VY have average and median IRRs below average and are profit making (TVPI between 1.8 and 1.99x). 'High' return VY have average and median IRRs above average and are profit making (TVPI between 2.0 and 2.79x). 'Very high' return VY have average and median IRRs far above average and are profit making (TVPI between 2.8 and 3.6x).
    - VY 1987 appears as a below average vintage, except for the TVPI. It is assigned to the 'medium' returns category, to be tested.
    - VY 1989 is an outlier, as it ranks below average for IRRs but above average according to its TVPI. It is assigned to the 'high' returns category, to be tested.

- VY 2001 appears as a below average vintage in terms of IRR (though very close to the average) and TVPI and would theoretically qualify for a 'low' returns category. However, it is quite far ahead in terms of performance from other vintages. It is assigned to the 'medium' returns category, to be tested.

- In EMEA VC: 'low' return VY have average and median IRRs below average and a loss-making TVPI or up to 1.3. 'Medium' return VY have average and median IRRs below average and are profit making (TVPI between 1.3 and 1.6). 'High' return VY have average and median IRRs above average and are profit making (TVPI between 1.6 and 1.89). 'Very high' return VY have average and median IRRs far above average and are profit making (TVPI between 1.9 and 2.5).
  - VY 1983 is singled out by its very high TVPI ('very high' returns) and IRRs assigning it to 'high' returns. It is assigned to 'high' returns, to be tested.
  - VY 1985 is singled out by its median IRR slightly above the 1984-2001 average. It is assigned to 'medium' returns, to be tested.
  - VY 1986 is singled out by its TVPI, which is slightly below the 1981-2001 average. It is assigned to 'high' returns, to be tested.
  - VY 1989 is above the 1981-2001 average for its median IRR and its TVPI, but below for its average IRR. It is assigned to 'high' returns, to be tested.
  - VY 1997 is above the 1981-2001 average for its average IRR and its TVPI, but below for its median IRR. It is assigned to 'high' returns, to be tested.
  - VY 1998 is an outlier as its average IRR is above the 1984-2001 bar (high returns), but its median IRR is negative (low returns) and its TVPI is below average (low returns). It is assigned to 'medium' returns, to be tested.

Table 15 – Initial return categorization of US and EMEA VC and LBO fund

These tables provide the results of the categorization of average US VC and LBO funds; and EMEA VC and LBO funds by VY, based on initial reading for fully realized funds based on average and median IRRs, and TVPIs for an attribution in one of the four ideal-type categories (low returns, medium returns, high returns and very high returns). Data reliability is put in perspective, notably for vintages identified as problematic (signaled by a minus sign). Outliers are signaled by an 'O*' (or 'O?' for those questioned).

US VC					
Vintage year	Average IRR (%)	Median IRR (%)	Average TVPI	Initial category	Data reliable?
1981	Below av.	Below av.	1.4 to 2.1x	Medium	++
1982	Below av.	Below av.	1.4 to 2.1x	Medium	++
1983	Below av.	Below av.	1.4 to 2.1x	Medium	++
1984	Below av.	Below av.	1.4 to 2.1x	Medium	++
1985	Below av.	Below av.	1.4 to 2.1x	Medium	++
1986	Below av.	Below av.	1.4 to 2.1x	Medium	+
1987	Below av.	Below av.	1.4 to 2.1x	Medium	++
1988	Below av.	Below av.	1.4 to 2.1x	Medium	++
1989	Below av.	Below av.	1.4 to 2.1x	Medium	++
1990	**Above av.**	**Above av.**	**2.2 to 2.5x**	**High (O?)**	++
1991	**Above av.**	**Below av.**	**1.4 to 2.1x**	**Medium (O*)**	+
1992	Above av.	Above av.	2.6 to 4.4x	Very High	++
1993	Above av.	Above av.	2.6 to 4.4x	Very High	++
1994	Above av.	Above av.	2.6 to 4.4x	Very High	+
1995	Above av.	Above av.	2.6 to 4.4x	Very High	++
1996	Above av.	Above av.	2.6 to 4.4x	Very High	++
1997	Above av.	Above av.	2.6 to 4.4x	Very High	++
1998	**Above av.**	**Below av.**	**1.4 to 2.1x**	**Medium (O*)**	++
1999	Negative av	Negative av.	Inf. to 1.2	Low	++
2000	Negative av	Negative av.	Inf. to 1.2	Low	++
2001	**Below av.**	**Below av.**	**Inf. to 1.2**	**Low (O?)**	++

US LBO					
Vintage year	Average IRR (%)	Median IRR (%)	Average TVPI	Initial category	Data reliable?
1981	-	-	-	-	
1982	-	-	-	-	
1983	-	-	-	-	
1984	Above av.	Above av.	2.8 to 3.6x	Very high	+
1985	Above av.	Above av.	2.8 to 3.6x	Very high	++
1986	Above av.	Above av.	2.8 to 3.6x	Very high	++
1987	**Below av**	**Below av.**	**1.8 to 2.0x**	**Medium (O*)**	-
1988	Below av.	Below av.	1.8 to 2.0x	Medium	++
1989	**Below av.**	**Above av.**	**2.0 to 2.8x**	**High (O*)**	++
1990	Below av.	Below av.	1.2 to 1.7x	Low	++
1991	Above av.	Above av.	2.0 to 2.8x	High	++
1992	Above av.	Above av.	2.0 to 2.8x	High	++
1993	Above av.	Above av.	2.0 to 2.8x	High	-
1994	Below av.	Below av.	1.8 to 2.0	Medium	++
1995	Below av.	Below av.	1.8 to 2.0	Medium	-
1996	Below av.	Below av.	1.2 to 1.7	Low	++
1997	Below av.	Below av.	1.2 to 1.7	Low	++
1998	Below av.	Below av.	1.2 to 1.7	Low	++
1999	Below av.	Below av.	1.2 to 1.7	Low	++
2000	Below av.	Below av.	1.8 to 2.0	Medium	+
2001	**Below av.**	**Below av.**	**1.2 to 1.7**	**Medium (O*)**	+

Table 15 (cont.) – Initial return categorization of US and EMEA VC and LBO fund

EMEA VC					
Vintage year	Average IRR (%)	Median IRR (%)	Average TVPI	Initial category	Data reliable?
1981	Above av.	Above av.	1.6 to 1.9x	High	+
1982	-	-	-	-	
1983	**Above av.**	**Above av.**	**1.9 to 2.5x**	**High (O*)**	++
1984	Above av.	Above av.	1.6 to 1.9x	High	+
1985	**Below av.**	**Above av.**	**1.3 to 1.6x**	**Medium (O*)**	++
1986	**Above av.**	**Above av.**	**1.3 to 1.6x**	**High (O*)**	++
1987	Below av.	Below av.	1.3 to 1.6x	Medium	++
1988	Below av.	Below av.	0.9 to 1.3x	Low	++
1989	**Below av.**	**Above av.**	**1.6 to 1.9x**	**High (O*)**	++
1990	Above av.	Above av.	1.9 to 2.5x	Very High	++
1991	Below av.	Below av.	1.3 to 1.6x	Medium	++
1992	Above av.	Above av.	1.9 to 2.5x	Very High	-
1993	Below av.	Below av.	1.3 to 1.6x	Medium	++
1994	Above av.	Above av.	1.6 to 1.9x	Very High (O*)	+
1995	Below av.	Below av.	0.9 to 1.3x	Low	++
1996	Above av.	Above av.	2.0 to 2.5x	Very High	++
1997	**Above av.**	**Below av.**	**1.6 to 1.9x**	**High (O*)**	+
1998	**Above av.**	**Negative av.**	**1.3 to 1.6x**	**Medium (O*)**	++
1999	Below av.	Negative av.	0.9 to 1.3x	Low	+
2000	Negative av	Negative av.	0.9 to 1.3x	Low	++
2001	Negative av	Negative av.	0.9 to 1.3x	Low	+

EMEA LBO					
Vintage year	Average IRR (%)	Median IRR (%)	Average TVPI	Initial category	Data reliable?
1981	-	-	-	-	
1982	-	-	-	-	
1983	-	-	-	-	
1984	**Above av.**	**Above av.**	**2.2 to 2.7x**	**High (O*)**	+
1985	-	-	-	-	
1986	**Above av.**	**Below av.**	**1.8 to 2.2x**	**High (O*)**	-
1987	Below av.	Below av.	1.4 to 1.8x	Medium	++
1988	Below av.	Below av.	1.4 to 1.8x	Medium	-
1989	Below av.	Below av.	1.3 to 1.4x	Low	++
1990	Below av.	Below av.	1.3 to 1.4x	Low	-
1991	Below av.	Below av.	1.4 to 1.8x	Medium	++
1992	Above av.	Above av.	1.8 to 2.2x	Very high	++
1993	**Above av.**	**Below av.**	**1.8 to 2.7x**	**High (O*)**	++
1994	**Above av.**	**Above av.**	**1.8 to 2.2x**	**Very high (O*)**	++
1995	**Above av.**	**Below av.**	**1.8 to 2.2x**	**High (O*)**	+
1996	Below av.	Below av.	1.4 to 1.8x	Medium	-
1997	**Above av.**	**Below av.**	**1.5 to 1.8x**	**Medium (O*)**	++
1998	**Below av.**	**Below av.**	**1.4 to 1.8x**	**Medium (O*)**	+
1999	**Below av.**	**Above av.**	**1.4 to 1.8x**	**Medium (O*)**	++
2000	Above av.	Above av.	2.2 to 2.7x	Very high	++
2001	Above av.	Above av.	1.8 to 2.7x	High	-

- In EMEA LBO: 'low' return VY have average and median IRRs below average and TVPI below 1.4x. 'Medium' return VY have average and median IRRs below average and are profit making (TVPI between 1.4 and 1.79x). 'High' return VY have average and median IRRs above average and are profit making (TVPI between 1.8 and 2.19x). 'Very high' return VY have average and median IRRs far above average and are profit making (TVPI between 2.2 and 2.7x).
    - VY 1984 shows a very high TVPI but IRRs close to the average. It is assigned to 'high' returns, to be tested.
    - VYs 1986, 1993 and 1995 are singled out as their median IRR are below the average, but their TVPI and average IRR are well above (VY 1993's TVPI is exactly at the average). They are assigned to 'high' returns, to be tested.
    - VY 1997 exhibits a high average IRR but its median IRR is low and its TVPI slightly below average. It is assigned to 'medium' returns, to be tested.
    - VY 1998 exhibits low IRRs, but a TVPI in the 'medium' range. It is assigned to 'medium' returns, to be tested.
    - VY 1999 has a median average that is above average, but its average IRR and TVPI are slightly below. It is assigned to 'medium' returns, to be tested.

While gathering data, the quality of the output varied. A score was assigned to it.

3.2.4. Data processing and methodology

Based on the four categories above, the first step was to create our 'ideal-types' profiles of cash-flows by aggregating J-curves of fully realized PEFs. The resulting statistical patterns will be used to benchmark actual and future funds. These cash-flows are boom/bust agnostic (they are not influenced by the Internet boom/bust for VC, nor the 2004-2008 boom for LBO); they are, by definition, normalized, as they aggregate each vintage year's J-curves with the same weight (that is, regardless of the amounts invested and distributed).

We then analyzed the four ideal-types identified and their usefulness as a predictor of this performance. Correlation tests have been used to qualify the ideal-types, identify representative vintages and challenge the outliers identified in section 3.3.

First step: data retrieval

From the PE section of Thomson ONE we have retrieved the quarterly cash-flows ('cash-flow summary') of VC and LBO funds in USA and EMEA (all flows are retrieved in USD), for all funds in each separate VY available through 2009 (after that date, funds are not mature enough to provide meaningful cash-flows). The operation was repeated to filter out the top quartile funds (some VY do not count three funds or

more and are hence unavailable). Thomson provides sample sizes, funds capitalization (cumulated fund size of the sample), takedowns (capital calls) and total distributions. Quarterly 'cumulative returns' from inception were then retrieved, providing IRRs (average, capital-weighted average, pooled average) calculated by Thomson (used only to cross-check our own IRR calculations).

Second step: sorting data

In Chapter 2, Table 4 provides the average net performance from Thomson: sample size, capital-weighted average IRR and the capital-weighted average TVPI. This breakdown has been done for each VY for US VC (1981-2009) and LBO (1984-2009), and EMEA VC (1981-2009) and LBO (1984-2009). The operation was repeated for top quartile funds [unreported]. Realized funds (up to 2001) have been separated from the unrealized funds (2002-2009).

Third step: data aggregation in fund categories (ideal-types) and graphical illustration

Each VY is then allocated to one of the four categories identified in Section 3.2.3. An average cash-flow curve for each category has been generated as well as another for the overall realized sample. These operations were then repeated for top quartile funds. Graphical illustrations (after computing data on a basis of 100) have been generated with cumulated distributions, cumulated takedowns and cumulated DPI to illustrate the 'J-curve' phenomenon, for the overall sample, then for each 'ideal-type' and for each of the partially unrealized vintage years. Graphical illustrations are reported as Figures 7 and 8 for US venture capital funds (first with the average and the different categories, then with the average, a low returns scenario – as a matter of illustration - and the unrealized vintages). Figures 9 and 10 depict US LBO funds (first with the average and the different categories, then with the average, a medium returns scenario – as a matter of illustration - and the unrealized vintages); Figure 11 and 12 illustrate EMEA venture capital funds (first with the average and the different categories, then with the average, a low returns scenario – as a matter of illustration - and the unrealized vintages). Finally, Figures 13 and 14 depict EMEA LBO funds (first with the average and the different categories, then with the average, a very high returns scenario – as a matter of illustration - and the unrealized vintages). Atypical behaviors, which could affect results, have been duly noted (Section 3.4).

Fourth step: determining the potential predictive power of the J-curve

A correlation table for average and top quartile funds was then set. These correlations are based on the cash-flows (J-curves) for the average 1980-2001, the different ideal-types and for each vintage (including those beyond 2001). Results are presented in Tables 16, 17, 18 and 19 for average funds. Regressions (unreported here) have been run on the data, but the high level of noise associated with this data have provided with unconclusive results. We thus stick to the correlation tests. Along these lines, additional tests (such as T-tests) usually performed along with regressions are not reported as also unconclusive.

Though often criticized, correlation tests are, in this case, the most effective tool to use: directionality is not a matter of discussion, correlation tests are robust and not sensitive to high variability in the quality of input data (some of the cash-flows provided by Thomson are incomplete). More sophisticated econometric techniques would be richer, assuming that accessible input data would be as well. As this is not the case (no information on the size of funds or industry focus or any additional data is offered with the performance data provided by Thomson), we directly accounted for the region of origin and investment strategy.

To test in-sample and out-of-sample periods, we ran correlations [unreported] with the VY 1985 of US VC funds paired with average US VC funds aggregated or by vintage (excluding VY 1985 from the paired data). The purpose was to identify its representativeness as the 'medium' return 'ideal-type', and to test it with fully realized and partially unrealized funds. The test was run with top quartile funds and bottom quartile funds of the VY 1985. The same reasoning was applied to VY 1990 ('high' performance scenario) for average, top and bottom quartile US VC funds; with VY 1995 ('very high' performance[88]); and VY 2000 ('low' performance).

Table 18 sums up the findings, and applies the predictive performance model to unrealized funds aggregated by VYs.

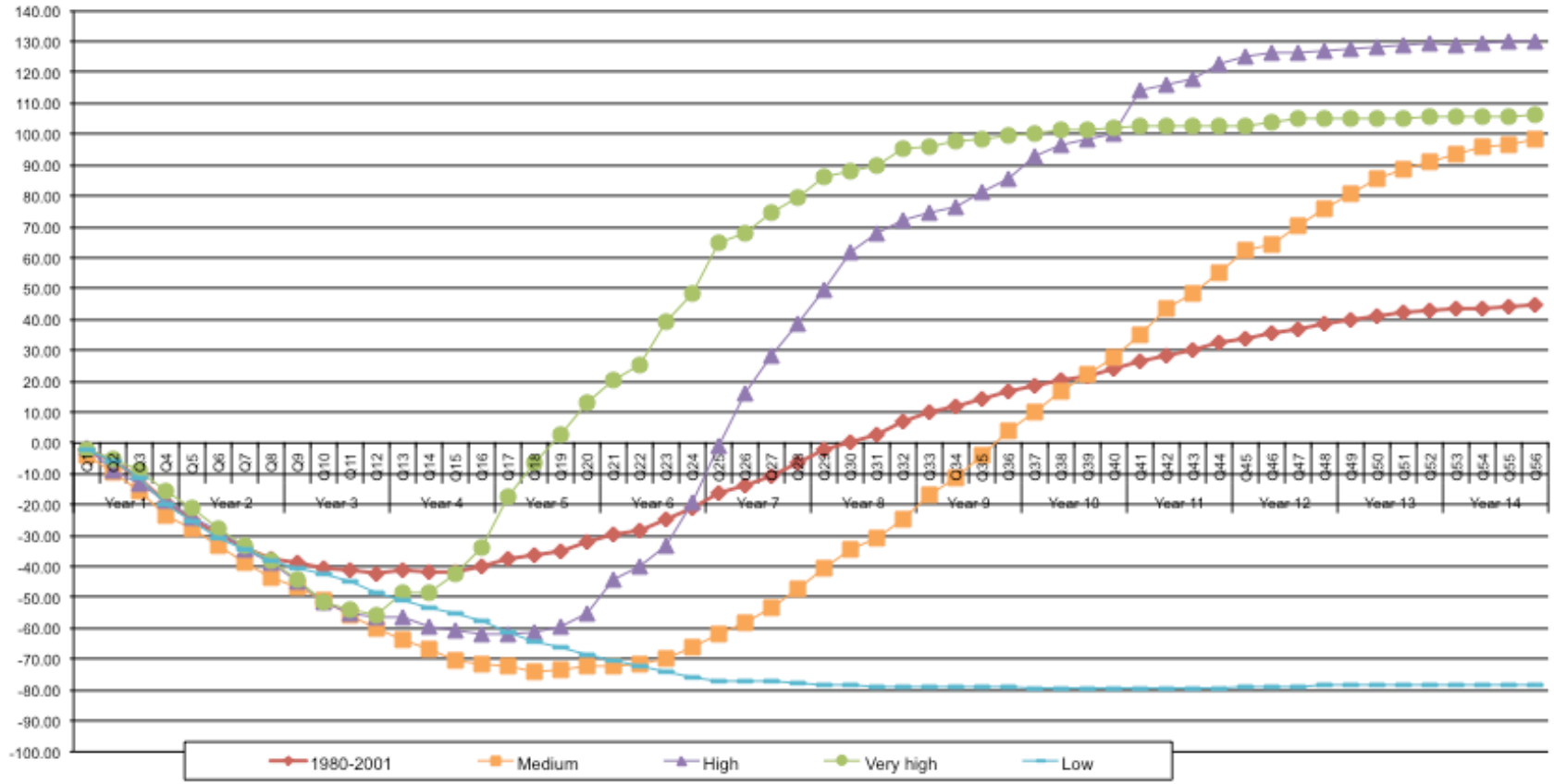
Fifth step: assessment of the reliability of the J-Curves to predict future performances

The last step was to determine when the correlations start to have a predictive role and to assess how reliable these predictions can be. We tested whether the 'ideal-type' assessment of the final quarter of each year [Table 19] reflects the final performance for each VY, in each strategy and in each geographical area. We then assessed the spread with the closest category of return, first if the end of quarter performance matched with the final performance, and then if it did not. This step replaced the usual concept of confidence intervals and provided probabilities which match the value-at-risk framework employed by the solvency and prudential ratio calculation.

[88] 1996 and 1997 could qualify as well: their correlations are lower with the 'Very High' returns category (0.93) but more distinctive with other return categories.

Figure 5 – Cumulated cash-flows curves of US VC funds for 1980-2001

The figure provides five cumulated cash-flow curves, based on data reported by Thomson ONE Banker[89] (re-scaled on a basis 100), excluding outliers. Four ideal-types are identified: 'high' returns (VYs 1980 and 1990), 'medium' returns (VYs 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989), 'low' returns (VYs 1999, 2000, 2001) and 'very high' returns (VY 1992, 1993, 1994, 1995, 1996, 1997).



[89] As of 31 December 2011.

Figure 6 – Cash-flows curves of US VC funds for 1980-2001 and 2002-2008

The figure provides nine cumulated cash-flow curves: the period 1980-2001, 'low' returns (VYs 1990, 2000, 2001); active VYs 2002, 2003, 2004, 2005, 2006, 2007 and 2008, and is based on data from Thomson ONE Banker (re-scaled on a basis 100).

