

**The Risks and Benefits of Credit Default Swaps and the Impact of a
New Regulatory Environment**

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Meinen Eltern

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Abstract

Since the breakout of the current financial crisis and the failures of system-relevant financial institutions such as Lehman Brothers, Bear Stearns and AIG, credit default swaps (CDSs) are being perceived as a double-edged sword and are the subject of a lively discussion in the academic community as well as in the media. In addition, a new regulatory framework is currently under way to be implemented at the European level, which will have a significant impact on CDS market participants. The controversial debates on the role of CDSs during the financial crisis along with the forthcoming regulatory changes make the CDS market an interesting and active field of research. This doctoral thesis comprises four research papers that seek to find answers to open questions regarding the application of credit risk models, the risks and benefits of CDSs and the impact of a new regulatory framework on the CDS market.

First, the theoretical foundation for measuring credit risk –with a focus on the application of credit risk models– is provided (see Chapter I). I examine the two main approaches for modeling credit risk, the structural approach and the reduced-form approach and provide valuable insights into the applicability of credit risk models when pricing credit derivatives.

Next, the theorized and empirically evidenced risks and benefits found in the CDS market are analyzed (see Chapter II). Subsequent to the analysis, appropriate policy recommendations are derived and discussed. The findings suggest that the identified risks of the CDS market are numerous and particularly detrimental in times of financial crises, which call for effective future policy arrangements.

In the following part, I turn the focus towards new regulatory requirements in the CDS market (see Chapter III). In particular, I analyze the design of central counterparties (CCPs) and assess their impact on CDS market participants. The results suggest that CCPs face a delicate trade-off between promoting and ensuring the stability of the financial system on the one hand and optimizing the efficient use of market participants' financial resources –such as margins– on the other.

Finally, I examine the promises and perils of CDSs for non-financial companies against the background of a new regulatory framework (see Chapter IV). I delve into the question why CDSs have not played a larger role in the risk management tool set of non-financial companies and how CDSs could add value for these firms in the future. I provide valuable insights into the use of CDSs and the ramifications of the new regulations on non-financial companies when applying CDSs in practice.

Zusammenfassung

Seit dem Ausbruch der jüngsten Finanzkrise sind Credit Default Swaps (CDS) ins Rampenlicht des akademischen und medialen Interesses gerückt und bilden seitdem den Gegenstand einer kontroversen Diskussion. Auf Europäischer Ebene werden zudem neue regulatorische Rahmenbedingungen eingeführt, die weitreichende Auswirkungen auf den CDS Markt haben werden. Die angesprochenen Kontroversen sowie die bevorstehenden regulatorischen Veränderungen machen den CDS Markt daher zu einem spannenden und wichtigen Forschungsgegenstand. Die vorliegende Dissertation beschäftigt sich in vier Forschungsarbeiten mit den Implikationen des Einsatzes von CDS auf Marktteilnehmer und gibt im speziellen Antworten auf offene Fragen hinsichtlich der Anwendung von Kreditrisikomodellen, des Nutzens und der Risiken von CDS und den Auswirkungen neuer Regulierungen auf den CDS Markt.

In Kapitel I werden die theoretischen Grundlagen zur Messung des Kreditrisikos gelegt, wobei der Fokus auf der praktischen Anwendung von Kreditrisikomodellen liegt. Hierbei untersuche ich die zwei gängigsten Kreditrisikomodelle: den firmenwertbasierten sowie den intensitätsbasierten Ansatz. Dabei gewinne ich wichtige Einblicke in den Einsatz von Kreditrisikomodellen im Zusammenhang mit der Nutzung von Kreditderivaten.

In Kapitel II werden der Nutzen und die Risiken von CDS unter theoretischen und empirischen Gesichtspunkten einer Analyse unterzogen. Basierend auf der Analyse werden nachfolgend regulatorische Handlungsempfehlungen abgeleitet und diskutiert. Die Ergebnisse zeitigen eine Reihe von Risiken, die sich insbesondere in Krisenzeiten verstärken und daher effektivere zukünftige Regulierungen verlangen.