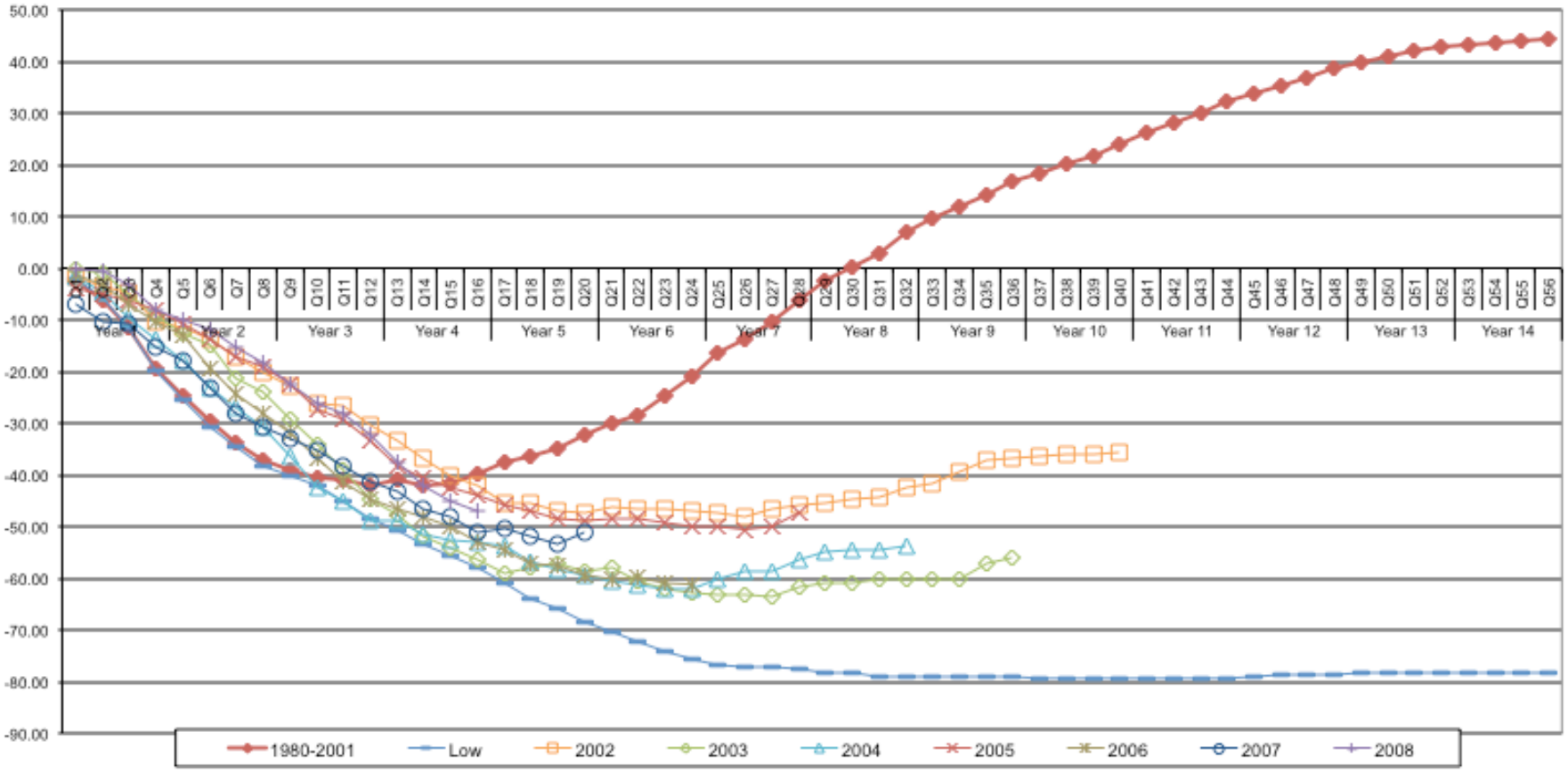
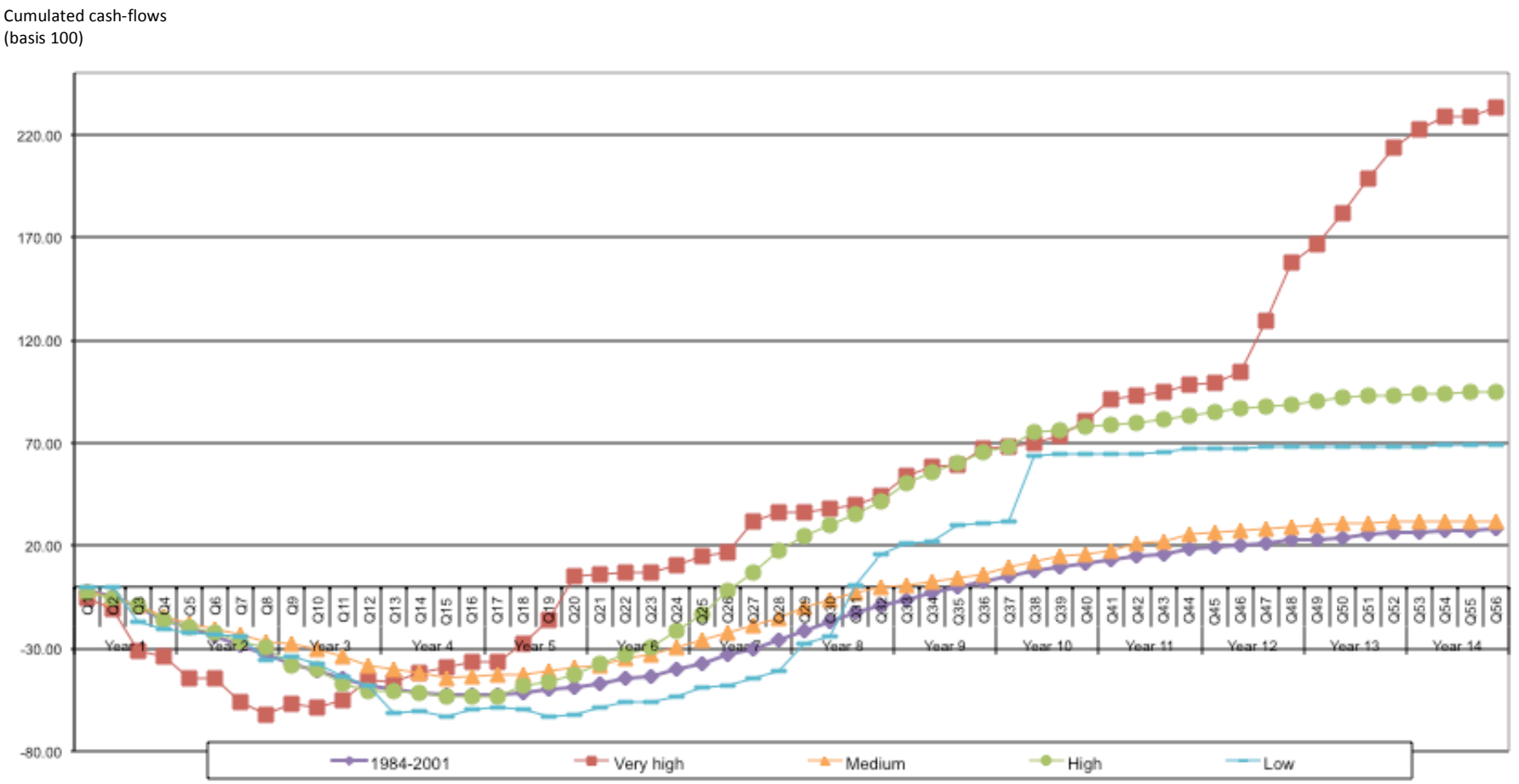


Figure 7 – Cumulated cash-flows curves of US LBO funds for 1984-2001

The figure provides five cumulated cash-flow curves, based on data reported by Thomson ONE Banker[90] (re-scaled on a basis 100), excluding outliers. Four ideal-types are identified: 'high' returns (VYs 1989, 1991, 1992, 1993), 'medium' returns (VYs 1988, 1994, 1995, 2000, 2001), 'low' returns (VYs 1990, 1996, 1997, 1998, 1999) and 'very high' returns (VY 1984, 1985, 1986).



[90] As of 31 December 2011.

Figure 8 – Cash-flows curves of US LBO funds for 1984-2001 and 2002-2008

The figure provides nine cumulated cash-flow curves: the period '1984-2001', 'low' returns (VYs 1990, 1996, 1997, 1998, 1999), active VYs 2002, 2003, 2004, 2005, 2006, 2007 and 2008, and is based on data from Thomson ONE Banker (re-scaled on a basis 100).

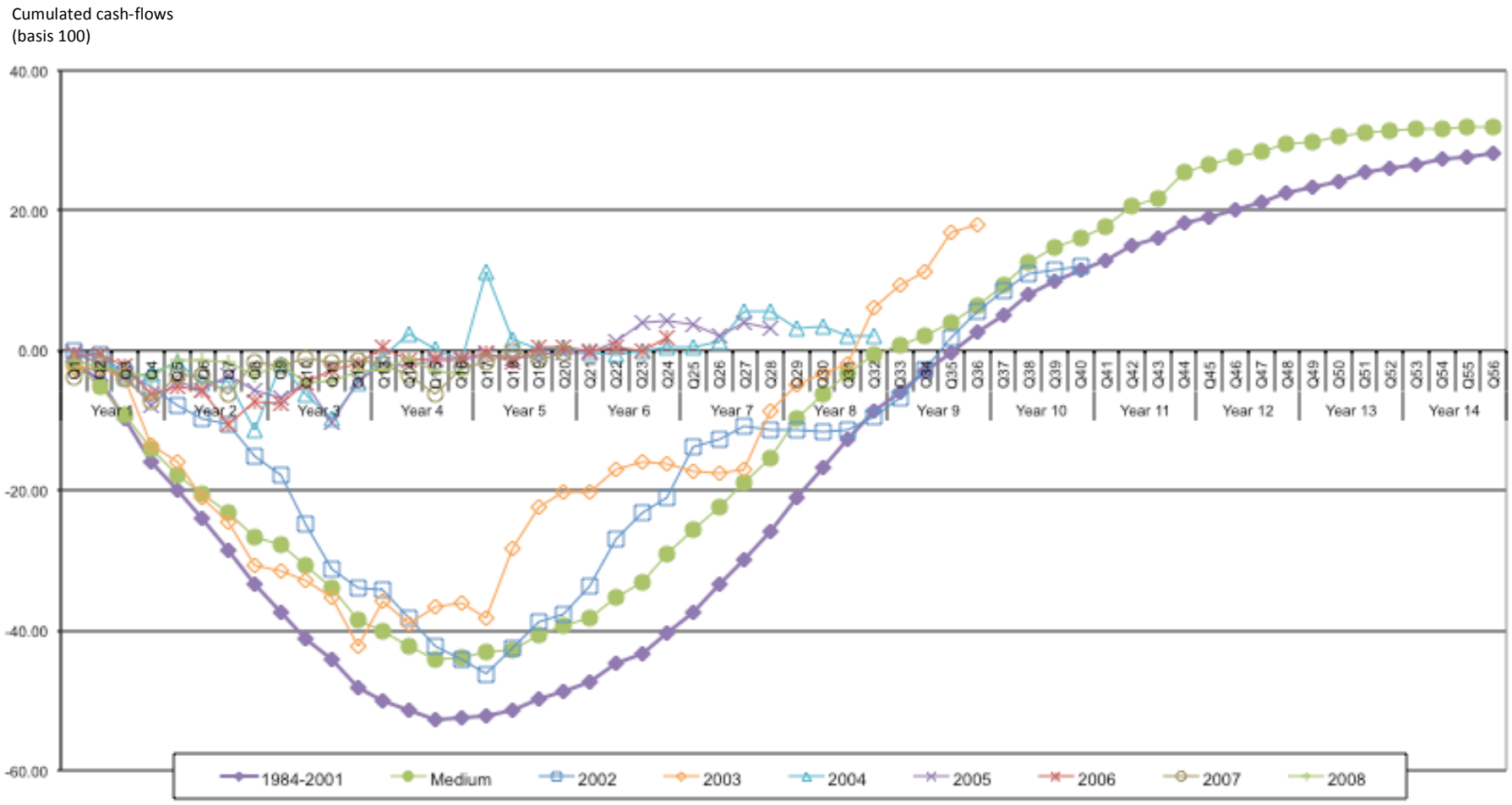
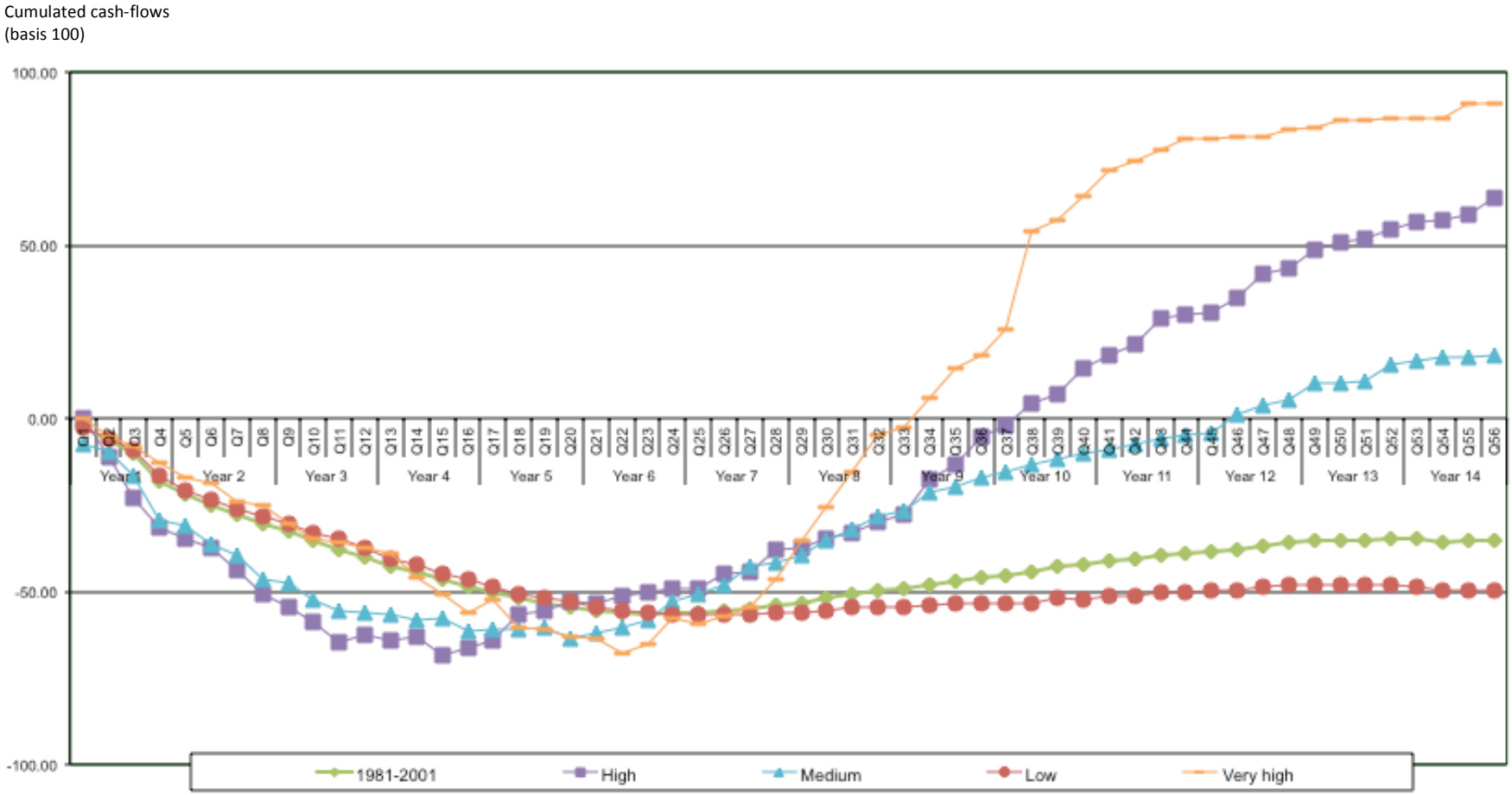


Figure 9 – Cumulated cash-flows curves of EMEA VC funds for 1981-2001

The figure provides five cumulated cash-flow curves, based on data reported by Thomson ONE Banker[91] (re-scaled on a basis 100), excluding outliers. Four ideal types are identified: 'high' returns (VYs 1983, 1984 and 1986), 'medium' returns (VYs 1985, 1987, 1991, 1993), 'low' returns (VYs 1995, 2000, 2001) and 'very high' returns (VY 1990 only).



[91] As of 31 December 2011.

Figure 10 – Cash-flows curves of EMEA VC funds for 1981-2001 and 2002-2008

The figure provides nine cumulated cash-flow curves: the period '1981-2001' (VYs 1983, 1984, 1985, 1986, 1987, 1990, 1991, 1993, 1995, 2000 and 2001), 'low' returns (VYs 1995, 2000, 2001), and active VYs 2002, 2003, 2004, 2005, 2006, 2007 and 2008, based on data from Thomson ONE Banker (re-scaled on a basis 100).

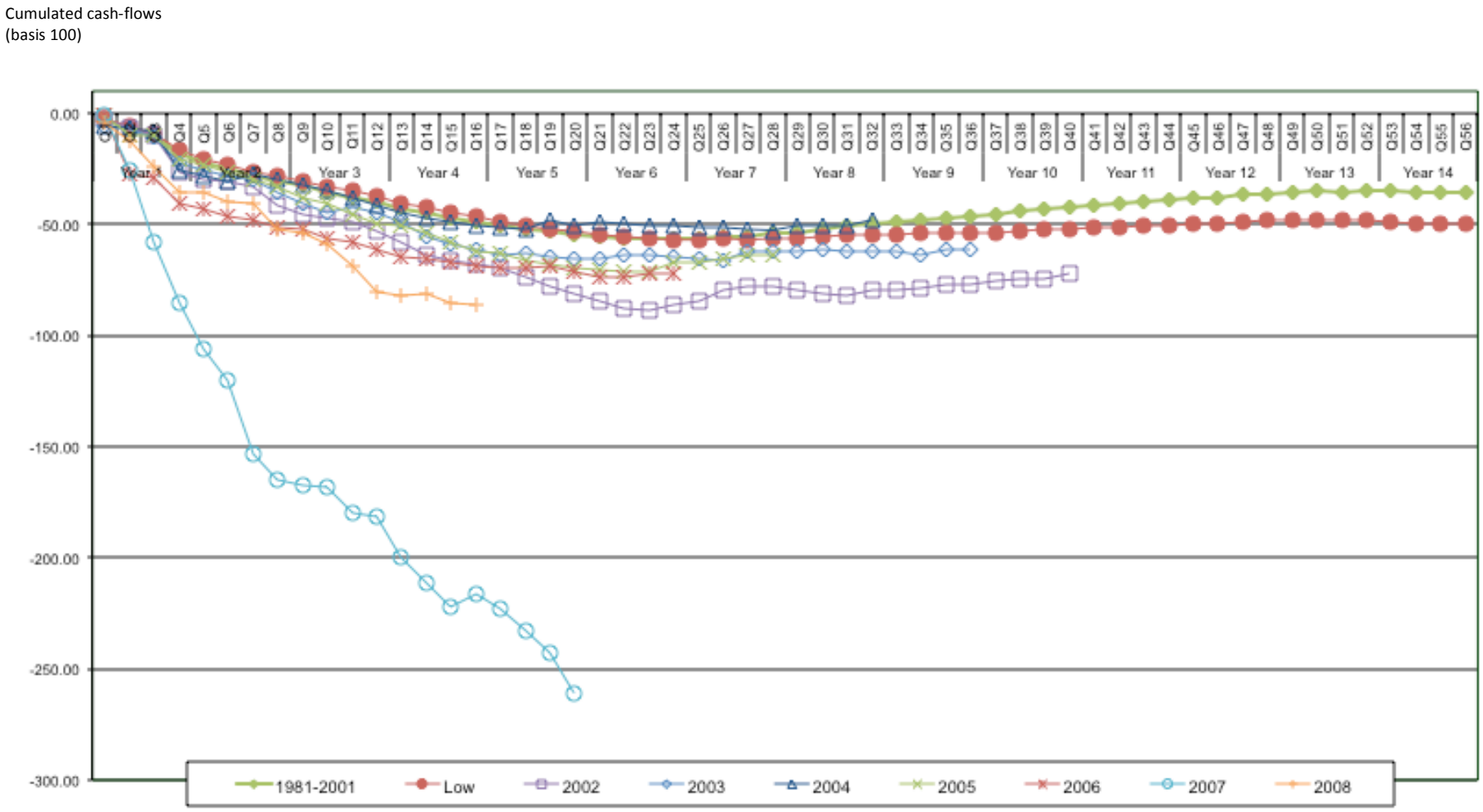
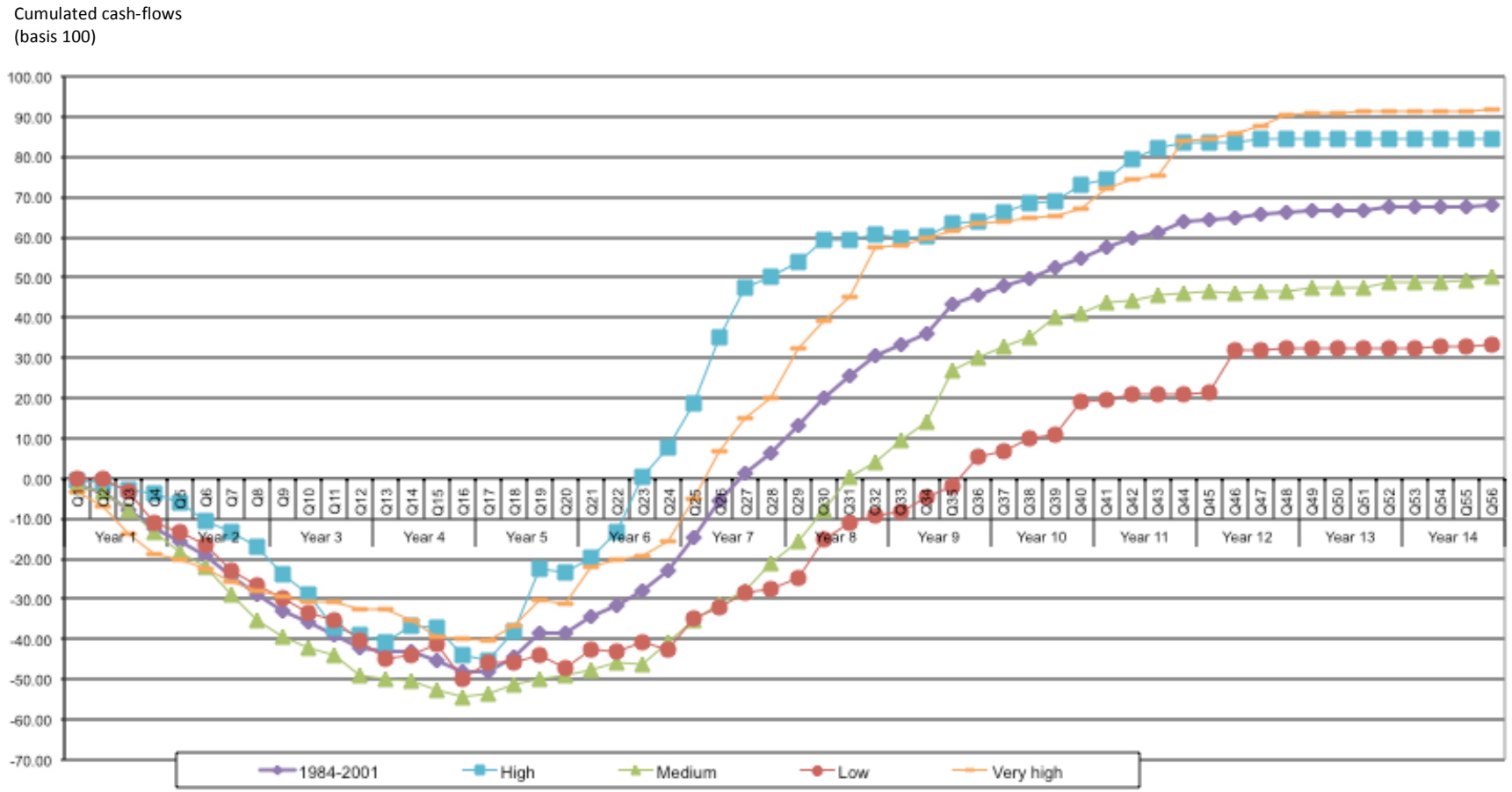


Figure 11 – Cash-flows curves of EMEA LBO funds for 1984-2001

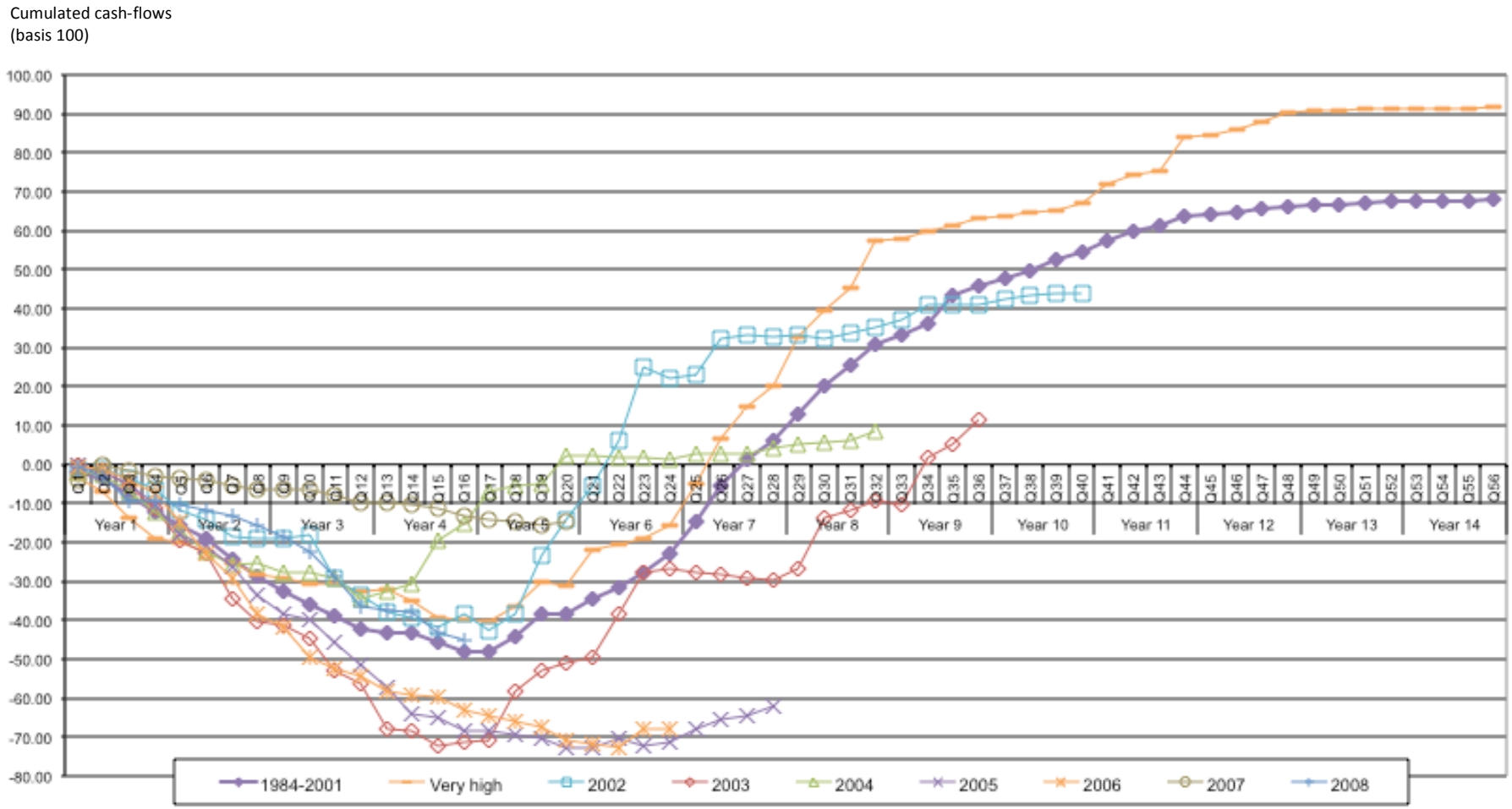
This figure provides five cumulated cash-flow curves, based on data reported by Thomson ONE Banker[92] (re-scaled on a basis 100), excluding outliers. Four ideal types are identified: 'high' returns (VYs 1984, 1986, 1995, 2001), 'medium' returns (VYs 1987, 1991, 1997, 1998, 1999), 'low' returns (VY 1989 only) and 'very high' returns (VYs 1991, 1994 and 2000).



[92] As of 31 December 2011.

Figure 12 – Cash-flows curves of EMEA LBO funds for 1984-2001 and 2002-2008

The figure provides nine cumulated cash-flow curves: the period '1984-2001' (VYs 1984, 1986, 1987, 1989, 1991, 1992, 1994, 1995, 1997, 1998, 1999, 2000 and 2001), 'very high' returns (VYs 1991, 1994 and 2000), and active VYs 2002, 2003, 2004, 2005, 2006, 2007 and 2008, based on data from Thomson ONE Banker (re-scaled on a basis 100).



3.3. Analysis and Findings

3.3.1. Analysis of the paid-in to committed capital (PICC) ratios

Calculations and analysis are based on Tables 16 and 17:

- 1,073 realized US VC funds (VYs 1981-2001), representing USD 181.7 bn committed and 164.4 bn paid-in. The net PICC is 0.90. The average fund size is 169.3 mn (from a minimum average size of 33.4 mn in 1981 to 470.6 mn in 2001). This average fund size increases to USD 197.6 mn if we include the funds of VYs 2002-2009 (leading to a total of 1,265 funds, with 249.9 bn committed and 213.9 bn paid-in).

- 425 realized US LBO funds (VYs 1984-2001), representing USD 292.2 bn committed and 266.8 bn paid-in. The net PICC is 0.91. The average fund size is 687.7 mn (min: 171.5 mn in 1985, max: 1161.5 mn in 2001). Average fund size increases to USD 1174.6 mn when we include VYs 2002-2009 (626 funds, with 735.3 bn committed and 612.1 bn paid-in).

- 447 realized EMEA VC funds (VYs 1981-2001), representing USD 29.1 bn committed and 22.7 bn paid-in. The net PICC is 0.78. The average fund size is 65.2 mn (min: 15.6 mn in 1981, max: 99.3 mn in 2000). The average fund size increases to USD 69.7 mn when we include VYs 2002-2009 (789 funds, with 54.9 bn committed and 41.5 bn paid-in).

- 269 realized EMEA LBO funds (VYs 1984-2001), representing USD 88.9 bn committed and 77.6 bn paid-in. The net PICC is 0.87. The average fund size is 330.4 mn (min: 16.0 mn in 1984, max: 809.9 mn in 2001). The average fund size increases to USD 691.0 mn when VYs 2002-2009 (471 funds, with 249.9 bn committed and 213.9 bn paid-in) are included.

The comparatively small number of EMEA funds accounted for necessitates a certain caution in our analysis and conclusions. Significant differences appear between the US and EMEA funds. The first is the PICC difference for VC (0.90 net in the US, 0.78 in EMEA): either because of different fund covenants or because of longer investment periods, EMEA VC funds have a lower PICC. This might explain their lower performances as compared with US funds, which have a more active reinvestment policy of early proceeds[93]. US and EMEA LBO funds have rather similar PICC. The second difference lies in fund sizes: US average fund sizes are more than

[93] Venture capital funds are allowed to reinvest in their portfolio companies even after the end of the investment period.

double that of EMEAs. The relative weight of fixed costs is higher for EMEA funds so a proportion of EMEA funds may not be economically viable.

A look at the gross PICC [Tables 16 and 17] helps to identify atypical behaviors of VYs (which might not be properly accounted for in terms of paid-in, hence introducing biases in our cash-flow analysis). Management fees have little chance to exceed 20 percent of the fund size. As a fund can only be invested up to 100 percent, net PICCs should be between 0.8-1.0. US VC fits within these brackets[94] (average net PICC is 0.90 for realized funds and 0.86 for unrealized funds). This is consistent with Ljungqvist and Richardson [2003] who found a 0.94 PICC over 1981-1992. US LBO 1987, 1993 and 1995 are above 1.0 while US LBO 2000 is at 0.76[95]. These vintages should be handled with caution. The average net PICC is 0.91 for realized funds and 0.83 (net for unrealized funds) [consistent with Ljungqvist and Richardson, 2003].

For EMEA, VC exhibits one VY above 1.0 (1992) and six below 0.8 (1981, 1984, 1994, 1997, 1999, 2001)[96]. LBO funds exhibit three vintages with a net PICC above 1.0 (1986, 1990 and 2001), and five vintages with a net PICC below 0.80 (1984, 1988, 1995, 1996, 1998)[97]. Though some of the VYs are to be taken with caution, there is no systematic bias of performance identifiable (out- or under-performance) with PICC above or below thresholds.

[94] For US VC top quartile funds, the net PICC of two vintages years (1981 and 1991) appear above 1.00. These two years have to be treated with caution.

[95] For US LBO top quartile funds, the net PICC is below 0.8 for 1989 and 1995; and above 1.00 for 1987 and 1997.

[96] For EMEA VC top quartile funds, the net PICC of three vintages falls below 0.8: 1997, 1999 and 2000.

[97] For EMEA LBO top quartile funds, the net PICC of three vintages falls below 0.8 (1993, 1995 and 1996) and two are above 1.00 (1994 and 2001).

Table 11 – Net PICC ratios for US/EMEA VC and LBO funds

This table provides the committed capital, average fund sizes, paid-in and paid-in/committed (PICC) ratio for US VC and LBO funds; and EMEA VC and LBO funds from Thomson ONE Banker database (1981-2009).

		US Venture Capital					US LBO				
	Vintage year	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	Sample	Total committed	Average fund size	Paid-in	PI/C (net)
Fully realized*	1981	21	701.44	33.40	690.47	0.98	-	-	-	-	-
	1982	28	1 119.72	39.99	963.48	0.86	-	-	-	-	-
	1983	58	2 521.04	43.47	2 405.00	0.95	-	-	-	-	-
	1984	63	2 553.13	40.53	2 397.38	0.94	7	1 662.43	237.49	1 660.00	**1.00**
	1985	46	1 441.36	31.33	1 390.30	0.96	8	1 372.09	171.51	1 285.25	0.94
	1986	38	2 621.64	68.99	2 505.89	0.96	10	1 876.57	187.66	1 750.44	0.93
	1987	64	2 816.49	44.01	2 710.84	0.96	24	12 454.11	518.92	13 306.89	**1.07**
	1988	45	2 400.35	53.34	2 318.40	0.97	16	8 448.70	528.04	8 156.23	0.97
	1989	50	3 989.77	78.95	3 891.16	0.98	25	5 628.12	335.12	5 274.41	0.90
	1990	23	1 433.08	62.31	1 299.16	0.91	10	2 652.26	265.23	2 401.37	0.91
	1991	17	836.28	49.19	838.54	1.00	5	1 439.98	288.00	1 292.66	0.90
	1992	28	2 488.25	88.86	2 438.39	0.98	14	4 378.17	312.73	4 171.24	0.95
	1993	41	3 234.06	78.88	2 949.31	0.91	20	9 688.50	484.42	10 017.64	**1.03**
	1994	36	4 660.01	129.44	4 427.88	0.95	25	10 855.95	434.24	9 831.23	0.91
	1995	48	4 594.92	95.72	4 205.92	0.92	25	18 913.27	756.53	19 033.33	**1.01**
	1996	38	4 988.69	131.28	4 671.07	0.94	25	11 451.85	458.07	11 077.51	0.97
	1997	61	9 426.45	154.53	8 868.91	0.94	40	32 537.01	813.43	31 653.02	0.97
	1998	80	18 606.36	232.58	17 158.86	0.92	55	54 065.35	978.99	50 014.37	0.93
	1999	106	32 793.82	309.37	29 684.69	0.91	38	30 638.44	806.27	27 561.62	0.90
	2000	122	50 267.59	412.03	43 065.30	0.86	51	53 778.32	1 054.47	51 075.29	**0.76**
	2001	60	28 234.16	470.57	25 514.20	0.90	27	31 359.25	1 161.45	27 303.40	**0.87**
Active	2002	19	4 531.11	238.48	3 030.98	**0.67**	19	17 448.74	918.35	15 289.60	0.88
	2003	21	5 177.48	246.55	4 864.27	0.94	17	20 669.31	1 215.84	19 633.17	0.95
	2004	28	9 256.61	330.59	7 907.48	0.85	21	21 407.18	1 019.39	18 262.24	0.85
	2005	23	6 829.59	296.94	4 795.89	0.70	33	50 379.02	1 526.64	45 943.77	0.91
	2006	44	25 174.61	572.15	19 618.60	0.78	35	114 324.79	3 266.42	109 205.67	0.96
	2007	24	6 174.40	257.26	4 002.40	0.65	37	121 534.01	3 284.70	86 226.24	0.71
	2008	20	7 572.94	378.65	3 747.58	0.49	29	73 481.07	2 637.27	38 743.69	0.51
	2009	13	3 495.83	268.91	1 601.26	0.46	10	20 757.54	2 075.75	11 943.46	0.58
Total realiz.		1073	181 698		164 394		425	292 281		266 865	
Av. realiz.				169.33		0.90			687.72		0.91
Total all		1265	249 911		213 963		626	735 283		612 113	
Av. all				197.56		0.86			1 174.57		0.83

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension peri

Table 16 (continued)

	Vintage year	EMEA Venture Capital					EMEA LBO				
		Sample	Total committed	Average fund size	Paid-in	PI/C (net)	Sample	Total committed	Average fund size	Paid-in	PI/C (net)
Fully realized*	1981	3	46.78	15.59	26.16	**0.56**	-	-	-	-	-
	1982	-	-	-	-	-	-	-	-	-	-
	1983	4	88.55	22.14	84.11	0.95	-	-	-	-	-
	1984	6	152.37	25.39	114.38	**0.75**	4	64.04	16.01	38.86	**0.61**
	1985	16	402.49	25.16	323.81	0.80	-	-	-	-	-
	1986	10	250.23	25.02	227.24	0.91	5	176.08	35.22	178.25	**1.01**
	1987	8	477.29	59.66	458.68	0.96	7	416.29	58.47	402.44	0.97
	1988	11	556.22	50.57	499.45	0.90	15	1 878.17	125.21	859.24	**0.46**
	1989	20	780.17	39.01	688.32	0.88	10	2 155.84	215.58	1 803.48	0.84
	1990	14	673.91	48.14	624.48	0.93	12	2 067.93	172.33	2 359.01	**1.14**
	1991	11	484.27	44.02	422.19	0.87	15	1 204.21	80.28	1 114.01	0.93
	1992	6	193.76	62.29	211.48	**1.09**	7	799.96	114.28	654.46	0.82
	1993	11	294.34	26.76	280.14	0.95	8	874.44	109.31	695.95	0.80
	1994	16	689.52	43.09	476.45	**0.69**	14	2 789.64	199.26	2 411.51	0.86
	1995	13	1 280.91	98.53	1 055.00	0.82	11	1 917.14	174.29	1 398.64	**0.73**
	1996	18	749.92	41.66	599.63	0.80	18	6 510.89	361.72	3 765.82	**0.58**
	1997	35	1 722.36	49.21	1 290.63	**0.75**	26	10 567.48	406.44	9 220.75	0.87
	1998	33	2 367.35	71.74	2 178.28	0.92	25	13 726.14	549.04	10 490.83	**0.76**
	1999	57	3 785.90	66.42	2 214.46	**0.58**	36	11 550.83	320.86	11 325.81	0.98
	2000	93	9 238.53	99.34	7 500.55	0.81	35	15 166.83	433.34	13 743.23	0.91
	2001	62	4 893.96	78.93	3 413.11	**0.70**	21	17 007.99	809.90	17 156.29	**1.01**
Active	2002	34	931.56	27.40	867.97	0.93	23	9 865.95	428.95	9 809.75	0.99
	2003	41	2 549.62	62.19	2 245.47	0.88	19	8 505.63	447.66	6 844.40	0.80
	2004	45	2 616.93	58.15	2 142.14	0.82	18	16 066.74	892.60	12 520.40	0.78
	2005	38	3 295.32	86.72	2 675.88	0.81	34	47 455.08	1 395.74	48 257.95	**1.02**
	2006	39	6 566.79	168.38	4 365.75	0.66	38	49 269.89	1 296.58	40 493.83	0.82
	2007	54	5 937.23	109.95	4 439.83	0.75	31	44 7088.86	1 444.80	34 162.80	0.76
	2008	55	3 070.35	54.37	1 619.31	0.53	26	47 046.15	1 809.47	24 355.05	0.52
	2009	36	866.94	24.08	511.51	0.59	13	13 592.36	1 045.56	4 398.47	0.32
Total realiz.		447	29 127		22 688		269	88 873		77 618	
Av. realiz.				65.16		0.78			330.38		0.87
Total all		789	54 962		41 556		471	325 464		258 461	
Av. all				69.66		0.76			691.01		0.79

Table 12 – Net PICC ratios, for top quartile US/EMEA VC and LBO funds

This table provides the committed capital, average fund sizes, paid-in and paid-in/committed (PICC) ratio for top quartile US VC and LBO funds; and EMEA VC and LBO funds from Thomson ONE Banker database (1981-2009).

		US Venture Capital					US LBO				
	Vintage year	Sample	Total committed	Average fund size	Paid-in	PI/C (net)	Sample	Total committed	Average fund size	Paid-in	PI/C (net)
Fully realized*	1981	6	335.52	55.92	356.64	**1.06**	-	-	-	-	-
	1982	7	341.78	48.82	313.38	0.92	-	-	-	-	-
	1983	15	735.77	49.05	719.24	0.98	-	-	-	-	-
	1984	16	729.80	45.61	658.87	0.90	-	-	-	-	-
	1985	12	341.77	24.48	341.81	1.00	-	-	-	-	-
	1986	10	1 592.24	159.22	1 498.80	0.94	3	957.20	319.07	765.15	0.80
	1987	16	1 078.08	67.38	1 022.15	0.95	7	3 371.55	481.65	3 564.26	**1.06**
	1988	12	1 294.87	107.91	1 247.77	0.96	5	2 170.40	434.08	2 162.13	1.00
	1989	13	723.48	55.65	706.17	0.98	7	2 578.35	368.34	1 802.71	**0.70**
	1990	6	551.32	91.88	532.14	0.97	-	-	-	-	-
	1991	4	200.16	50.04	202.04	**1.01**	-	-	-	-	-
	1992	7	865.05	123.58	806.48	0.93	4	1 486.53	371.63	1 469.58	0.99
	1993	11	1 251.44	113.77	1 177.31	0.94	6	3 132.00	522.00	3 092.84	0.99
	1994	9	3 029.61	336.62	2 937.48	0.97	7	4 894.60	699.23	4 109.56	0.84
	1995	12	1 403.68	116.97	1 329.33	0.95	7	3 820.36	545.77	2 991.35	**0.78**
	1996	10	1 163.00	116.30	1 089.18	0.94	7	3 313.57	473.37	3 243.35	0.98
	1997	16	2 329.63	145.60	2 241.63	0.96	10	13 415.82	1 341.58	13 891.97	**1.04**
	1998	20	3 704.77	185.24	3 530.35	0.95	15	6 092.65	406.17	5 819.36	0.96
	1999	27	7 140.70	264.47	6 402.59	0.90	10	9 858.40	985.84	9 135.55	0.93
	2000	31	18 856.47	608.27	16 991.42	0.90	14	20 227.22	1 444.80	16 472.69	0.81
	2001	15	11 910.31	794.02	11 001.16	0.92	7	7 779.50	1 111.36	7 504.61	0.96
Active	2002	5	723.13	144.63	542.84	0.75	5	3 416.39	683.28	3 609.62	**1.06**
	2003	6	1 125.02	187.50	1 070.13	0.95	5	9 318.60	1 863.72	7 780.53	0.83
	2004	7	2 821.82	403.12	2 428.93	0.86	6	6 373.20	1 062.20	5 985.02	0.94
	2005	6	1 558.83	259.81	1 390.32	0.89	9	19 618.09	2 179.79	18 547.75	0.95
	2006	11	7 581.20	689.20	6 512.72	0.86	9	12 697.00	1 410.78	12 008.21	0.95
	2007	6	1 584.55	264.09	1 222.04	0.77	10	19 283.50	1 928.35	13 494.88	0.70
	2008	5	933.75	186.75	454.32	0.49	7	6 104.01	872.00	3 423.68	0.56
	2009	4	1 482.30	370.58	832.05	0.56	-	-	-	-	-
Total realiz.		275	59 579		55 105		109	82 491		76 025	
Av. realiz.				216.65		0.92			756.80		0.92
Total all		325	77 390		69 559		160	159 301		140 874	
Av. all				238.12		0.90			995.64		0.88

* Vintage years 2001, though having reached their 10-year lifespan, might still be active and under life extension peri

Table 17 (continued)

EMEA Venture Capital					EMEA LBO				
Sample	Total committed	Average fund size	Paid-in	PI/C (net)	Sample	Total committed	Average fund size	Paid-in	PI/C (net)
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
3	104.21	34.74	94.88	0.91	3	398.83	132.94	278.46	**0.70**
4	212.87	53.22	202.92	0.95	4	1 271.78	317.94	1 294.52	**1.02**
4	873.13	218.28	738.81	0.84	3	1 160.15	386.72	710.68	**0.61**
4	192.23	48.06	161.42	0.84	5	2 986.81	597.36	1 227.00	**0.41**
9	652.04	72.45	489.85	**0.75**	7	2 784.91	397.84	2 545.72	0.91
8	393.66	49.21	369.39	0.94	7	8 114.15	1 159.16	6 822.67	0.84
14	468.43	33.46	306.61	**0.65**	10	2 555.23	255.52	2 182.86	0.85
22	1 119.37	50.88	811.21	**0.72**	9	4 464.39	496.04	4 388.94	0.98
15	676.12	45.07	650.13	0.96	6	11 208.47	1 868.08	12 162.80	**1.09**
7	225.81	32.26	224.99	1.00	6	3 932.65	655.44	3 462.05	0.88
10	578.99	57.90	556.87	0.96	5	2 410.80	482.16	2 701.73	**1.12**
12	1 340.55	111.71	992.00	0.74	4	2 496.84	624.21	2 773.79	**1.11**
10	447.99	44.80	419.22	0.94	9	8 549.22	949.91	8 315.50	0.97
10	4 071.89	407.19	2 787.68	0.68	10	8 725.48	872.55	7 959.61	0.91
14	1 188.23	84.87	805.66	0.68	8	11 462.32	1 432.79	7 640.69	0.67
14	1 507.45	101.95	537.40	0.36	5	1 922.72	384.54	1 061.29	0.55
9	171.73	19.08	95.17	0.55	4	7 862.60	1 965.65	1 952.17	0.25
83	4 692		3 825		54	34 944		31 613	
		56.53		0.82			647.12		0.90
169	14 224		10 244		105	82 307		67 480	
		84.17		0.72			783.88		0.82

3.3.2. Graphical analysis of the J-Curves

Following up on the categorization of returns, we drew the J-Curves of US VC funds for the average and four ideal-types [Figure 15], and then selected an ideal-type (low returns) and the current partially unrealized VYs [Figure 16]. All flows were re-scaled on a basis 100 for that purpose. The operation was then repeated for US LBO funds [Figures 17 and 18], EMEA VC funds [Figures 19 and 20] and EMEA LBO funds [Figures 21 and 22].

3.3.3. First predictor of performance: the time to break-even

Looking at Figure 15, the five curves exhibit different shapes. The average curve (1980-2001) shows that the maximum cumulated draw-down is actually slightly more than 40 percent of the committed capital, and crosses the x-axis in Q2 Year Eight. The maximum cumulated draw-down for the ‘very high’ returns curve is 55 percent

and the curve crosses the x-axis in Q3 Year Five. The maximum cumulated draw-down for the 'high' returns curve is 60 percent and the curve crosses the x-axis in Q1 Year Seven. The 'medium' returns curve exhibits a cumulated draw-down of close to 75 percent and crosses the x-axis in Q4 Year Nine. The 'low' returns curve reaches an 80 percent draw-down and never recovers. These shapes are rather distinctive and signal that the cash-flows of performing and underperforming VYs differ significantly.

The best VYs are those that exhibit a faster recovery of the J-Curve and that cross the x-axis early. As seen, the 'very high' returns curve bottoms in Year Four, the 'high' returns curve crosses in Year Five, the 'medium' returns curve crosses in Year Five and the 'low' returns curve bottoms in Year Eight. That the best VYs are bottoming in Year Four or Five shows that the holding period of the assets is indeed lower than the expected five years and should be three to four years. Being so distinct, these ideal-type curves could be a potential predictor for the returns of unrealized curves. We turn to Figure 16 to compare current VYs with the average and 'low' returns curves. None of these curves actually crosses the x-axis. VYs 2002, 2003, 2004, 2005 and 2007 have bottomed respectively in Year Seven for the first four and Year Five for 2007. Predicting the results by interpreting the graphical interpretation alone is rather difficult.

Looking at Figure 17, a few differences appear for US LBO. 'Very high' returns and 'Low' return curves bottom in the same region (slightly below -60 percent), while 'High' returns bottom in the region of –55 percent and 'Medium' returns at around –45 percent. Consistent with US VC, the shorter the time to cash-flow break-even, the better the performance is: Year Five for 'Very high' returns, Year Seven for 'High', Year Eight for 'Medium' / 'Low'.

3.3.4. Ideal-type categories to be adapted to each market

US LBO curves exhibit specific features, such as sudden recoveries of their cash-flows (for example, Q17 to Q20 and Q46 to Q48 for 'Very High' returns; and Q37 to Q38 for 'Low' returns). These might be related to refinancing opportunities ('dividend recaps').

Interestingly, the shape of the 'Low' returns J-Curve is closer to higher returns than to 'Medium'. The performance of 'Medium' being better than 'Low', this illustration belies the identification of a VY by simply reading the graphical interpretation. Turning to Figure 18, VYs 2002 and 2003 can be visually compared with the ideal-types, but other VYs are more difficult to compare.

EMEA VC funds curves [Figure 19] are another challenge: given the high number of outliers and the limited number of available VYs, some curve shapes (such as 'very

high' returns) are based on only one VY (1990 in that case). Ideal-types curves might have to be broken down differently in EMEA (in three or five categories). In EMEA, the earliest that the J-Curve crosses the x-axis is in Year Nine ('Very high' returns). 'High' returns cross the axis in Year Ten only, while the 'Medium' returns J-Curve crosses the x-axis in Year 12. Surprisingly, 'very high' and 'high' returns are the curves reaching the lowest points in terms of cumulated draw-downs (70 percent). 'Medium' returns reach –65 percent and the 'Low' returns stop at –55 percent. Hence, EMEA VC funds exhibit specific cash-flow shapes. Figure 20 hints at a possibly good performance of VY 2002, as well as 2003 and 2005.

3.3.5. Graphical representations: insufficient for performance predictions

Reading the potential performance from the graphical illustration remains difficult. EMEA LBO funds' J-Curves [Figure 21] clearly differentiate the 'High' and 'Very high' returns funds from 'Medium' and 'Low' returns. The first two categories bottom out respectively at –45 percent and –40 percent, while the next two reach respectively –55 percent and –50 percent. 'High' returns cross the x-axis in Year Six (Q23) and 'Very high' returns in Year Seven (Q25), while 'Medium' returns cross the axis in Year Eight (Q31) and 'Low' returns in Year Nine (Q35). 'High' returns show a more attractive profile than 'Very high' returns until Year 11. This suggests that it is necessary to break down the return categories differently for EMEA, or that there is the presence of outliers in the cash-flows. Figure 22 illustrates the difficulty of predicting the performance of current vintages based on their J-Curves. The case in point is VY 2002: it drew down a maximum of 40 percent of its commitment and crossed the x-axis in Year Six, which would qualify it for 'High' returns. However, its performance since Year Seven draws it towards the 'Medium' category. VY 2003 seemed to be 'Low' performance but crossed the x-axis in Year Nine.

3.3.6. Correlation analysis of the J-Curves

Though graphical interpretation of J-Curves is difficult, the shape of these curves might be of use to identifying the potential performance of a VY. Given the flaws of data available, our method will focus on measuring the distance of a given VY from the 'ideal-types' categories.

3.3.6.1. US VC

Table 18 provides a correlation matrix for US VC funds by VYs (fully realized and unrealized) and by categories. 'Low' return categories clearly appear as negatively correlated with the rest of the categories. 'Very high' returns also exhibit a 0.71 correlation rate with 'Medium' returns and a 0.92 correlation rate with 'High' returns. Digging into the categories and their VYs, we have sought to identify which vintage is the most representative of each category. 1985 exhibits a 1.0 correlation with

'Medium' returns (and a higher differentiation with other categories than VY 1987, which also exhibits a 1.0 correlation with 'Medium' returns). 1990 is the most representative VY of 'High' (1.0), 1995 of 'Very high' (0.98) and 2000 of 'Low' returns (0.79). Focusing on unrealized VYs, 2002, 2003, 2004 and 2005 would belong to the 'Low' returns categories. VY 2006 does not appear clearly as belonging either to a 'Low' or a 'Medium' returns category (yet). It is clear that it will not be a 'Very high' return VY, and most likely not a 'High' returns VY. VY 2007 is excluded from the 'Very high' returns category, and VY 2008 drifts away from this category. Most likely, 2007 and 2008 would belong to 'Medium' returns. VY 2009 is difficult to attribute, but a closer look shows that its pattern exhibits a correlation of 1.0 with VYs 2003, 2005 and 2006.

3.3.6.2. US LBO

The exercise is repeated for US LBO funds [Table 18]. The differentiation between the vintages is much smaller[98]. Though less important, we judge the correlation rates sufficiently distinct to draw conclusions. 1986 is the most representative VY of 'Very high' returns, 1990 of 'Low', 1993 of 'High' and 1995 of 'Medium' returns. Analyzing unrealized VYs, a first phenomenon appears: some correlation rates fall at or below 0.6. This might signal a potential new category. 2002 appears as most likely to be a 'Medium' vintage (0.95 category correlation, 0.97 with VY 1995). 2003 is likely to be a 'High' vintage (0.93 category correlation, 0.94 with VY 1993). 2004 is leaning towards 'Medium' (0.88 category correlation, 0.92 with VY 1995), though 'Low' returns remain possible. VY 2005 is likely to exhibit 'Low' performances (0.98 category correlation, 0.98 with VY 1990). VY 2006 could be also 'Low' (0.95 category correlation as well as with 'Medium', but a 0.95 correlation rate with 1990 and a 0.94 with VY 1995). VY 2007 is likely to be a 'Medium' performance (0.97 category correlation, though 'Low' is close at 0.96 – and both representative VY are at 0.96). 2008 and 2009 will not be 'Very high' return vintages, 2008 most likely to be 'Medium' to 'Low' and 2009 'Medium' to 'High'.

3.3.6.3. EMEA VC

Table 19 provides the results for EMEA VC funds. The different categories appear as very distinctive, but not necessarily very representative. In fact 'Very high' returns relies only on VY 1990. 'High returns' rely on two vintages (1984 being the most representative). 'Medium' returns rely on four VYs (1991 as the most representative) and 'Low' returns on three vintages (2000 is the most representative). 2002 and 2003 are going to be 'Low' returns VYs. 2004 is most likely to be a 'Low' returns VY as well (0.90 category correlation rate, 0.88 with VY 2000). 2005 is a puzzle: it shows a very strong correlation with 'Low' and at the same time 'Very high' returns (0.99 correlation

[98] This might be an argument to refine the categories and aggregate the vintages differently, should this investigation be a support for further research (with higher density and quality of data)

with both categories). This can be related to the quality of the underlying cash-flows, which is insufficient, or the emergence of a new category. It can mean that VY 1990 started as a 'Low' returns vintage to later recover spectacularly. 2006 is most likely a 'Low' returns VY (0.93 category correlation, at par with 'Medium', but the highest correlation is with VY 2000). 2007 leans closer to 'Medium' than 'Low' (0.98 category correlation versus 0.97) but the closest VY is 2000. 2008 leans towards 'High' returns (0.98 category correlation, at par with 'Medium', but the highest correlation is with 1984), while 2009 leans towards 'Low' (category correlation) to Medium (VY correlation).

3.3.6.4. EMEA LBO

Table 20 provides the results for EMEA LBO funds. The same initial limitation appears: the categories are not substantially differentiated. Just as for US LBO funds, some correlation rates appear at or below 0.6 for the unrealized vintages. This might signal a new category (possibly related to the use of 'dividend recaps'). VY 1989 appears as the most representative of 'Low' returns, 1999 of 'Medium' returns, 2000 of 'Very high' and 2001 for 'High returns'. 2002 is most likely to be a 'High' returns VY (0.96 category correlation, 0.95 with VY 2001). 2003 leans towards 'Medium' (0.92 category correlation) to 'Low' (0.91 category correlation, and 0.91 with VY 1989). 2004 is a case of 'High' returns (0.71 category correlation, 0.66 with VY 2001) and 2005 an example of 'Low' returns (0.93 category correlation and with VY 1989), as well as 2006 (0.98 for both). 2007 appears as leaning towards 'Low' (0.98 category correlation and 0.98 correlation with 1989, though the correlation is higher with 1999). 2008 is likely to be a 'High' returns VY (0.96 category correlation and 0.97 with VY 2001). 2009 is leaning towards 'Low' (0.98 for both).

Table 18 – Correlation table for US VC funds by VY and category of returns

This table provides the results of correlation tests between of the cash-flow curves for US VC funds by VY and by category of returns (very high, high, medium and low) as well as the 1980-2001 average. Cash-flows are provided by Thomson ONE database (as of 31/12/2011). Categories are ours.

Correlation Matrix							High	Medium									High					Very high						Low								
		1980-2001	Medium	High	Very high	Low	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	1980-2001	1	0,94	0,99	0,90	-0,55	1,00	0,97	0,95	0,92	0,90	0,93	0,84	0,96	0,97	0,93	0,98	0,98	0,97	0,96	0,95	0,86	0,73	0,79	0,98	0,38	0,10	0,16	-0,08	-0,14	0,13	0,22	0,61	0,83	0,86	0,93
	Medium	0,94	1	0,90	0,71	-0,36	0,93	0,98	0,97	0,98	0,98	1,00	0,96	1,00	0,98	0,99	0,90	0,96	0,85	0,86	0,82	0,66	0,50	0,60	0,89	0,49	0,39	0,52	0,39	0,46	0,81	0,91	0,98	1,00	0,98	0,98
	High	0,99	0,90	1	0,92	-0,62	0,99	0,94	0,91	0,87	0,85	0,88	0,78	0,93	0,96	0,91	1,00	0,97	0,99	0,98	0,98	0,89	0,75	0,79	0,97	0,28	0,02	0,11	-0,16	-0,25	-0,03	0,11	0,73	0,98	0,96	0,99
	Very high	0,90	0,71	0,92	1	-0,78	0,91	0,80	0,75	0,68	0,63	0,69	0,57	0,75	0,81	0,70	0,93	0,85	0,96	0,93	0,95	0,98	0,93	0,92	0,91	0,08	-0,30	-0,23	-0,47	-0,55	-0,42	-0,49	-0,28	0,19	0,79	0,99
	Low	-0,55	-0,36	-0,62	-0,78	1	-0,57	-0,42	-0,30	-0,25	-0,20	-0,30	-0,25	-0,42	-0,49	-0,38	-0,62	-0,49	-0,70	-0,67	-0,70	-0,81	-0,88	-0,86	-0,60	0,54	0,79	0,73	0,91	0,97	0,95	0,97	0,99	0,99	0,96	0,95
Hi	1980	1,00	0,93	0,99	0,91	-0,57	1	0,96	0,94	0,90	0,88	0,91	0,82	0,95	0,97	0,93	0,99	0,98	0,98	0,97	0,96	0,86	0,74	0,80	0,98	0,35	0,08	0,16	-0,10	-0,17	0,09	0,23	0,64	0,86	0,88	0,96
Medium	1981	0,97	0,98	0,94	0,80	-0,42	0,96	1	0,97	0,97	0,95	0,97	0,92	0,97	0,96	0,96	0,93	0,97	0,89	0,88	0,88	0,76	0,61	0,68	0,91	0,47	0,28	0,39	0,19	0,18	0,45	0,54	0,86	0,95	0,95	0,98
Medium	1982	0,95	0,97	0,91	0,75	-0,30	0,94	0,97	1	0,98	0,98	0,98	0,90	0,97	0,96	0,96	0,90	0,97	0,87	0,86	0,83	0,69	0,53	0,61	0,91	0,62	0,43	0,53	0,40	0,45	0,72	0,74	0,87	0,95	0,93	0,95
Medium	1983	0,92	0,98	0,87	0,68	-0,25	0,90	0,97	0,98	1	0,99	0,99	0,96	0,97	0,94	0,96	0,86	0,93	0,81	0,81	0,78	0,62	0,47	0,56	0,86	0,63	0,51	0,62	0,53	0,62	0,82	0,83	0,92	0,96	0,96	0,98
Medium	1984	0,90	0,98	0,85	0,63	-0,20	0,88	0,95	0,98	0,99	1	0,99	0,95	0,97	0,94	0,97	0,84	0,93	0,79	0,79	0,76	0,57	0,39	0,49	0,84	0,64	0,58	0,71	0,64	0,70	0,92	0,94	0,99	0,99	0,97	0,98
Medium	1985	0,93	1,00	0,88	0,69	-0,30	0,91	0,97	0,98	0,99	0,99	1	0,97	0,98	0,96	0,98	0,87	0,94	0,83	0,83	0,80	0,64	0,48	0,57	0,87	0,56	0,46	0,60	0,49	0,56	0,83	0,87	0,97	0,99	0,96	0,98
Medium	1986	0,84	0,96	0,78	0,57	-0,25	0,82	0,92	0,90	0,96	0,95	0,97	1,00	0,93	0,89	0,93	0,77	0,85	0,71	0,72	0,70	0,53	0,39	0,49	0,77	0,50	0,52	0,73	0,75	0,81	0,95	0,95	0,98	0,99	0,99	0,97
Medium	1987	0,96	1,00	0,93	0,75	-0,42	0,95	0,97	0,97	0,97	0,97	0,98	1	1	0,99	0,99	0,92	0,97	0,89	0,89	0,85	0,70	0,55	0,65	0,92	0,44	0,30	0,41	0,24	0,30	0,72	0,88	0,98	0,99	0,96	0,97
Medium	1988	0,97	0,98	0,96	0,81	-0,49	0,97	0,96	0,96	0,94	0,94	0,96	0,89	0,99	1	1	0,95	0,99	0,93	0,94	0,89	0,76	0,61	0,70	0,94	0,37	0,20	0,29	0,08	0,05	0,46	0,76	0,96	0,99	0,99	0,99
Medium	1989	0,93	0,99	0,91	0,70	-0,38	0,93	0,96	0,96	0,96	0,97	0,98	0,93	0,99	0,98	1,00	0,90	0,96	0,86	0,87	0,82	0,66	0,49	0,60	0,89	0,43	0,35	0,49	0,34	0,39	0,75	0,95	0,98	0,97	0,99	0,98
Hi	1990	0,98	0,90	1,00	0,93	-0,62	0,99	0,93	0,90	0,86	0,84	0,87	0,77	0,92	0,95	0,90	1	0,97	0,99	0,98	0,98	0,90	0,75	0,79	0,96	0,26	0,00	0,11	-0,17	-0,27	-0,06	0,08	0,74	0,99	0,98	0,99
Very high	1991	0,98	0,96	0,97	0,85	-0,49	0,98	0,97	0,97	0,93	0,93	0,94	0,85	0,97	0,99	0,96	0,97	1	0,95	0,94	0,92	0,81	0,65	0,71	0,95	0,40	0,20	0,30	0,09	0,07	0,37	0,55	0,82	0,99	0,99	0,99
Very high	1992	0,97	0,85	0,99	0,96	-0,70	0,98	0,89	0,87	0,81	0,79	0,83	0,71	0,89	0,93	0,86	0,99	0,95	1	0,99	0,98	0,93	0,82	0,85	0,96	0,19	-0,11	-0,03	-0,29	-0,41	-0,26	-0,25	0,11	0,81	0,97	0,99
Very high	1993	0,96	0,86	0,98	0,93	-0,67	0,97	0,88	0,86	0,81	0,79	0,83	0,72	0,89	0,94	0,87	0,98	0,94	0,99	1	0,95	0,88	0,78	0,83	0,97	0,20	-0,07	0,00	-0,25	-0,36	-0,21	-0,17	0,17	0,62	0,91	0,99
Very high	1994	0,95	0,82	0,98	0,93	-0,70	0,96	0,88	0,83	0,78	0,76	0,80	0,70	0,85	0,89	0,82	0,98	0,92	0,98	0,95	1	0,94	0,81	0,83	0,94	0,14	-0,15	-0,05	-0,33	-0,43	-0,26	-0,25	0,47	0,95	0,97	0,99
Very high	1995	0,86	0,66	0,89	0,98	-0,81	0,86	0,76	0,69	0,62	0,57	0,64	0,53	0,70	0,76	0,66	0,90	0,81	0,93	0,88	0,94	1	0,92	0,88	0,86	-0,01	-0,37	-0,29	-0,52	-0,60	-0,50	-0,54	-0,40	0,30	0,87	0,92
Very high	1996	0,73	0,50	0,75	0,93	-0,88	0,74	0,61	0,53	0,47	0,39	0,48	0,39	0,55	0,61	0,49	0,75	0,65	0,82	0,78	0,81	0,92	1,00	0,95	0,75	-0,16	-0,57	-0,54	-0,72	-0,75	-0,68	-0,74	-0,66	-0,49	0,30	0,95
Very high	1997	0,79	0,60	0,79	0,92	-0,86	0,80	0,68	0,61	0,56	0,49	0,57	0,49	0,65	0,70	0,60	0,79	0,71	0,85	0,83	0,83	0,88	1	1	0,84	-0,09	-0,50	-0,52	-0,72	-0,78	-0,68	-0,79	-0,67	-0,55	-0,36	0,94
Very high	1998	0,98	0,89	0,97	0,91	-0,60	0,98	0,91	0,91	0,86	0,84	0,87	0,77	0,92	0,94	0,89	0,96	0,95	0,96	0,97	0,94	0,86	0,75	0,84	1	0,32	0,01	0,04	-0,19	-0,29	-0,06	-0,05	0,24	0,40	0,43	0,75
Low	1999	0,38	0,49	0,28	0,08	0,54	0,35	0,47	0,62	0,63	0,64	0,56	0,50	0,44	0,37	0,43	0,26	0,40	0,19	0,20	0,14	-0,01	-0,16	-0,09	0,32	1	0,87	0,80	0,82	0,82	0,90	0,83	0,88	0,91	0,86	0,90
Low	2000	0,10	0,39	0,02	-0,30	0,79	0,08	0,28	0,43	0,51	0,58	0,46	0,52	0,30	0,20	0,35	0,00	0,20	-0,11	-0,07	-0,15	-0,37	-0,57	-0,50	0,01	0,87	1	0,95	0,99	0,97	0,99	0,98	0,99	0,99	0,96	0,95
Low	2001	0,16	0,52	0,11	-0,23	0,73	0,16	0,39	0,53	0,62	0,71	0,60	0,73	0,41	0,29	0,49	0,11	0,30	-0,03	0,00	-0,05	-0,29	-0,54	-0,52	0,04	0,80	0,95	1	0,97	0,95	0,97	0,99	0,98	0,98	1,00	0,99
	2002	-0,08	0,39	-0,16	-0,47	0,91	-0,10	0,19	0,40	0,53	0,64	0,49	0,75	0,24	0,08	0,34	-0,17	0,09	-0,29	-0,25	-0,33	-0,52	-0,72	-0,72	-0,19	0,82	0,99	0,97	1	0,99	0,98	1,00	0,99	0,99	1,00	0,99
	2003	-0,14	0,46	-0,25	-0,55	0,97	-0,17	0,18	0,45	0,62	0,70	0,56	0,81	0,30	0,05	0,39	-0,27	0,07	-0,41	-0,36	-0,43	-0,60	-0,75	-0,78	-0,29	0,82	0,97	0,95	0,99	1	0,98	1,00	1,00	0,99	1,00	1,00
	2004	0,13	0,81	-0,03	-0,42	0,95	0,09	0,45	0,72	0,82	0,92	0,83	0,95	0,72	0,46	0,75	-0,06	0,37	-0,26	-0,21	-0,26	-0,50	-0,68	-0,68	-0,06	0,90	0,99	0,97	0,98	0,98	1	0,98	1,00	0,99	0,97	0,99
	2005	0,22	0,91	0,11	-0,49	0,97	0,23	0,54	0,74	0,83	0,94	0,87	0,95	0,88	0,76	0,95	0,08	0,55	-0,25	-0,17	-0,25	-0,54	-0,74	-0,79	-0,05	0,83	0,98	0,99	1,00	1,00	0,98	1	0,99	0,99	1,00	1,00
	2006	0,61	0,98	0,73	-0,28	0,99	0,64	0,86	0,87	0,92	0,99	0,97	0,98	0,98	0,96	0,98	0,74	0,82	0,11	0,17	0,47	-0,40	-0,66	-0,67	0,24	0,88	0,99	0,98	0,99	1,00	1,00	0,99	1	1,00	0,98	1,00
	2007	0,83	1,00	0,98	0,19	0,99	0,86	0,95	0,95	0,96	0,99	0,99	0,99	0,99	0,99	0,97	0,99	0,99	0,81	0,62	0,95	0,30	-0,49	-0,55	0,40	0,91	0,99	0,98	0,99	0,99	0,99	0,99	1,00	1	0,98	0,99
	2008	0,86	0,98	0,96	0,79	0,96	0,88	0,95	0,93	0,96	0,97	0,96	0,99	0,96	0,99	0,99	0,98	0,99	0,97	0,91	0,97	0,87	0,30	-0,36	0,43	0,86	0,96	1,00	1,00	1,00	0,97	1,00	0,98	0,98	1	0,99
	2009	0,93	0,98	0,99	0,99	0,95	0,96	0,98	0,95	0,98	0,98	0,98	0,97	0,97	0,99	0,98	0,99	0,99	0,99	0,99	0,99	0,92	0,95	0,94	0,75	0,90	0,95	0,99	0,99	1,00	0,99	1,00	1,00	0,99	0,99	1

* Data as of December 31st, 2011

** Categorisation based on ThomsonOne's communicated returns

Table 19 – Correlation table for US LBO funds by VY and category of returns

This table provides the results of correlation tests between of the cash-flow curves for US LBO funds by VY and by category of returns (very high, high, medium and low) as well as the 1984-2001 average. Cash-flows are provided by Thomson ONE database (as of 31/12/2011). Categories are ours.

Correlation Matrix

		1984-2001	Very high	Medium	High	Low	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
							Very high				Med.	Hi	Low	High			Med.		Low					Med.								
	1984-2001	1	0,87	1,00	0,96	0,98	0,87	0,88	0,81	0,94	0,99	0,96	0,98	0,95	0,90	0,96	0,95	0,99	0,96	0,99	0,93	0,97	0,98	0,97	0,95	0,89	0,94	0,95	0,98	0,96	0,98	0,98
	Very high	0,87	1	0,89	0,90	0,84	0,98	0,97	0,97	0,86	0,89	0,89	0,84	0,88	0,87	0,90	0,91	0,87	0,77	0,82	0,66	0,73	0,88	0,83	0,63	0,84	0,22	-0,20	-0,11	0,05	0,45	0,82
	Medium	1,00	0,89	1	0,98	0,98	0,89	0,90	0,83	0,94	0,99	0,98	0,98	0,96	0,93	0,98	0,95	0,99	0,94	0,98	0,89	0,94	0,99	0,99	0,95	0,91	0,88	0,90	0,95	0,97	0,99	0,97
	High	0,96	0,90	0,98	1	0,96	0,93	0,92	0,81	0,87	0,95	0,99	0,96	0,98	0,97	1,00	0,90	0,96	0,87	0,93	0,81	0,86	0,98	0,96	0,86	0,93	0,66	0,59	0,86	0,93	0,98	0,98
	Low	0,98	0,84	0,98	0,96	1	0,85	0,88	0,78	0,93	0,98	0,98	1,00	0,97	0,88	0,95	0,90	0,97	0,92	0,98	0,87	0,92	0,96	0,94	0,88	0,85	0,87	0,98	0,95	0,96	0,98	0,94
Very high	1984	0,87	0,98	0,89	0,93	0,85	1	0,98	0,91	0,81	0,87	0,91	0,85	0,90	0,93	0,93	0,89	0,87	0,76	0,81	0,64	0,71	0,86	0,80	0,61	0,82	0,21	-0,21	-0,13	0,05	0,58	0,90
	1985	0,88	0,97	0,90	0,92	0,88	0,98	1	0,90	0,87	0,90	0,92	0,88	0,93	0,89	0,92	0,91	0,89	0,79	0,85	0,68	0,74	0,86	0,79	0,60	0,80	0,18	-0,25	-0,12	-0,10	0,33	0,92
	1986	0,81	0,97	0,83	0,81	0,78	0,91	0,90	1	0,85	0,85	0,80	0,78	0,80	0,76	0,82	0,87	0,81	0,73	0,77	0,62	0,71	0,87	0,87	0,65	0,81	0,23	-0,09	-0,02	0,16	0,20	0,39
	1987	0,94	0,86	0,94	0,87	0,93	0,81	0,87	0,85	1	0,96	0,89	0,93	0,89	0,76	0,86	0,95	0,95	0,94	0,96	0,88	0,92	0,87	0,87	0,84	0,60	0,89	0,97	0,99	0,95	0,97	0,98
M.	1988	0,99	0,89	0,99	0,95	0,98	0,87	0,90	0,85	0,96	1	0,97	0,98	0,96	0,87	0,95	0,94	0,99	0,94	0,98	0,89	0,94	0,97	0,96	0,93	0,83	0,90	0,98	0,96	0,98	0,99	0,96
Hi	1989	0,96	0,89	0,98	0,99	0,98	0,91	0,92	0,80	0,89	0,97	1	0,98	0,99	0,94	0,98	0,89	0,96	0,87	0,94	0,81	0,87	0,97	0,96	0,86	0,89	0,65	0,69	0,94	0,98	0,99	0,97
L.	1990	0,98	0,84	0,98	0,96	1,00	0,85	0,88	0,78	0,93	0,98	0,98	1	0,97	0,88	0,95	0,90	0,97	0,92	0,98	0,87	0,92	0,96	0,94	0,88	0,85	0,87	0,98	0,95	0,96	0,98	0,94
High	1991	0,95	0,88	0,96	0,98	0,97	0,90	0,93	0,80	0,89	0,96	0,99	0,97	1	0,92	0,96	0,89	0,95	0,87	0,94	0,80	0,86	0,94	0,92	0,82	0,89	0,71	0,71	0,92	0,94	0,92	0,92
	1992	0,90	0,87	0,93	0,97	0,88	0,93	0,89	0,76	0,76	0,87	0,94	0,88	0,92	1	0,97	0,84	0,90	0,79	0,84	0,73	0,78	0,93	0,91	0,81	0,90	0,52	0,28	0,56	0,77	0,94	0,97
	1993	0,96	0,90	0,98	1,00	0,95	0,93	0,92	0,82	0,86	0,95	0,98	0,95	0,96	0,97	1	0,90	0,95	0,87	0,93	0,82	0,87	0,98	0,95	0,86	0,94	0,70	0,64	0,85	0,91	0,97	0,97
Med.	1994	0,95	0,91	0,95	0,90	0,90	0,89	0,91	0,87	0,95	0,94	0,89	0,90	0,89	0,84	0,90	1	0,95	0,93	0,93	0,86	0,92	0,90	0,87	0,83	0,83	0,80	0,71	0,79	0,80	0,79	0,89
	1995	0,99	0,87	0,99	0,96	0,97	0,87	0,89	0,81	0,95	0,99	0,96	0,97	0,95	0,90	0,95	0,95	1	0,96	0,98	0,91	0,95	0,97	0,97	0,97	0,86	0,92	0,91	0,94	0,96	0,99	0,97
	1996	0,96	0,77	0,94	0,87	0,92	0,76	0,79	0,73	0,94	0,94	0,87	0,92	0,87	0,79	0,87	0,93	0,96	1	0,96	0,96	0,97	0,88	0,86	0,92	0,70	0,92	0,94	0,94	0,94	0,99	0,98
Low	1997	0,99	0,82	0,98	0,93	0,98	0,81	0,85	0,77	0,96	0,98	0,94	0,98	0,94	0,84	0,93	0,93	0,98	0,96	1	0,93	0,97	0,95	0,92	0,90	0,78	0,92	0,98	0,99	0,98	0,97	0,98
	1998	0,93	0,66	0,89	0,81	0,87	0,64	0,68	0,62	0,88	0,89	0,81	0,87	0,80	0,73	0,82	0,86	0,91	0,96	0,93	1	0,98	0,84	0,82	0,87	0,67	0,95	0,98	0,99	0,95	0,96	0,99
	1999	0,97	0,73	0,94	0,86	0,92	0,71	0,74	0,71	0,92	0,94	0,87	0,92	0,86	0,78	0,87	0,92	0,95	0,97	0,97	0,98	1	0,91	0,87	0,91	0,75	0,93	0,97	0,99	0,97	0,95	0,98
Med.	2000	0,98	0,88	0,99	0,98	0,96	0,86	0,86	0,87	0,87	0,97	0,97	0,96	0,94	0,93	0,98	0,90	0,97	0,88	0,95	0,84	0,91	1	0,98	0,91	0,93	0,84	0,87	0,95	0,96	0,98	0,97
	2001	0,97	0,83	0,99	0,96	0,94	0,80	0,79	0,87	0,87	0,96	0,96	0,94	0,92	0,91	0,95	0,87	0,97	0,86	0,92	0,82	0,87	0,98	1	0,94	0,87	0,81	0,85	0,94	0,96	0,99	0,96
	2002	0,95	0,63	0,95	0,86	0,88	0,61	0,60	0,65	0,84	0,93	0,86	0,88	0,82	0,81	0,86	0,83	0,97	0,92	0,90	0,87	0,91	0,91	0,94	1	0,80	0,86	0,86	0,90	0,95	0,99	0,96
	2003	0,89	0,84	0,91	0,93	0,85	0,82	0,80	0,81	0,60	0,83	0,89	0,85	0,89	0,90	0,94	0,83	0,86	0,70	0,78	0,67	0,75	0,93	0,87	0,80	1	0,78	0,59	0,70	0,76	0,92	0,97
	2004	0,94	0,22	0,88	0,66	0,87	0,21	0,18	0,23	0,89	0,90	0,65	0,87	0,71	0,52	0,70	0,80	0,92	0,92	0,92	0,95	0,93	0,84	0,81	0,86	0,78	1	0,92	0,94	0,86	0,97	0,98
	2005	0,95	-0,20	0,90	0,59	0,98	-0,21	-0,25	-0,09	0,97	0,98	0,69	0,98	0,71	0,28	0,64	0,71	0,91	0,94	0,98	0,98	0,97	0,87	0,85	0,86	0,59	0,92	1	0,98	0,97	0,99	0,98
	2006	0,98	-0,11	0,95	0,86	0,95	-0,13	-0,12	-0,02	0,99	0,96	0,94	0,95	0,92	0,56	0,85	0,79	0,94	0,94	0,99	0,99	0,99	0,95	0,94	0,90	0,70	0,94	0,98	1	0,96	0,95	0,99
	2007	0,96	0,05	0,97	0,93	0,96	0,05	-0,10	0,16	0,95	0,98	0,98	0,96	0,94	0,77	0,91	0,80	0,96	0,94	0,98	0,95	0,97	0,96	0,96	0,95	0,76	0,86	0,97	0,96	1	0,97	0,96
	2008	0,98	0,45	0,99	0,98	0,98	0,58	0,33	0,20	0,97	0,99	0,99	0,98	0,92	0,94	0,97	0,79	0,99	0,99	0,97	0,96	0,95	0,98	0,99	0,99	0,92	0,97	0,99	0,95	0,97	1	0,97
	2009	0,98	0,82	0,97	0,98	0,94	0,90	0,92	0,39	0,98	0,96	0,97	0,94	0,92	0,97	0,97	0,89	0,97	0,98	0,98	0,99	0,98	0,97	0,96	0,96	0,97	0,98	0,98	0,99	0,96	0,97	1

* Data as of December 31st, 2011

** Categorisation based on ThomsonOne's communicated returns

Table 20 – Correlation table for EMEA VC funds by VY and category of returns

This table provides the results of correlation tests between of the cash-flow curves for EMEA VC funds by VY and by category of returns (very high, high, medium and low) as well as the 1981-2001 average. Cash-flows are provided by Thomson ONE database (as of 31/12/2011). Categories are ours.

Correlation Matrix

		1981-2001	High	Medium	Low	V. High	1981	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
								High		Med.	High	Med.			Very High	Med.		Med.		Low						Low								
	1981-2001	1	0,32	0,45	0,89	0,35	0,41	0,46	0,36	0,25	0,25	0,54	0,38	0,37	0,35	0,42	0,02	0,73	0,40	0,37	0,47	0,29	0,65	0,97	0,92	0,99	0,98	0,99	0,93	0,99	0,94	0,97	0,97	0,96
	High	0,32	1	0,97	-0,13	0,96	0,96	0,98	0,98	0,98	0,99	0,94	0,97	0,98	0,96	0,85	0,94	0,76	0,95	-0,73	0,70	0,91	0,79	0,31	-0,12	0,18	0,14	0,37	0,77	0,72	0,85	0,92	0,98	0,95
	Medium	0,45	0,97	1	0,01	0,95	0,97	0,96	0,96	0,97	0,96	0,96	0,98	0,97	0,95	0,92	0,88	0,84	0,98	-0,61	0,75	0,92	0,87	0,46	0,05	0,40	0,34	0,53	0,84	0,89	0,93	0,98	0,98	0,96
	Low	0,89	-0,13	0,01	1	-0,10	-0,02	0,02	-0,07	-0,20	-0,21	0,13	-0,07	-0,09	-0,10	0,01	-0,42	0,39	-0,04	0,73	0,18	-0,12	0,31	0,88	1,00	0,97	0,99	0,98	0,90	0,99	0,93	0,97	0,97	0,97
	V. High	0,35	0,96	0,95	-0,10	1	0,91	0,96	0,91	0,94	0,97	0,87	0,97	0,99	1,00	0,90	0,91	0,82	0,94	-0,65	0,58	0,86	0,75	0,29	-0,09	0,21	0,20	0,47	0,78	0,99	0,90	0,93	0,93	0,93
	1981	0,41	0,96	0,97	-0,02	0,91	1	0,94	0,97	0,97	0,94	0,96	0,93	0,94	0,91	0,84	0,86	0,77	0,96	-0,66	0,72	0,87	0,81	0,45	0,04	0,37	0,33	0,54	0,79	0,81	0,87	0,93	0,92	0,86
High	1983	0,46	0,98	0,96	0,02	0,96	0,94	1	0,95	0,94	0,96	0,95	0,95	0,97	0,96	0,84	0,87	0,82	0,92	-0,62	1	1	0,81	0,44	0,08	0,40	0,49	0,72	0,92	0,90	0,91	0,95	0,97	0,94
M. High	1984	0,36	0,98	0,96	-0,07	0,91	0,97	0,95	1	0,97	0,95	0,97	0,92	0,95	0,91	0,79	0,88	0,71	0,93	-0,70	0,71	0,87	0,78	0,37	-0,02	0,31	0,28	0,46	0,74	0,69	0,87	0,93	0,98	0,94
	1985	0,25	0,98	0,97	-0,20	0,94	0,97	0,94	0,97	1	0,98	0,92	0,96	0,96	0,94	0,86	0,95	0,72	0,96	-0,77	0,69	0,91	0,77	0,24	-0,23	0,08	-0,02	0,15	0,56	0,57	0,81	0,95	0,98	0,96
M. H.	1986	0,25	0,99	0,96	-0,21	0,97	0,94	0,96	0,95	0,98	1	0,91	0,97	0,98	0,97	0,86	0,96	0,74	0,94	-0,76	0,68	0,92	0,77	0,23	-0,22	0,06	-0,03	0,16	0,64	0,59	0,76	0,87	0,98	0,96
	1987	0,54	0,94	0,96	0,13	0,87	0,96	0,95	0,97	0,92	0,91	1	0,90	0,92	0,87	0,78	0,79	0,79	0,91	-0,55	0,78	0,86	0,85	0,58	0,27	0,61	0,59	0,72	0,90	0,83	0,86	0,94	0,95	0,91
	1988	0,38	0,97	0,98	-0,07	0,97	0,93	0,95	0,92	0,96	0,97	0,90	1	0,96	0,97	0,94	0,92	0,83	0,97	-0,63	0,73	0,93	0,85	0,38	-0,07	0,27	0,22	0,43	0,78	0,84	0,92	0,98	0,97	0,95
	1989	0,37	0,98	0,97	-0,09	0,99	0,94	0,97	0,95	0,96	0,98	0,92	0,96	1	0,99	0,87	0,91	0,81	0,95	-0,67	0,62	0,87	0,77	0,31	-0,06	0,26	0,23	0,45	0,84	0,98	0,94	0,97	0,97	0,95
M. WH	1990	0,35	0,96	0,95	-0,10	1,00	0,91	0,96	0,91	0,94	0,97	0,87	0,97	0,99	1	0,90	0,91	0,82	0,94	-0,65	0,58	0,86	0,75	0,29	-0,09	0,21	0,20	0,47	0,78	0,99	0,90	0,93	0,93	0,93
M.	1991	0,42	0,85	0,92	0,01	0,90	0,84	0,84	0,79	0,86	0,86	0,78	0,94	0,87	0,90	1	0,81	0,84	0,93	-0,47	0,64	0,85	0,82	0,40	-0,01	0,33	0,24	0,39	0,67	0,87	0,89	0,94	0,96	0,98
	1992	0,02	0,94	0,88	-0,42	0,91	0,86	0,87	0,88	0,95	0,96	0,79	0,92	0,91	0,91	0,81	1	0,60	0,88	-0,85	0,61	0,89	0,65	-0,01	-0,49	-0,25	-0,41	-0,38	-0,08	-0,23	0,09	0,51	0,84	0,90
	1993	0,73	0,76	0,84	0,39	0,82	0,77	0,82	0,71	0,72	0,74	0,79	0,83	0,81	0,82	0,84	0,60	1	0,82	-0,18	0,64	0,75	0,87	0,70	0,42	0,67	0,65	0,78	0,89	0,97	0,92	0,94	0,93	0,90
	1994	0,40	0,95	0,98	-0,04	0,94	0,96	0,92	0,93	0,96	0,94	0,91	0,97	0,95	0,94	0,93	0,88	0,82	1	-0,62	0,72	0,90	0,83	0,40	-0,03	0,32	0,22	0,40	0,72	0,89	0,89	0,94	0,93	0,90
L.	1995	0,37	-0,73	-0,61	0,73	-0,65	-0,66	-0,62	-0,70	-0,77	-0,76	-0,55	-0,63	-0,67	-0,65	-0,47	-0,85	-0,18	-0,62	1	-0,33	-0,63	-0,27	0,50	0,87	0,79	0,92	0,90	0,74	0,91	0,82	0,89	0,93	0,96
	1996	0,47	0,70	0,75	0,18	0,58	0,72	0,69	0,71	0,69	0,68	0,78	0,73	0,62	0,58	0,64	0,61	0,64	0,72	-0,33	1	0,86	0,90	0,60	0,18	0,41	0,34	0,43	0,69	0,53	0,69	0,86	0,94	0,95
	1997	0,29	0,91	0,92	-0,12	0,86	0,87	0,88	0,87	0,91	0,92	0,86	0,93	0,87	0,86	0,85	0,89	0,75	0,90	-0,63	0,86	1	0,88	0,35	-0,13	0,16	0,07	0,20	0,60	0,48	0,67	0,83	0,95	0,97
	1998	0,65	0,79	0,87	0,31	0,75	0,81	0,81	0,78	0,77	0,77	0,85	0,85	0,77	0,75	0,82	0,65	0,87	0,83	-0,27	0,90	0,88	1	0,72	0,33	0,59	0,54	0,65	0,86	0,81	0,90	0,93	0,96	0,96
	1999	0,97	0,31	0,46	0,88	0,29	0,45	0,44	0,37	0,24	0,23	0,58	0,38	0,31	0,29	0,40	-0,01	0,70	0,40	0,50	0,60	0,35	0,72	1	1	0,97	0,94	0,96	0,97	0,97	0,94	0,98	0,97	0,95
Low	2000	0,92	-0,12	0,05	1,00	-0,09	0,04	0,08	-0,02	-0,23	-0,22	0,27	-0,07	-0,06	-0,09	-0,01	-0,49	0,42	-0,03	0,87	0,18	-0,13	0,33	0,87	1	0,94	0,98	0,97	0,88	0,98	0,93	0,97	0,97	0,96
	2001	0,99	0,18	0,40	0,97	0,21	0,37	0,40	0,31	0,08	0,06	0,61	0,27	0,26	0,21	0,33	-0,25	0,67	0,32	0,79	0,41	0,16	0,59	0,97	0,94	1	0,98	0,99	0,94	1,00	0,92	0,96	0,96	0,97
	2002	0,98	0,14	0,34	0,99	0,20	0,33	0,49	0,28	-0,02	-0,03	0,59	0,22	0,23	0,20	0,24	-0,41	0,65	0,22	0,92	0,34	0,07	0,54	0,94	0,98	0,98	1	0,98	0,91	0,99	0,93	0,98	0,98	0,98
	2003	0,99	0,37	0,53	0,98	0,47	0,54	0,72	0,46	0,15	0,16	0,72	0,43	0,45	0,47	0,39	-0,38	0,78	0,40	0,90	0,43	0,20	0,65	0,96	0,97	0,99	0,98	1	0,94	0,99	0,92	0,95	0,95	0,95
	2004	0,93	0,77	0,84	0,90	0,78	0,79	0,92	0,74	0,56	0,64	0,90	0,78	0,84	0,78	0,67	-0,08	0,89	0,72	0,74	0,69	0,60	0,86	0,97	0,88	0,94	0,91	0,94	1	0,93	0,92	0,96	0,97	0,99
	2005	0,99	0,72	0,89	0,99	0,99	0,81	0,90	0,69	0,57	0,59	0,83	0,84	0,98	0,99	0,87	-0,23	0,97	0,89	0,91	0,53	0,48	0,81	0,97	0,98	1,00	0,99	0,99	0,93	1	0,93	0,96	0,96	0,95
	2006	0,94	0,85	0,93	0,93	0,90	0,87	0,91	0,87	0,81	0,76	0,86	0,92	0,94	0,90	0,89	0,09	0,92	0,89	0,82	0,69	0,67	0,90	0,94	0,93	0,92	0,93	0,92	0,92	0,93	1	0,94	0,97	0,94
	2007	0,97	0,92	0,98	0,97	0,93	0,93	0,95	0,93	0,95	0,87	0,94	0,98	0,97	0,93	0,94	0,51	0,94	0,94	0,89	0,86	0,83	0,93	0,98	0,97	0,96	0,98	0,95	0,96	0,96	0,94	1	0,99	0,98
	2008	0,97	0,98	0,98	0,97	0,93	0,92	0,97	0,98	0,98	0,98	0,95	0,97	0,97	0,93	0,96	0,84	0,93	0,93	0,93	0,94	0,95	0,96	0,97	0,97	0,96	0,98	0,95	0,97	0,96	0,97	0,99	1	0,99
	2009	0,96	0,95	0,96	0,97	0,93	0,86	0,94	0,94	0,96	0,96	0,91	0,95	0,95	0,93	0,98	0,90	0,90	0,90	0,96	0,95	0,97	0,96	0,95	0,96	0,97	0,98	0,95	0,99	0,95	0,94	0,98	0,99	1

* Data as of December 31st, 2011

** Categorisation based on ThomsonOne's communicated returns

Table 21 – Correlation table for EMEA LBO funds, by VY and category of returns

This table provides the results of correlation tests between of the cash-flow curves for EMEA LBO funds by VY and by category of returns (very high, high, medium and low) as well as the 1984-2001 average. Cash-flows are provided by Thomson ONE database (as of 31/12/2011). Categories are ours.

Correlation Matrix							High		Me.		Low		Me.	V. H.		V. H	H.			Medium		V. H.	High								
	1984-2001	High	Medium	Low	Very high	1984	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1984-2001	1	0,98	0,99	0,95	0,99	0,92	0,97	0,94	0,94	0,95	0,90	1,00	0,99	0,96	0,99	0,79	0,96	0,94	0,99	0,98	0,99	0,97	0,89	0,87	0,62	0,48	0,85	0,96	0,95	0,99
High	0,98	1	0,93	0,87	0,98	0,87	0,96	0,88	0,85	0,87	0,82	0,97	0,98	0,99	0,98	0,87	0,97	0,85	0,96	0,92	0,97	1,00	0,96	0,79	0,71	0,08	0,54	0,87	0,96	0,97
Medium	0,99	0,93	1	0,98	0,96	0,92	0,94	0,96	0,97	0,98	0,95	0,98	0,97	0,91	0,95	0,70	0,92	0,98	0,99	0,99	0,95	0,90	0,78	0,92	0,41	0,83	0,95	0,97	0,94	0,98
Low	0,95	0,87	0,98	1	0,92	0,93	0,92	0,98	0,98	1,00	0,97	0,94	0,92	0,85	0,90	0,62	0,86	0,98	0,96	0,96	0,89	0,83	0,66	0,91	0,20	0,93	0,98	0,98	0,95	0,98
Very High	0,99	0,98	0,96	0,92	1	0,92	0,98	0,92	0,92	0,92	0,85	0,98	0,99	0,97	0,99	0,82	0,96	0,91	0,98	0,96	1,00	0,98	0,90	0,77	0,66	0,15	0,65	0,95	0,91	0,94
1984	0,92	0,87	0,92	0,93	0,92	1	0,95	0,96	0,93	0,93	0,85	0,90	0,91	0,87	0,91	0,72	0,90	0,92	0,91	0,90	0,92	0,87	0,81	0,82	0,84	0,23	0,45	0,58	0,60	0,95
1986	0,97	0,96	0,94	0,92	0,98	0,95	1	0,94	0,92	0,92	0,83	0,95	0,97	0,95	0,97	0,80	0,94	0,90	0,95	0,92	0,97	0,97	0,91	0,73	0,73	0,07	0,57	0,74	0,73	0,97
1987	0,94	0,88	0,96	0,98	0,92	0,96	0,94	1	0,96	0,98	0,93	0,93	0,92	0,87	0,90	0,66	0,89	0,96	0,95	0,94	0,89	0,84	0,72	0,93	0,45	0,79	0,87	0,94	0,87	0,97
1988	0,94	0,85	0,97	0,98	0,92	0,93	0,92	0,96	1	0,98	0,95	0,92	0,91	0,83	0,90	0,56	0,83	0,98	0,94	0,97	0,89	0,80	0,57	0,75	-0,08	0,90	0,95	0,95	0,89	0,96
1989	0,95	0,87	0,98	1,00	0,92	0,93	0,92	0,98	0,98	1	0,97	0,94	0,92	0,85	0,90	0,62	0,86	0,98	0,96	0,96	0,89	0,83	0,66	0,91	0,20	0,93	0,98	0,98	0,95	0,98
1990	0,90	0,82	0,95	0,97	0,85	0,85	0,83	0,93	0,95	0,97	1	0,91	0,87	0,79	0,82	0,54	0,80	0,96	0,93	0,93	0,81	0,74	0,59	0,87	0,02	0,93	0,96	0,98	0,97	0,98
1991	1,00	0,97	0,98	0,94	0,98	0,90	0,95	0,93	0,92	0,94	0,91	1	0,99	0,96	0,98	0,80	0,96	0,93	1,00	0,98	0,98	0,97	0,90	0,91	0,62	0,51	0,80	0,96	0,95	0,99
1992	0,99	0,98	0,97	0,92	0,99	0,91	0,97	0,92	0,91	0,92	0,87	0,99	1	0,98	0,99	0,82	0,97	0,90	0,98	0,96	0,99	0,98	0,92	0,83	0,69	0,24	0,65	0,93	0,90	0,94
1993	0,96	0,99	0,91	0,85	0,97	0,87	0,95	0,87	0,83	0,85	0,79	0,96	0,98	1	0,97	0,90	0,98	0,82	0,95	0,89	0,96	0,98	0,97	0,77	0,79	-0,04	0,32	0,79	0,85	0,92
1994	0,99	0,98	0,95	0,90	0,99	0,91	0,97	0,90	0,90	0,90	0,82	0,98	0,99	0,97	1	0,84	0,97	0,89	0,97	0,94	0,99	0,97	0,90	0,71	0,73	-0,12	0,24	0,69	0,79	0,94
1995	0,79	0,87	0,70	0,62	0,82	0,72	0,80	0,66	0,56	0,62	0,54	0,80	0,82	0,90	0,84	1	0,91	0,60	0,78	0,65	0,78	0,82	0,90	0,55	0,89	-0,43	-0,32	0,00	0,94	0,97
1996	0,96	0,97	0,92	0,86	0,96	0,90	0,94	0,89	0,83	0,86	0,80	0,96	0,97	0,98	0,97	0,91	1	0,85	0,96	0,89	0,94	0,94	0,94	0,77	0,93	-0,08	0,16	0,57	0,74	0,96
1997	0,94	0,85	0,98	0,98	0,91	0,92	0,90	0,96	0,98	0,98	0,96	0,93	0,90	0,82	0,89	0,60	0,85	1	0,95	0,96	0,87	0,77	0,59	0,84	0,08	0,96	0,97	0,96	0,96	0,97
1998	0,99	0,96	0,99	0,96	0,98	0,91	0,95	0,95	0,94	0,96	0,93	1,00	0,98	0,95	0,97	0,78	0,96	0,95	1	0,98	0,97	0,95	0,88	0,93	0,62	0,58	0,84	0,94	0,93	0,98
1999	0,98	0,92	0,99	0,96	0,96	0,90	0,92	0,94	0,97	0,96	0,93	0,98	0,96	0,89	0,94	0,65	0,89	0,96	0,98	1	0,95	0,90	0,75	0,86	0,29	0,87	0,98	0,99	0,92	0,96
2000	0,99	0,97	0,95	0,89	1,00	0,92	0,97	0,89	0,89	0,89	0,81	0,98	0,99	0,96	0,99	0,78	0,94	0,87	0,97	0,95	1	0,98	0,90	0,78	0,63	0,21	0,71	0,96	0,92	0,93
2001	0,97	1,00	0,90	0,83	0,98	0,87	0,97	0,84	0,80	0,83	0,74	0,97	0,98	0,98	0,97	0,82	0,94	0,77	0,95	0,90	0,98	1	0,95	0,79	0,66	0,16	0,67	0,92	0,97	0,96
2002	0,89	0,96	0,78	0,66	0,90	0,81	0,91	0,72	0,57	0,66	0,59	0,90	0,92	0,97	0,90	0,90	0,94	0,59	0,88	0,75	0,90	0,95	1	0,79	0,77	-0,04	0,22	0,84	0,97	0,96
2003	0,87	0,79	0,92	0,91	0,77	0,82	0,73	0,93	0,75	0,91	0,87	0,91	0,83	0,77	0,71	0,55	0,77	0,84	0,93	0,86	0,78	0,79	0,79	1	0,50	0,68	0,79	0,94	0,96	0,98
2004	0,62	0,71	0,41	0,20	0,66	0,84	0,73	0,45	-0,08	0,20	0,02	0,62	0,69	0,79	0,73	0,89	0,93	0,08	0,62	0,29	0,63	0,66	0,77	0,50	1	-0,27	-0,10	0,16	0,61	0,96
2005	0,48	0,08	0,83	0,93	0,15	0,23	0,07	0,79	0,90	0,93	0,93	0,51	0,24	-0,04	-0,12	-0,43	-0,08	0,96	0,58	0,87	0,21	0,16	-0,04	0,68	-0,27	1	0,99	0,98	0,97	0,98
2006	0,85	0,54	0,95	0,98	0,65	0,45	0,57	0,87	0,95	0,98	0,96	0,80	0,65	0,32	0,24	-0,32	0,16	0,97	0,84	0,98	0,71	0,67	0,22	0,79	-0,10	0,99	1	0,98	0,94	0,98
2007	0,96	0,87	0,97	0,98	0,95	0,58	0,74	0,94	0,95	0,98	0,98	0,96	0,93	0,79	0,69	0,00	0,57	0,96	0,94	0,99	0,96	0,92	0,84	0,94	0,16	0,98	0,98	1	0,93	0,95
2008	0,95	0,96	0,94	0,95	0,91	0,60	0,73	0,87	0,89	0,95	0,97	0,95	0,90	0,85	0,79	0,94	0,74	0,96	0,93	0,92	0,92	0,97	0,97	0,96	0,61	0,97	0,94	0,93	1	0,95
2009	0,99	0,97	0,98	0,98	0,94	0,95	0,97	0,97	0,96	0,98	0,98	0,99	0,94	0,92	0,94	0,97	0,96	0,97	0,98	0,96	0,93	0,96	0,96	0,98	0,96	0,98	0,98	0,95	0,95	1

* Data as of December 31st, 2011

** Categorisation based on ThomsonOne's communicated returns

We then tried to assess whether geographies and/or strategies are correlated [unreported]. For EMEA and US VC, 'Low' returns are uniquely correlated (0.97) indicating that there is a specific J-Curve profile for Low returns. As for other returns, 'Medium' US VC returns correlates the most highly with 'High', 'Medium' and 'Very High' EMEA VC. This confirms that EMEA data have to be further assessed, and that the rather disappointing average results of local funds prevent the potential development a single model for all VC funds. For EMEA and US LBO, the picture is split between 'High'/'Very high' and 'Medium'/'Low'. This limits the generalization of the findings. Refining categories with better data would improve the results.

The analysis is deepened with same geographies but different strategies as they are partially correlated. Though 'Low' returns do not match, 'High' US VC and US LBO exhibit a perfect correlation. 'Medium' US VC returns correlate with 'Medium' and 'Low' US LBO returns, hence confirming that there might be too many categories for LBO. 'Very high' returns are also highly and distinctively correlated (0.94). The same conclusion for US funds applies to 'Low' returns in EMEA VC and EMEA LBO. Other results are not conclusive. 'Very high' EMEA VC returns match with 'Low' EMEA LBO returns while 'Medium' EMEA VC returns match with 'Low' EMEA LBO returns and 'High' EMEA VC returns match with 'Low' EMEA LBO returns.

3.3.7. Correlations first eliminate categories, then select one

From the correlations, we conclude that:

i) below two years of activity, correlations do not give any clear information about the performance categories which are relevant to analyze a given VY: correlations are high with all the 'ideal-type' categories;

ii) for Years Three to Five of funds activity, some categories drop in terms of correlation. The most likely performance appears with three and then two categories;

iii) from Year Six and on, the performance category to which the VY will most likely belong clearly appears.

3.3.8. The predictive power of the J-Curve

Table 22 provides a summary of our initial categorization, and the results from the model. The model is then used to predict the performance of active funds, and to identify the closest comparison in terms of VY. Outliers and problematic vintages are indicated.

provides probabilities that the performance categories identified at the end of each year are the same as the final performance of the VY. For the four strategies/geographies considered, it appears that below two years the prediction is below or around 50 percent. At the end of the third year of activity, for the four strategies/geographies considered, the category of performance can predict the final performance at 50 percent (VC EMEA) to 65 percent (LBO EMEA rate). Year Four exhibits an increase of this probability (except for EMEA LBO, which actually falls below 50 percent). From Year Five and on, the percentage increases systematically (if the impact of outliers and defective vintages is excluded).

When the year-end performance category is the same as the final performance category, the spread of correlations with the three other categories and with the closest category increases significantly in Year Four (US strategies) and Five (EMEA strategies).

Table 22 – Compared categorization of US/EMEA VC and LBO funds and predictions for unrealized funds

These tables provide the results of the categorization of average US VC and LBO funds; EMEA VC and LBO funds by VY, based on initial reading and ideal-type predictions (mixing categories and J-curves) for fully realized funds based on previous results; predictions and categorization of partially realized vintages, based on the identification by ideal-type (« model result ») and identification of the closest comparable. Data reliability is put in perspective, notably for vintages identified as problematic (signaled by a minus sign). Outliers are signaled by an 'O*'.

US VC

Vintage year	Initial category	Model result	Confirmed initial?	Closest comparable	Data reliable?
1981	Medium	Medium	Yes		++
1982	Medium	Medium	Yes		++
1983	Medium	Medium	Yes		++
1984	Medium	Medium	Yes		++
1985	Medium	Medium	Yes		++
1986	Medium	Medium	Yes		+
1987	Medium	Medium	Yes		++
1988	Medium	Medium	Yes		++
1989	Medium	Medium	Yes		++
1990	High (O?)	High	Yes		++
1991	**Medium (O*)**	**High**	**No**		+
1992	**Very High**	**High**	**No**		++
1993	**Very High**	**High**	**No**		++
1994	**Very High**	**High**	**No**		+
1995	Very High	Very High	Yes		++
1996	Very High	Very High	Yes		++
1997	Very High	Very High	Yes		++
1998	**Medium (O*)**	**High**	**No**		++
1999	Low	Low	Yes		++
2000	Low	Low	Yes		++
2001	Low (O?)	Low	Yes		++
2002	-	Low		2000	+
2003	-	Low		2000	++
2004	-	Low		2000	++
2005	-	Low		2001	++
2006	-	Low/Medium		1984 & 2000	++
2007	-	Medium/Low/High		1984-88, 1990-91, 2000	+
2008	-	Medium/Low/High		2001	+
2009	-	High/Very High/Medium		1988, 1990-1994, 2001	+

US LBO

Vintage year	Initial category	Model result	Confirmed initial?	Closest comparable	Data reliable?
1981	-				
1982	-				
1983	-				
1984	Very high	Very high	Yes		+
1985	Very high	Very high	Yes		++
1986	Very high	Very high	Yes		++
1987	**Medium (O*)**	**Medium (Low)**	**Yes**		-
1988	Medium	Medium (Low)	Yes		++
1989	High (O*)	High	Yes		++
1990	Low	Low	Yes		++
1991	High	High	Yes		++
1992	High	High	Yes		++
1993	**High**	**High**	**Yes**		-
1994	Medium	Medium	Yes		++
1995	**Medium**	**Medium**	**Yes**		-
1996	**Low**	**Medium**	**No**		++
1997	**Low**	**Medium/Low**	**No**		++
1998	**Low**	**Medium**	**No**		++
1999	**Low**	**Medium**	**No**		++
2000	Medium	Medium	Yes		+
2001	Medium (O*)	Medium	Yes		+
2002	-	Medium		1995	++
2003	-	High		1993	++
2004	-	Medium		1998	++
2005	-	Low		1988, 1990, 1997-98	++
2006	-	Medium/Low		1987, 1997-99	++
2007	-	Medium		1988-89, 1997	++
2008	-	Medium		1988-89, 1995-96, 2001	+
2009	-	High		1998	+

Table 22 (continued)

EMEA VC					
Vintage year	Initial category	Model result	Confirmed initial?	Closest comparable	Data reliable?
1981	**High**	**Medium**	**No**		+
1982	-				
1983	High (O*)	High	Yes		++
1984	High	High	Yes		+
1985	**Medium (O*)**	**High**	**No**		++
1986	High (O*)	High	Yes		++
1987	Medium	Medium	Yes		++
1988	**Low**	**Medium**	**No**		++
1989	**High (O*)**	**Very High**	**No**		++
1990	Very High (O*)	Very High	Yes		++
1991	Medium	Medium	Yes		++
1992	**Very High**	**High**	**No**		-
1993	Medium	Medium	Yes		++
1994	**Very High**	**Medium**	**No**		+
1995	Low	Low	Yes		++
1996	**Very High**	**Medium**	**No**		++
1997	**High (O*)**	**Medium**	**No**		+
1998	Medium (O*)	Medium	Yes		++
1999	Low	Low	Yes		+
2000	Low	Low	Yes		++
2001	Low	Low	Yes		+
2002	-	Low		2000, 2001	++
2003	-	Low		2001	++
2004	-	Low		1999	++
2005	-	Low/Very High		2001	++
2006	-	Medium/Low		1999	+
2007	-	Medium		1999	++
2008	-	Medium		1984-1986	+
2009	-	Low		1991	+

EMEA LBO					
Vintage year	Initial category	Model result	Confirmed initial?	Closest comparable	Data reliable?
1981	-				
1982	-				
1983	-				
1984	High (O*)	Medium/V. High	No		+
1985	-				
1986	**High (O*)**	**Very high**	**No**		-
1987	Medium	Low	No		++
1988	**Medium**	**Low**	**No**		-
1989	Low	Low	Yes		++
1990	**Low**	**Low**	**Yes**		-
1991	Medium	Medium/V. High	Yes		++
1992	Very high	Very high	Yes		++
1993	High (O*)	High	Yes		++
1994	Very high (O*)	Very high	Yes		++
1995	High (O*)	High	Yes		+
1996	**Medium**	**High**	**No**		-
1997	Medium (O*)	Medium/Low	Yes		++
1998	Medium (O*)	Medium	Yes		+
1999	Medium (O*)	Medium	Yes		++
2000	Very high	Very high	Yes		++
2001	**High**	**High**	**Yes**		-
2002	-	High		1993	++
2003	-	Medium		1987	++
2004	-	High		1996	+
2005	**-**	**Low**		**1997**	-
2006	-	Low		1989, 1999	++
2007	-	Low		1999	++
2008	-	High		1990, 2001	+
2009	-	Medium/Low		1991	+

Table 23 – Probability that performance analysis reflects the final performance of the fund

These tables provide the percentage of quarterly performance analyses (at year end) reflecting the final performance of the fund (realized funds only), for average US and EMEA VC and LBO funds, based on the ideal-type categories. If year end (YE) performance equals final performance (FP), the average spread with the other categories is provided, as well as the spread with the closest comparable. If YE differs with FP, the spread with the closest comparable is provided, as well as the highest spread witnessed, the lowest, and highest among the lowest.

VC CF USA (realized funds 1980-2001)

Fund Age (Years)	2	3	4	5	6	7	8	9	10	11	12	All (max 14 Y)
Year end performance = final performance	**45,45%**	**59,09%**	**68,18%**	**63,64%**	**72,73%**	**81,82%**	**86,36%**	**100,00%**	**95,45%**	**100,00%**	**100,00%**	**79,65%**
If YE = FP: average spread with three other categories	-0,6%	-0,7%	-6,0%	-29,1%	-41,0%	-48,6%	-49,2%	-46,3%	-46,2%	-44,8%	-44,5%	30,7%
If YE = FP: spread with closest comparable	0,4%	0,5%	4,2%	13,9%	20,2%	17,4%	19,2%	17,3%	17,1%	13,4%	11,1%	11,4%
If YE <> FP: spread with closest comparable	0,5%	0,7%	2,0%	3,8%	**6,2%**	4,8%	0,3%	-	1,1%	-	-	0,7%
If YE <> FP: higest spread with closest comparable	0,162											
If YE <> FP: lowest spread with closest comparable	0,000											
If YE <> FP: highest minimum spread with closest comparable	0,015											
If YE <> FP, does the comparable stays the same?	Yes:	8	(50%)	No:	8	(50%)						
Outlier	1	(1981)				Performance:		Medium				

LBO CF USA (realized funds 1984-2001)

Fund Age (Years)	2	3	4	5	6	7	8	9	10	11	12	All (max 14 Y)
Year end performance = final performance	**44,44%**	**61,11%**	**61,11%**	**55,56%**	**66,67%**	**72,22%**	**77,78%**	**88,89%**	**88,89%**	**88,89%**	**88,24%**	**72,22%**
If YE = FP: average spread with three other categories	-3,1%	-7,0%	-16,7%	-32,2%	-36,2%	-33,4%	-23,5%	-15,9%	-11,1%	-8,1%	-6,5%	12,8%
If YE = FP: spread with closest comparable	1,3%	3,7%	11,0%	21,1%	19,9%	15,4%	10,0%	6,7%	4,8%	3,5%	3,1%	6,7%
If YE <> FP: spread with closest comparable	0,3%	1,2%	0,6%	0,7%	1,2%	**4,9%**	4,1%	2,1%	1,9%	1,5%	0,5%	0,6%
If YE <> FP: higest spread with closest comparable	0,110											
If YE <> FP: lowest spread with closest comparable	0,000											
If YE <> FP: highest minimum spread with closest comparable	0,010											
If YE <> FP, does the comparable stays the same?	Yes:	3	(33%)	No:	6	(67%)						
Outliers	2	(1987,1988)				Performances:		Medium (x2)				

Table 23 (continued)

VC CF EMEA (realized funds 1981-2001)

Fund Age (Years)	2	3	4	5	6	7	8	9	10	11	12	All (max 14 Y)
Year end performance = final performance	**50,00%**	**50,00%**	**75,00%**	**55,00%**	**50,00%**	**70,00%**	**70,00%**	**75,00%**	**90,00%**	**95,00%**	**94,74%**	**70,45%**
If YE = FP: average spread with three other categories	-1,4%	-0,8%	-2,4%	-6,6%	-12,0%	-15,6%	-21,3%	-27,4%	-30,6%	-33,0%	-33,2%	14,3%
If YE = FP: spread with closest comparable	0,9%	0,6%	0,9%	3,2%	6,7%	5,6%	11,5%	17,1%	18,0%	18,1%	15,7%	7,6%
If YE <> FP: spread with closest comparable	0,4%	0,6%	0,5%	2,1%	3,3%	**5,5%**	5,2%	4,9%	3,1%	1,8%	0,3%	1,1%
If YE <> FP: higest spread with closest comparable	0,134											
If YE <> FP: lowest spread with closest comparable	0,000											
If YE <> FP: highest minimum spread with closest comparable	0,016											
If YE <> FP, does the comparable stays the same?	Yes:	3	(27%)	No:	8	(73%)						
Outliers	6	(1989, 1991, 1993, 1996-98)				Performances:		V High, Medium (x5)				

LBO CF EMEA (realized funds 1984-2001)

Fund Age (Years)	2	3	4	5	6	7	8	9	10	11	12	All (max 14 Y)
Year end performance = final performance	**52,94%**	**64,71%**	**47,06%**	**58,82%**	**70,59%**	**88,24%**	**76,47%**	**82,35%**	**82,35%**	**82,35%**	**87,50%**	**72,19%**
If YE = FP: average spread with three other categories	-3,1%	-3,1%	-2,4%	-4,9%	-15,5%	-24,3%	-21,1%	-14,0%	-10,1%	-7,8%	-6,3%	8,6%
If YE = FP: spread with closest comparable	1,9%	1,5%	1,4%	3,1%	4,7%	3,1%	5,4%	4,1%	3,0%	2,4%	2,1%	2,4%
If YE <> FP: spread with closest comparable	0,7%	0,5%	1,2%	0,9%	2,6%	**2,7%**	0,8%	1,0%	1,2%	0,9%	0,8%	0,5%
If YE <> FP: higest spread with closest comparable	0,047											
If YE <> FP: lowest spread with closest comparable	0,000											
If YE <> FP: highest minimum spread with closest comparable	0,006											
If YE <> FP, does the comparable stays the same?	Yes:	4	(36%)	No:	7	(64%)						
Outliers	4	(1984, 1986, 1987, 1991)				Performances:		Low, V high, Low, Medium				

When the year-end performance category differs from the final performance category, the spread of correlation with the closest comparable (the category of final performance) peaks in Year Six for US VC and Year Seven all other strategies/geographies. It is on average 6.2 percent for US VC (the highest correlation spread is 0.16), 2.7 percent for US LBO (0.11), 3.3 percent for EMEA VC (0.13) and 2.6 percent for EMEA LBO (0.05).

Overall, the spread with the closest comparison if the year-end performance category differs from the final performance is on average from 0.5 percent (EMEA LBO) to 1.1 percent (EMEA VC). If the year-end performance category is the same as the final performance, the average spread is then from 2.4 percent (EMEA LBO) to 11.4 percent (US VC). In practical terms, this means that if the spread of the year-end performance of a given active US VC fund with its closest comparison is beyond 6.2 percent (or 0.162) then the final performance has an above-average likelihood to be the final performance category. If the performance spread is at or above 11.4 percent, then in effect, the performance category has above a 60 percent chances to be the final one.

3.4. Conclusion, Discussion and Limitations

The approach taken has been to use only cash-flows and build a model which defines historical return patterns and categories which are, in turn, used to identify the return potential of active funds[99]. The purpose of the model is not to immediately attribute a fund to a precise category but to reduce the time needed to attribute it to a given category – and hence to reduce the solvency costs associated with investing in PE. In this respect, the model is helpful (and 'conceptually [the] most simple and efficient framework for a risk model' as we have designed 'a data-driven cash flow prediction at fund level' [Cornelius *et al.*, 2013, p. 165]). During the first two to five years of activity, correlations with return categories will progressively exclude certain return patterns and then a given vintage will lean towards the most likely category of return to which it belongs. It is only after six to eight years of activity that a final attribution can be done[100].

Testing it with individual vintages, and then with top and bottom quartile returns for each vintage, correlation tests hold true. Unreported tests of the most representative VYs of return categories for US VC and of the top and bottom quartile funds of these most representative VYs have been undertaken to mimic the situation of individual

[99] Our model notably passes the test described by Cornelius *et al.* [2013, p. 164] according to whom a cash flow model should 'capture the essential features of limited partnership funds […]; have the capability to treat a variety of fund types and their behavior through setting of parameters […]; should [provide] continuous test of whether parameters are plausible and whether the behavior of funds is different compared to the assumptions [… and] should not just generate a single value, but a range of potential outcomes'.

[100] We thus would amend the statement of Meyer and Mathonet [2005, p. 13], according to whom 'the first 4-6 years can give no real indication of final returns'. This is true if one focuses on interim IRRs (as they do), but not if we focus on cash-flows as we do with our method.

funds (and their correlation to the four categories). VY 1985, representing the 'Medium' returns category, was excluded from the overall samples (all categories are recalculated). Snapshots of its cash-flows were taken for each year after the first two years. In Year Four, the hypothesis of 'Very high' returns is excluded. After six years of activity, the most likely possibility is 'Medium' returns. VY 1990 representing 'High' returns category is tested with the same procedure. The correlation tests hint at a 'Medium' return until Year Six, when the 'High' returns appear as the category to which it belongs. Given the fact that 1990 is the only item in the 'High' returns category, we could infer that this VY is the one during which the cycle turned from 'Medium' to 'Very High' returns. VY 1995 representing 'Very high' returns was also tested. The most likely return category after two years is 'Low'. It is only in Year Five that the 'Very high' returns category appears as the one to which it belongs. We test VY 2000, representing 'Low' returns. After four years, the 'Very high' returns category was excluded; after six years, 'High' returns were excluded and 'Low' seem to be the most probable.

The same reasoning is applied to top quartile funds of the same VYs [unreported]. For top quartile VY 1985, the vintage correlates the closest with the average VY 1985. In Year Four, the 'Medium' returns scenario appears as the highest correlation. It is in Year Six that this is definitely confirmed. For 1990, though top quartile, the same conclusions apply for the average of the vintage. As the correlation switches from 'Medium' to 'High'/'Very High' after five years, we can only confirm that 1990 might have been a transition vintage. For 1995, the correlations fall below 0.6 during two years of activity, hence confirming that a specific phenomenon has affected this vintage in 1998 and 1999 (which were the peak of the technology bubble). In Year Five, the category appears as 'Very high' returns. For 2000, 'Very high' returns are excluded from Year Four; then 'High' returns from Year Five. At this point, 'Low' appears and remains the most probable scenario until Year Eight, when it switches to 'Medium'.

The same reasoning is applied to bottom quartile funds of the same VYs. For 1985, in Year Four, the 'Very high' returns scenario is excluded. In Year Five, the highest correlation is with 'High' (this is not confirmed with the most representative VY, as 1985 remains the highest one). In Year Seven, 'High' is excluded and in Year Eight, 'Low' becomes prevalent. Overall, the closest VY is the 'Low' returns year 1999 (0.97), which appears clearly in Year Seven. For 1990, unlike for top quartile and the average, the bottom quartile vintage excludes very high returns after three years, high returns after four years and medium returns after seven years. Though being among the bottom quartile of 'High' returns, it hence appears as a 'Low' returns group of funds. For 1995, the bottom quartile of 'Very high' returns have been excluded from the 'Very high' returns after three years, then from 'High' returns after five years; and they then belong to the 'Medium' category before drifting to 'Low' in Year 9. For 2000, 'Very high' returns have been excluded after three years, then 'High' returns

after four years. At this stage, the correlation with 'Low' returns increases and remains prevalent.

Assessing the reliability of performance predictions also confirms that prior to two years of activity, the predictive power is not high enough (below 50 percent chances of accurate prediction of the final performance). Year Three and Four deliver a good idea of what the vintage will *not* be and progressively what it will be. After Year Five, the performance attribution appears as rather solid and only improves with time.

This Chapter has several theoretical (3.4.1) and practical (3.4.2) implications. It is nevertheless confronted with limitations (3.4.3) and would support further research (3.4.4).

3.4.1. Use for academic purposes

There is little prospect in the short to mid term of the emergence of a comprehensive database recording cash-flows measured in a consistent and coherent way for all the PEFs worldwide. Our approach deals with data uncertainty by measuring the distance of a given stream of cash-flows from a series of ideal-type cash-flows (the return categories). The model deals with partial data, lack of precision and can function with incomplete cash-flows.

Cash-flows are reliable and verifiable, and much more difficult to manipulate than NAVs[101]. By using cash-flows, we identified that the time to break-even for a fund is a first predictor of performance: the earlier a VY breaks even, the better the overall performance. This finding would need further research beyond US VC and LBO.

3.4.2. Use for practitioners and regulators

For practitioners (LPs) and regulators, the outcomes of the model are different. What matters to LPs is assessing the performance by GPs, and the ability of the latter to replicate performances in the future. This is during the fund selection phase.

Once committed, LPs need to determine the progress of the GPs as compared to expectations and their peer group. A dynamic model using cash-flows is more suitable than reference to absolute past performances. Regulations with dynamic solvency ratio calculations for institutional LPs require these models. We have offered a benchmarking methodology which can be used independently of returns assumptions.

[101] Either voluntarily, or under valuation methods requirements (such as the 'fair market value' and the mark-to-market, which are ill adapted to PE).

This model can be used to sort vintages early (after two to three years) and exclude certain return scenarios. This should, in turn, reduce the adverse effects of solvency ratios, notably because the maximum and average losses can be predicted statistically based on our categories [and for example Weidig and Mathonet, 2004]. The illiquidity of the asset class becomes less problematic if return scenarios can be sorted after two years of activity.

The model might support a more active management of existing portfolios of PE funds. The secondary market of PEFs stakes will probably initially make the most of this performance attribution model. LPs will be able to better negotiate the discounts/premia on their existing stakes, and securitize mature portfolios. Should the model be validated and adopted, the dynamics of pricing on PE's secondary market could change significantly.

Regulators have the opportunity to reduce the cost of capital associated with investing in PE. Illiquidity in PE is not necessarily associated with uncertainties and lack of transparency: cash-flows tell us a story since the early age of funds. This should be reflected in solvency ratios. 'Value at risk' frameworks can integrate the output of our model (as recommended by Cornelius *et al*. [2013]).

3.4.3. Limitations

A certain stability at the helm of GPs was assumed. Terms and conditions determining fund cash-flows and the behavior of GPs towards these cash-flows[102] were assumed as remaining materially the same. Changes of LPA terms may change the outcome of the model. This model might also be sensitive to cash-flows strategies tentatively signaling a strong performance by reaching the break-even point faster[103].

PE being still largely an American activity, a significant share of the results is drawn from data collected on this market, limiting the generalization of the conclusions. Even though EMEA data is patchy[104], comparisons exhibit differences in the shape of J-Curves, time to break-even and the overall significance of the different return categories identified (this is indirectly confirmed by Cornelius *et al.* [2013, p. 101] according to whom data from more advanced markets do not provide meaningful guidance for other markets). Cash-flows labeled in USD for EMEA funds could explain some erratic data. As performances exhibit wave patterns, a possible bias in favor of EMEA LBO funds might be cycle-related.

[102] A clear example is a switch in the calculation of management fees in the investment period from a percentage of the fund size to a percentage of the capital paid in. The incentive would, therefore, be to deploy the capital faster and change the cash-flow patterns.
[103] See VYs 2004, 2005 and 2006 for US LBO and 2002, 2003, 2004 and 2007 for EMEA LBO as an illustration.
[104] We have methodically signaled dubious data and vintages, which should support further research.

Ideal-type categories rely on past cash-flows: some might become irrelevant ('Very high' returns for EMEA VC) and others could emerge (that the model, with its explicit construction on the measure of distance of VY to categories, could help identify).

3.4.4. Further developments

We must ask whether the model is applicable to single funds. This question remains partially unsolved due to a lack of access to cash-flows of individual funds. The issue was tackled by testing individual vintages and quartiles. So far, the model confirms its predictive power, but a thorough testing with individual cash-flows would be necessary to confirm the conclusions.

At the current stage, the model does not differentiate between intrinsic and idiosyncratic behaviors of cash-flows. This is not a major limitation: funds are affected by the overall macro-economic conditions, as well as by the skills of the fund managers.

3.5. Summary and contribution to the research

The purpose of this Chapter was to use illiquidity, which is a fundamental defining factor of PE investing, as a basis for reasoning on past, current and future performances of the sector. The specific and constant cash-flow pattern of PEFs (J-curves) is first tested as a potential tool to support this analysis.

J-curve shapes vary significantly from one return category to the other. They also vary significantly from one strategy to the other and from geography to geography. They are distinctive and the best funds are the ones that break-even early. Moreover, not only the best funds invest earlier (see Chapter 2), but also they have shorter holding periods. Part of the performance of the best GPs is hence related to a higher rotation of assets.

Once validated, correlation tests are run between J-curves of fully realized funds to assess the extent of the reliability of this approach, and of current funds to try to determine their potential performance. By excluding an active PEF from certain return categories, and then attributing it to a specific one during the first two to five years of activity of this PEF, our method supports a better calibration of solvency and prudential ratios.

The model effectively helps to lower the cost of investing in PE, as it is compatible and coherent with the value-at-risk ('VaR') method adopted by banks[105] and

[105] It is also compatible with the pending revision of Basel III Agreements, and could actually alleviate the regulatory costs associated with the « mandate based » approach (see Duffell, Thomas, « Basel III revision could hit fundraising », Private Equity Manager, 17/1/2014)

insurance groups (and to a certain extent, pension funds). The method deals with data of variable quality, though its output increases significantly with a high number of reliable data streams. However, this method does not match the usual 12-month time horizon set by institutions for their VaR calculations.

Practitioners can use the method to assess the PEFs in which they have invested during their activity, and possibly sell them ('exit', see Chapter 0) if they diverge substantially from a certain path. They can also assess existing funds offered on the secondary market more effectively (though this advantage might be transitory if all LPs integrate this method to their analysis).

4. General conclusion

This research is at the junction of asset management (the side of limited partners) and PE (the side of general partners). Both worlds have their own idiosyncratic and differing ways of thinking and analysing facts and figures. These differences are amplified by regulations and an inadequate intellectual framework designed for liquid financial markets [Cornelius *et al.,* 2013, p. 39]. The result of these differences leads to misunderstandings, generalisations through inadequate theoretical categories and simplifications that harm relationships between PE principals and agents. It also results in the misallocation of capital, in unbalanced cash inflows and outflows in PE and in behaviours ultimately prejudicial to the financing of small and medium size businesses. Cornelius *et al.* [2013, p. 40] even wonder if it is 'acceptable to forgo financial returns because the asset in question cannot be integrated in the traditional modern portfolio theory-based models'.

This research aimed at bridging the gap between asset management and PE approaches. The purpose was to contribute to a better understanding of:

i) The actions of limited partners (Chapters 0 and 1)
   a. by themselves: Why limited partners enter/exit the PE market and how? Why do they invest in certain strategies (or not)? in certain sectors of activity (technology, biotech, services…)? in certain companies (small, medium, large, very large)? Why do they target certain financial instruments?
   b. by general partners: What is the strategy of LPs depending on their size, visibility, reputation and experience?

ii) The actions of general partners (Chapters 0, 1 and 2)
   a. In their activities
   b. In their performances

iii) The PE sector itself (Chapters 0, 1, 2 and 3)
   a. Through the analysis of its actual performances
   b. Through an innovative method to forecast these performances

Section 4.1 will summarize and put in context the findings of the research. Section 4.2 will discuss the findings and put them in perspective. Section 4.3 will draw some perspectives for future research.

4.1. Summary

Relationships between LPs and GPs are stressed by a long-term trend of declining marginal returns. This context should theoretically push LPs to actively voice their

implicit and explicit expectations. It should also support the assessment of the alignment of interest between LPs and GPs notably by investigating GPs' performance, and potentially lead to the development of new instruments to improve the alignment of interest, monitor it and and ultimately allow LPs to exit, voice or stay loyal to GPs.

In order to understand 'how limited partners can bridge the gap between their expectations and what they actually get from general partners', we have focused on three questions:

i) What happens when limited partners have conflicting explicit and implicit targets while investing in private equity funds?

Our hypothesis was that the financial and social endeavours of American MBE financing have implicit conflicting goals: as the social endeavour is not explicitly and clearly formulated, the official financial goals should prevail. GPs will follow a path to generate social and financial returns, hence sacrificing the maximisation of the latter. As a result, we concluded that financial returns are LPs' top and prevailing aim when investing in PE.

ii) What performance do GPs generate and what do LPs effectively earn?

Our hypothesis was that while officially serving the interests of the principal (LPs), agents (GPs) have a clear interests to keep the interests of limited partners divided, so as to maximise their own profit. GPs still have to provide returns to LPs for 'signalling' purpose (a proxy assertion of quality for further fund raising). The identification of a gap (our assumption) in the alignment of interests should appear in analysing net and gross returns, and the split of the proceeds. Subsequent solutions to bridge this gap and how they could be implemented were expected. We concluded that, on average, GPs get the lion's share of the profits and LPs get, at best, a limited upside.

iii) How can LPs better understand and forecast returns to actively decide to hold or sell their private equity holdings?

A common LP can only marginally negotiate the terms of the LPA: s/he has to adhere to the conditions as such, with only marginal modifications possible. As a consequence, his/her options with a PEF are limited to 'exit, voice and loyalty' - where loyalty might not be rewarded by satisfying returns.

Our hypothesis is that the 'exit' scenario is constrained because LPs do not have enough information to actively manage it. The 'exit' currently happens essentially

when an LP does not commit to a fund raised by a GP. To be more active in 'exit', LPs need to assess whether the underperformance of a given GP is related to macro-economic factors, to industry cycles, to waves of performances, or to the fact that the GP belongs to a low performance category. Applying this approach to active funds and forecasting their outcomes is a difficult exercise. Net asset values provided quarterly by GPs are notoriously unreliable, especially in a context of fund raising.

We concluded that LPs might use the J-Curve cash-flow profiles that affect systematically PEFs as a predictor of future performance. This cash-flow-based method could be used to identify particular J-Curve shapes related to certain categories of returns (ideal-types) and then to test the attribution of current funds to these categories. The LP could then benefit from an 'early detection system' and potentially exit early on the secondary market, hence minimizing the downside of its PEF investment.

4.2. Discussion

This research has demonstrable consequences on at least three topics: the extra-financial endeavors which are assigned to PE investing (4.2.1); the treatment of PE by current regulations setting solvency and prudential ratios (4.2.2); and the relationships between LPs and GPs (4.2.3).

4.2.1. Consequences on extra-financial endeavors in private equity

One of the consequences of the findings of Chapter 1 is the clarification of the question of the priority of extra-financial endeavors in PE: they clearly come second to returns. This has important consequences for sustainable investing criteria[106] in PE[107]: whenever returns will conflict with the latter, return generation will prevail.

Proponents of sustainable and responsible investing state that there is no contradiction between return generation and sustainability criteria[108]. In fact, the alignment of interest between sustainable development and returns is on cost savings[109], which somehow are the 'low hanging fruits' for return generation in sustainable development; they improve the cost structure of companies (and hence their investors' returns), and save resources (hence 'reducing environmental impacts[110]'). Moreover, they do not request any additional resource at GP level.

[106] Sometimes also referred to as: socially responsible investing (SRI), impact investing, triple bottom line investing or environmental, social and governance (ESG) investing.
[107] Explored in Demaria [2004].
[108] For anecdotal evidence: Agefiwork [2013].
[109] For anecdotal evidence: Goldman [2012] and Mazzacurati [2013].
[110] Mazzacurati [2013].

However, it seems that the alignment of interest between sustainable development and PE stops there[111].

As illustrated in Chapter 1 with MBE-PE, going beyond the current state of the art PE investment practices requires additional specialised resources. Not only does this imply additional costs for GPs (4.2.1.1), but it also entails some adverse signalling: the underlying business might not be dedicated to returns maximisation – and hence lead to an adverse selection (4.1.2.2). Moreover, biases and risks (4.2.1.3) might affect the investment strategy: investment targets have to be chosen from a reduced pool of opportunities (as these opportunities have to offer a basis for sustainability criteria to apply).

4.2.1.1. Addressing extra costs of extra-financial criteria

Does this dilemma imply that extra-financial endeavors will not expand beyond their limited current cost-savings perimeter (setting aside pure communication efforts, often described as 'greenwashing[112]' when it comes to dressing up companies under a favorable sustainable development light)? As illustrated in Chapter 2, the answer lies in the return figures:

i) If gross returns are in favor of 'returns with extra financial criteria' initiatives, then GPs will choose this solution. This is currently done without any special label, by GPs cutting costs and saving resources at the same time.

ii) If gross returns are at par between 'pure returns generation' initiatives and 'returns with extra financial criteria' initiatives, then the likelihood is that net returns will favor the first category as it is more cost effective for the GP than the second (as evidenced in Chapter 1). The leverage for proponents of the second category is either to compensate GPs supporting extra costs to comply with extra-financial criteria; or to sanction financially GPs which do not comply, hence modifying their cost structure.

iii) If gross returns are in favor of 'pure returns', then GPs will choose this path. To change this, proponents of the 'returns with extra financial criteria' category have to set up a mechanism to compensate the loss of returns *in*

[111] potentially triggering the following question: is the adoption of SRI criteria by PEF and the managers a way to 'greenwash' cost cutting?

[112] Greenwashing is defined by the University of Oregon and EnviroMedia as a 'coordinated attempt to hide unpleasant facts […] in an environmental context. […] It's greenwashing when a company or organisation spends more time and money claiming to be « green » through advertising and marketing than actually implementing business practices that minimize environmental impacts' (http://www.greenwashingindex.com/about-greenwashing/, accessed 31/1/2014). Greenpeace explains it as a way to put 'environmentalism [as] little more than a convenient slogan [when] at best, such statements stretch the truth ; at worst, they help conceal corporate behavior that is environmentally harmful by any standard' (http://www.stopgreenwash.org/introduction, accessed 31/1/2014).

fine supported by LPs (maybe on the template set by 'social impact bonds').

4.2.1.2. Addressing signaling effects

MBE-PE might appear as a mixed signal for the companies supported: it validates a business and might open the doors to debt financing (Chapter 1); but it might also signal to other investors that it is not *per se* an investment for return maximisation endeavors. To avoid this mixed signal, sustainable development financing benefits from a lever that MBE-PE cannot really count on: reputational risk associated with not complying with the criteria, and forced divestments in case of scandals (or even 'exit' from the LP if the reputational damage to the GP and potentially for the LP itself is too serious). An example of the latter case was the divestment of Cerberus Capital Management in Freedom Group after the shooting in a primary school in Newtown, Connecticut in 2012. Freedom Group manufactures the AR-15 rifle used to shoot the 20 children in the school. Under the pressure of CalSTRS and CalPERS, the two largest American pension funds representing teachers, Cerberus had to put its stake in Freedom Group up for sale[113].

4.2.1.3. Addressing extra risks

One of the conclusions drawn from Chapter 1 is that MBE-PE potentially increases the costs of investing. In the case of ESG investing, which adopts a 'best in class' approach, extra work at selection time and then during the investment period is required. Another conclusion is that applying extra criteria to PE selection reduces the investment universe if this implies a filtering process. This is the case of MBE-PE, but applies to SRI and ESG investing which excludes certain sectors of investment such as weaponry, tobacco and gambling.

Theoretically, for each increment of risk added to an investment opportunity, a corresponding return opportunity should arise. In the case of MBE-PE, this return opportunity remains unformulated. GPs have to equip themselves to provide additional services to their portfolio companies, and thus create value by fulfilling the need of these companies. These additional services are either by creating a total value in excess of the costs entailed and compensating the risks associated with MBE-PE, or by compensating GPs with a mechanism (such as a social impact bond) which will compensate them. If this is theoretically possible with MBE PE (as the business case is rather clear), it is more difficult to set up for SRI/ESG initiatives, as the social benefit of the work from the GP tends to be diffuse and a public good. Measuring it and compensating for it might be even more difficult than for MBE-PE.

[113] For an illustration: Neate [2012].

4.2.2 Consequences of solvency and prudential ratios for PE

Banks, insurance groups and pension funds are a major source of capital for PE funds, notably in Europe[114]. Solvency and prudential ratios are a determining factor of capital allocation by these institutions to PE funds. Current and upcoming international regulations governing the calculations of these ratios for banks (Basel II and Basel III Agreements, the US Dodd-Franck Wall Street Reform and Protection Act[115] and the European Capital Requirement Directive III and IV[116]), European insurance groups (Solvency II European Directive[117]), and European pension plans (EIORP Consultation[118], that the European Commission suggested aligning to the Solvency II European Directive[119]) have put capital adequacy, stress testing and liquidity risk at the core of assessing risks.

Under these rules, banks, insurance groups and pension funds have the choice to use three methods to calibrate their prudential and solvency ratios: simplified standard, standard and internal models. Internal models are built on internal historical statistics. Unless a given institution has already an exposure to PE, it will have to use the pre-defined ratios ('standard formula'), which might prove to be dissuasive[120] to invest in PE (see EDHEC [2010] and Studer and Wicki [2010] for European insurance groups, for example).

The calibration of models setting the pre-defined ratios defines the quantity of capital required to cover the risks of a given investment, and hence the minimum expected return of this investment to cover the cost of capital. The question of performances, valuations and risks associated with PE funds has become a determining stake for the future of fund raising and activity in PE[121].

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[114] According to the European Private Equity and Venture Capital Association, banks, pension funds and insurance groups provided respectively 15.6 percent, 23.0 percent and 9.9 percent of capital to PE over the period 2003-2007. These figures were respectively 18.4 percent, 14.4 percent and 9.3 percent in 2010 [EVCA, 2011].

[115] Public Law 111-203, 21/7/2010 (http://www.gpo.gov/fdsys/pkg/PLAW-111publ203/content-detail.html, accessed 2/7/2012)

[116] CRD I (Directives 2000/12 and 2006/49), CRD II (Directive 2009/111) and CRD III (Directive 2010/76) are adopted. CRD IV is being currently discussed (20/7/2011, EC Proposal COM(2011) 453 final, 2011/0203 (COD), 154 p. (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0453:FIN:EN:PDF, accessed 22/6/2012).

[117] Directive 2009/138 (25/11/2009), Official Journal of the European Union, 1/7/2011, 17/12/2009, pp. 335/1 – L 335/155 (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:335:0001:0155:en:PDF, accessed 22/6/2012).

[118] European Federation for Retirement Provision, 'A European Institution for Occupational Retirement Provision', July 2000, 32 p. (http://www.efrp.org/LinkClick.aspx?fileticket=s0zQ1rZdjkk%3D&tabid=1554, accessed 22/6/2012).

[119] European Commission, 'White paper: an agenda for adequate, safe and sustainable pensions', COM (2012) 55 final, 16/2/2012, 40 p. (http://ec.europa.eu/social/BlobServlet?docId=7341&langId=en, accessed 22/6/2012).

[120] Anecdotal reports illustrate this point (Brendan [2012, b]). However, the impact of Solvency II may also lead to an increase in allocation (Brendan [2012, a]).

[121] Additional changes, such as the adoption of the European Alternative Investment Fund Directive in 2011 and its upcoming transposition by European member states in national legislation will put PEF valuations, and hence performances, further under scrutiny. This piece of legislation notably states that a third party will have to review and deliver an opinion on the interim valuation provided each quarter by PEFs managers.

A vigorous debate has emerged on the topic (see Chapter 2), notably illustrating the difficulty to access and use performance data. One of the calibration models, notably retained by the Solvency II Directive and seemingly by the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS), uses the correlation measurement of listed share performance and PE performances. The choice of the listed share index is of importance[122] (see Chapter 2). Alternative methods are explored, notably to feed in the 'standard formula' and allow institutions to continue to invest in PE at a reasonable cost. One alternative has been to focus on the historical risk and return profile of PE funds.

Part of these difficulties come from the specific characteristics affecting PE (see Chapter 0, 2 and 3), which are difficult to conciliate with the calibration of solvency and prudential pre-defined ratios. LPs are primarily motivated by return generation (as established in Chapter 1) and notably the maximisation of their risk-return profile. As explained in Chapter 0, liabilities and the prudential treatment of these liabilities drives the investment strategy of institutions, namely banks, insurance groups and pension funds. Hence, risk assessment is, in fact, driving the PE investment strategy. So far, the limited percentage (0 to 10 percent) of assets under management allocated by these institutions to PE has had two consequences: first, that these institutions could get away with their limited PE investments without investing too many resources in the specific risk assessment of this category of investments as the cost of investing in PE was deemed to be potentially high, but limited to a small amount of capital. The rules of portfolio diversification (and somehow of the generalized interpretation of the 'prudent man' rule according to modern portfolio construction theory) required institutions to invest in this sector. It was assumed for a time that PE had a risk diversification role for portfolios dominated by stocks, bonds and real estate. Adding PE (along with hedge funds, commodities and foreign exchange instruments) to the mix was a matter of reducing risk and marginally increasing the potential return of the overall portfolio.

Second, as the returns from stocks, bonds and real estate decreased or stagnated, and the liabilities remained stable or increased (notably of pension funds), this equilibrium evolved towards the maximisation of relative returns but also a certain focus on absolute returns. The focus shifted from risk diversification to return generation. Unfortunately, the very nature of absolute returns generators, and specifically PE, does not fit in a framework notably designed for liquid assets with a solid and long trail of historical data.

Directive 2011/61 (8/6/ 2011), Official Journal of the European Union, 1/7/2011, pp. L-174/1 – L-174/73 (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:174:0001:0073:EN:PDF, accessed 20/3/2012).

[122] In that respect, the LPX 50 index chosen by the Solvency II Directive is not relevant as this 'index of listed private equity firms is, by design, distorted by the idiosyncratic risk of the firms that make up the index' [EDHEC, 2010].

Specifically, the solvency framework currently in use (banks and insurance groups) is ill-adapted to PE, as it requires a liquidity horizon of 12 months, which is not compatible with the time horizon of investing in PE. Moreover, its assumption combines historical data with scenarios (a combination of statistics and probabilities). Historical data in PE is partial (see Chapters 2 and 3), and usual value-at-risk scenarios do not match the nature of PE investing through funds: PEFs are portfolios actively managed, substantially disconnected from the vagaries of the stock exchange[123]. Making scenarios of losses based on intervals of confidence and catastrophic assumptions does not provide any useful information about the behavior of the overall PEF portfolio and the aptitude of the fund manager to manage risks.

However, conscious that switching from a VaR to a new framework is likely to require time and effort, and will be decided only if the rewards justify the costs (ie, not only for PE), we offer a partial solution to the liquidity-scenario conundrum while remaining in a VaR framework (Cornelius *et al*. [2013, p. 123] are convinced that VaR will be extended to alternative classes): our J-Curve forecasting method[124] reduces the 'uncertainty period' from seven-ten to two-five years, and offers at least rough but reliable assumptions of the likely outcome of a given PE fund. It contributes to solving problems related to the use of NAVs and stale pricing (Cornelius *et al.* [2013, p. 127]) as our method is based on actual cash-flows, and thus takes into account the fund's lifecycle characteristics – a need expressed by Cornelius *et al.* [2013, p. 128]. A practitioner has already adopted our recommendation: the Swiss Unigestion has developed an approach (the 'Expected Cumulatinve Downside Absolute Deviation[125]') 'based on actual cash flows of PE funds [which] defines risk as the deviation of actual cash flows from expected cash flows by timing and amount' [Perryman, 2014].

4.2.3 Consequences on the relationship between LP and GP

Despite partial listings of GPs[126], of funds[127] and of combined GP-LP entities[128], PE will remain in essence private for most of its activity in the foreseeable future. As a consequence, funds will continue to be structured under significant constraints, with

[123] Meyer and Mathonet indicated that credit risk and market risk are not applicable to PE [2005, p. 73]. They also state that 'for long-term equity holdings, the divide between market and credit risk is not entirely clear. For PEFs, mainly the unobservable economic value is of relevance' [p. 78-79].

[124] Our J-Curve forecasting method applies the suggestion of using the 'cluster analysis' proposed by Lhabitant and explained by Cornelius *et al.* [2013, p. 139]: 'a technique to classify similar objects into relatively homogeneous groups and dissimilar objects into different groups'.

[125] 'which uses fund cash flows as an input and measures the difference between the actual cash flow curve and the expected cash flow curve, retaining as risk the amounts where actual cash flows are lower than expected cash flows' [Perryman, 2014].

[126] For example: Partners Group in 2006, Blackstone in 2007, Oaktree in 2012.

[127] For example: KKR on Euronext in 2006 with KPE.

[128] For example: 3i in 1994, Eurazeo in 2001.

unsatisfactory alignment of interests. Spindler [2009] even calls for a reform of securities laws on PE to correct these imbalances.

Harris [2010] states that LPs cannot easily 'exit[129]', and hence their ability to constrain GPs is rather low. Chapter 3 shows that an early warning system might tip the balance of power more in favor of LPs, notably if the secondary market gains momentum. Assuming that LPs use the secondary market not only to rebalance their portfolio, or to handle a shortage of available capital; but also to sanction a disappointing performance, the signal sent by secondary operations would change – and the resulting pricing as well.

In that respect, Chapter 2 contributes to answering one of the questions raised by Harris [2010]: are fund managers more prone to hold on to capital and to delay mandatory distribution of income to LPs or do they speed up their exit strategy from portfolio companies? Our findings show that the best fund managers speed their exit strategy, while the less performing delay these exits. American LPAs grant the right to GPs to reinvest the proceeds of early distributions if the fund is still in its investment period. Top-performing American GPs can hence effectively invest up to 100 percent of the fund (and use 120 to 130 percent of the committed capital by investing 100 percent of the fund and collecting management and other fees – hence the high PIC associated with top performers[130]); not only do GPs show attractive IRRs, but they also maximize their carried interest. This conclusion is consistent with Lerner and Cao [2009] who found that, on average, GPs exit their portfolio companies at least six to nine months too early.
It is important to ask why less performing GPs would hang on their portfolio companies and delay the asset sale. The answer would seem to be that they seek to maximize the income stream derived from their management fees. As LPAs often state that the management fees should be calculated on the NAVs of the portfolio during the divestment period, it might be in the interest of GPs to maximize this holding period if there is no prospect to generate an income stream from carried interest by selling these assets. In that respect, the GP can actively manage his next fund raising as he can potentially inflate the value of his current assets under management [Jenkinson, Sousa and Stucke, 2013].

This situation is the consequence of the LPs' flight to quality: by focusing only on top quartile/decile/centile of the GPs, LPs in effect separate GPs in two categories: the top performers and the rest. Top performers (top 25 percent) consistently achieve a level of performance which allows them to beat the hurdle rate and generate a profit for themselves through the carried interest. They have a strong incentive to maximize the overall returns of their funds: the LP-GP agreement is fully effective in that respect.

[129] His expression is '« vote » with their feet'.
[130] This would need to be investigated in further research.

The rest of the GPs (75 percent of the pool) cannot beat the eight percent threshold of the hurdle rate regularly (second quartile), or only sporadically (the second half of the pool). Their incentive is hence to maximize the income from management fees. Unfortunately, as marginal returns are going down in PE (Chapter 2), the incentive might increasingly come from management fees and less from the carried interest.

To avoid, this situation, our conclusion is double:

i) The hurdle rate calculation should be dynamically calculated through the PME method. When the performance of the GP is eight percent above the PME, then s/he is entitled to a carried interest.

ii) The management fees should potentially be reviewed to reflect the cost structure of the GP (budgets) and not be calculated as a percentage of assets under management (whether committed or in portfolio).

By using the monitoring instrument of the J-Curve, LPs will be better able to sort out the 75 percent of the pool and avoid altogether permanently chasing (and spending a significant amount of resources to get access to) the top 25 percent.

Due to a persistence of performance of GPs [Kaplan and Schoar, 2005], the latter category of 25 percent is difficult to access once identified. It is not only that LPs cannot allocate the amount of capital that they would like to the funds managed by top quartile GPs, but they are also vulnerable to a change in the GP. In fact, GPs are structures significantly affected by the retirement or departure of their leading principals. As shown by Ewens and Rhodes-Kropf [2013], individual principals are driving the performance of GPs (hence keymen clauses in LPAs[131]). The ability of LPs to regularly lead their due diligences and to assess the status and the dynamics of GPs is necessary to properly invest in PEFs. The accelerated fund raising that top quartile GPs set up, often with limited or no due diligence allowed for new LPs, prevents investors from assessing their risks when investing with these GPs. Existing LPs might not be better off, as the internal dynamics of GPs remains largely hidden from LPs, the communication with whom is being managed very carefully by GPs.

LPs have to invest in the second quartile GPs, sometimes in the third, and try to avoid the bottom quartile. Their expectations still have to reflect this reality. By recognizing that their return expectations, which still prime over their other extra-financial criteria, should evolve from absolute to relative returns targets, LPs would, in actuality, change the dynamics of their relationships with GPs. The alignment of

[131] Keymen are 'key senior professionals actively involved in the sourcing, analysis, negotiation and subsequent monitoring of portnial investments made by a Fund' [EVCA, 2012, p. 39 –also see sections '3.2.8 Terms in the fund documents' and '3.7.6. Keyman provisions'].

interest could be redefined and better reflected in LPAs. It is worthwhile to question whether this alignment means that there would be 'two LPAs', the traditional one for top performers, and a new one for less performing GPs along the lines suggested by Da Rin and Phalippou [2013]. We would argue that this is not necessarily the case. In fact, it might be in the interest of the LPs to keep the LPA as a standard marginally adjusted (in line with Gompers and Lerner [1996] who state that the need for convenants is inversely proportional to the sensitivity of the GP's compensation to performance). Not only does this approach save costs on the LP and on the GP side, but it might resort to a sound risk management practice.

By planning not only for the best and the worst, but also for 'the less good' in the same LPA, LPs not only avoid any reputational mismatch or negative signal by using one set of clauses or another, but they can also manage the accession of GPs to the top quartile or their downgrade to a lower quartile. The LPA becomes a dynamic incentive instrument, not only by including a budget and a dynamic hurdle rate, but also by introducing a carried interest, potentially hedging above 20 percent of profits for the truly high performers. In fact, this logic might even lead to the blend of the hurdle rate in a dynamic scale of carried interest thresholds based on PME assessments. Harris [2010] is, however, very explicit about the temptation to reach the 'perfect LPA': 'managers tend to undermine even the most thoughtful incentive-based compensation arrangements. […] The implication is that contract design is an unsatisfactory solution to the agency costs in PE'.

In a search for the solution, investors might turn to alternative private enforcement mechanisms such as increased, ongoing monitoring of fund manager conduct' 'instead of an over-reliance on contract design' (even for a Law specialist like Harris [2010]). Our analysis joins this conclusion in Chapter 3: the grounding of investments on facts (known performances and state-of-the-art knowledge of the asset class), scenarios (the LPA covering this side) and active arbitrage (notably thanks to instruments devised in Chapter 3). Reputations are in the grey area between 'information' and 'noise'. They are thus difficult to assess and to interprete at investment time and during the monitoring period of PEF investments. A solution combining the solutions above would relegate these reputations to one (potentially minor) element of information among others for LPs and GPs. In fact, this might be a positive evolution for LPs and GPs altogether.

As Harris [2010] states, reputation is 'necessarily a long-term measure that works best if those who depend on reputation are relatively stable and rely on it to generate new deal flow'. As expressed by Perkins [2008], Brooke and Penrice [2009], and Draper [2011], the founding generation of modern PE is retiring. Therefore, stability is not guaranteed, and the value of reputation might fade rapidly. Moreover, the institutionalisation of PE [Demaria, 2010 and 2013] reduces the influence of

reputation in deal sourcing, notably in large to mega LBOs (though this might still prove to be the case in venture capital, growth capital and small to mid-sized LBOs).

Our solution is also in line with the conclusion of Harris [2010], according to whom instead of lengthening LPAs or making them more complex, investors will turn to 'alternative private enforcement mechanisms for protection', and namely increased monitoring and *ex ante* action. Chapter 3 illustrates what this increased monitoring can be (though other mechanisms are likely to emerge as well, Harris referring to Advisory Boards, which are explored in Chapter 0). However, this does not stop here.

4.3. Outlook

One must now ask what might be the expected trends derived from the findings of this research. On the empirical side, GPs will have to handle their individual and collective communication differently (4.3.1); and LPs will have to set their own collective discipline to avoid creating a new systemic risk (4.3.2). On the academic side, some questions would benefit from further exploration (4.3.3).

4.3.1 Consequences on the communication from GPs

Whether they like it or not, GPs will fundamentally have to evolve in information management, and at least for three reasons. The first, and most pressing, is regulatory. European (AIFMD, Solvency II), American (FATCA, Volcker Rule, Dodd-Franck Act) and international (Basel III, pension and insurance regulations) have introduced new obligations which have a direct impact on PE. They can be summed up as follows: always faster (insurance groups request quarterly reports within 45 to 60 days after closing of the quarter), always more comprehensive (CalPERS vs San Jose Mercury News kick-started the movement in 2004) and always more objective (AIFMD, with third party valuations of funds). Operational consequences will be, for example, the necessary adopting of a state-of-the-art IT system, to save time and to provide this level of details.

The second reason is communication. The increasing number of LPs new to the asset class, the qualitative and quantitative need of information and the recurring scarcity of information in PE are a strong motivation to document the activity of the GPs permanently and on an on-going basis. This supports the quasi-permanent fund raising activity of the GPs. The 2007-2009 crisis also emphasized the need to conduct thorough due diligences on GPs.

The third reason for evolved information management is to address operational risk management, which is a new risk for an asset class which is used to small teams managed as boutiques. Cases of potential conflicts of interests in these 'asset management houses' (as large PE fund managers describe themselves) will

dramatically increase as they operate in various interconnected sectors (private real estate, distressed debt, LBO, PIPE, etc.), but also potential insider trading cases as LBOs are increasingly targeting listed groups. This should argue in favour of advanced monitoring and reporting systems to protect GPs themselves in case of legal procedures (to which Harris [2010] points as increasingly frequent in a sector historically shy of bringing cases to the courts).

The logical conclusion is that management fees will paradoxically not decrease – at least in the short term. The reason is that the equipment with IT systems, the weight of regulations (financially and time-wise) and the need of extensive track records of GPs (notably due to the quasi-impossibility to create captive firms in banks and insurances going forward), will push towards a concentration of GPs and increase barriers to entry to the PE sector. The balance of power will likely stay on the side of existing GPs – whether good or not – and the fees will continue to be set by the GPs to their advantage. Thus, the recommendation to operate GPs on a budget (see 4.2.3) might make sense for LPs but GPs will have significant ground to maintain the current status quo and to continue to charge fees as a percentage of assets under management.

4.3.2 Consequences on the behaviour of LPs

The regulations adopted before or due to the aftermath of the financial crisis (enumerated above in 4.3.1) assume that there is a systemic risk associated with PE. If there is one, it is, in fact, not where the regulations have attempted to find it – that is at the general partner level. The Alternative Investment Fund Managers Directive (AIFMD) was the result of this assumption. In fact, the behaviour of limited partners has proven to be the source of systemic risk.

The financial crisis has shown in many instances that PE fund managers were able to deal with the financial crisis as they invest without any leverage at fund level (each underlying investment having its specific leverage, if any). Risks were insulated at portfolio company level and the portfolio diversification was helping to manage these risks.

However, the lack of experience and poor management of liquidity at the LPs level was creating a potential systemic risk in two ways:

i) First, by disposing of assets at fire sale prices, they were feeding a spiral of downward asset prices, which in retrospect was itself putting pressure on banks and insurances to review the value of their assets. This caused a rippling through the financial system.

ii) Then, by reducing the ability of PE funds to finance companies, they were actually transferring the financial crisis to the real economy. The credit crunch, which was already hitting the small and medium size businesses due to new solvency ratios and the difficulties of banks, was suddenly amplified by an equity crunch due to the poor understanding and handling of PE-specific mechanisms, and in particular cash flow needs.

In particular, it is necessary to understand that the 'co-opetition' strategy of LPs has consequences on each other: LPs form a system. As such, they need to define a collective discipline; their focus on their asset allocation and portfolio strategy has to be put in balance with the interests of the community of LPs and of the PE sector as a whole. This approach is valid for asset allocation (and the capacity of absorption of private companies and local economies of a capital inflow), for capital deployment as well as for PE strategies selection (to minimize the collectively and generally prejudiciable 'wave' phenomenon described by Harris, Jenkinson and Kaplan [2012]). This is also valid when it comes to eliminating disfunctional GPs on the market, notably if barriers to entry for new comers are increased and thus if existing GPs benefit from an undue rent due to the new regulations.

4.3.3 Perspectives for further academic and empirical research

Throughout this research, we have tried to point out areas which would benefit from further analysis. A significant challenge lies in the ability of academia and practitioners to produce more consistent, qualitative, precise and reliable data on the activity and performance of PE funds. Though that endeavour is a long-term and uncertain project[132], it is mandatory so as to avoid further ill-conceived regulations, misperceptions and ultimately prejudiciable evolutions in the PE sector. LPs have a defining role as they collect a wealth of data and could benefit hugely by pooling this resource (even though some, in that process, might lose an edge as they can privately mine this treasure trove).

The second area of exploration remaining to be done is to connect PE and behavioral finance. Dealing with uncertainty is what behavioral finance contributes to, notably by identifying investors' biases, preconceptions and behavioral idiosyncracies. It would notably help to explore questions such as: when are reputations information and when do they become noise? How to scientifically assess reputations in PE? What could these assessments deliver in terms of academic findings and empirically for LPs selecting GPs?

The third area of future research is the identification of other instruments that help LPs to better manage their portfolio of funds and their relationships with GPs. We already hinted that the PIC might be an instrument to explore (Chapter 2), notably to

[132] One valuable attempt being the Private Capital Research Institute (PCRI) initiated by Josh Lerner.

identify how much it is a marker of potential high performance. Another would be capitalising on the findings of Chapter 3, to refine the PME-DPI analysis and to try to identify what would be the incentive thresholds to set in place to motivate GPs. Assuming access to high quality data, it would also be helpful to identify the specificities of J-Curves for markets beyond the US: refine the European results (maybe by countries or regional aggregates) and explore emerging markets results.

These suggestions illustrate the fact that our research is essentially, just like any academic research, a work in progress. We hope that it will support further developments towards a better understanding of this fascinating asset class: PE.

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Curriculum Vitae

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09/1997 – 06/2000	HEC, France Diplôme de Grande Ecole (Master) in Entrepreneurship
09/1998 – 07/1999	Université Paris-V, France DESS (eq. Master), Major: European Business Law
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Work Experience

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07/2012 – 06/2014	Independent consultant, Switzerland
09/2009 – 06/2012	Founder and CIO of Tiaré Investment Management, Switzerland
02/2008 – 08/2009	Special Advisory to the President at CASDEN, France
09/2007 – 01/2008	Independent consultant, Switzerland
03/2006 – 08/2007	Founder of Pionat Sustainable Investments, Switzerland
01/2005 – 02/2006	Associate at Adveq, Switzerland
07/2003 – 12/2004	Independent consultant, France
03/2002 - 06/2003	Head of Corporate Development at Externall, France
08/2000 – 02/2002	Analyst at Pyramid Technology Ventures I, France/USA