Kapitel III konzentriert sich auf neue regulatorische Anforderungen im CDS Markt. Dabei liegt der Fokus auf der Ausgestaltung der Zentralen Gegenparteien und den Auswirkungen deren Einführung auf die Marktteilnehmer. Die Ergebnisse zeigen, dass Zentrale Gegenparteien einem Zielkonflikt unterliegen, der auf der einen Seite die Förderung der Finanzstabilität verlangt und auf der anderen Seite die Optimierung der eingesetzten finanziellen Mittel der Marktteilnehmer sicherstellen soll.

In Kapitel IV analysiere ich schließlich die Einsatzmöglichkeiten von CDS für nicht-finanzielle Unternehmen vor dem Hintergrund neuer regulatorischer Rahmenbedingungen. Die Ergebnisse zeigen Möglichkeiten und Beispiele für den wertsteigernden Einsatz von CDS sowie die Auswirkungen neuer Regulierungen auf nicht-finanzielle Unternehmen auf.

Introduction

Motivation and Objective

Credit derivatives are one of the major financial innovations of the last decade. The market for credit derivatives has become the third-largest derivatives market –after interest rate and foreign exchange derivatives– in terms of gross market value, accounting for USD 1.3 trillion as of June 2011. Among credit derivatives, the credit default swap (CDS) is the most popular instrument for trading credit risk. However, despite their great success in the past, CDSs went to rack and ruin in public and have been blamed by its critics for being a major driver of the current financial crisis. For instance, in 2008 a Reuter’s report about CDSs, headlined “Buffett’s time bomb goes off on Wall Street”, blames CDSs for the failures of Lehman Brothers, Bear Stearns and AIG. Since then, CDSs are being perceived as a double-edged sword and are the subject of a lively discussion in the academic community as well as in the media.

In addition, as a result of the role played by over-the-counter (OTC) derivative markets during the current financial crisis, which made the financial system prone to contagion and increased systemic risk, new regulatory frameworks are under way to be implemented at the European level such as the European Market Infrastructure Regulation (EMIR) and Basel III. These regulations will have a significant impact on the CDS market and its participants. In particular, a major consequence of the new regulations will be an increase of the importance of central counterparties (CCPs) in the CDS market.

All these controversial debates and ongoing as well as far-reaching changes make the CDS market an interesting and active field of research. The main purpose of this dissertation is, therefore, to investigate the implications of the use of CDSs as well as the impact of a new regulatory framework on the CDS market and its participants. In particular, I will address the following research questions which are relevant for academics as well as practitioners alike:

- Which credit risk model is the most appropriate one to apply when using CDSs?
- What are the major benefits and risks of the CDS market?
- Given the identified risks, how can the CDS market be further developed through appropriate regulations?
- What are the major differences between the CCPs in the European CDS market?
- How are participants in the CDS market affected by the introduction of CCPs?
- How can non-financial companies apply CDSs in practice and why have they failed to do so until now?
- How are non-financial companies affected by the new regulatory requirements when using CDSs?

Areas of Research and Major Contributions

This doctoral thesis consists of four research papers that seek to find answers to open questions regarding the application of credit risk models, the risks and benefits of CDSs and the impact of a new regulatory framework on the CDS market.

Chapter I provides the theoretical foundation for measuring credit risk and focuses on the application of credit risk models when using financial products with payoffs tied to credit-related events such as CDSs. I examine the two main approaches for modeling credit risk, the structural approach and the reduced-form approach. It is shown that the applicability of the specific model depends to a large extent on the situation at hand and investors should give preference to reduced-form models when pricing credit derivatives.

Chapter II analyzes the costs and benefits found in the CDS market, connecting theoretical findings with an assessment of the empirical evidence. Subsequent to the analysis, appropriate policy recommendations are derived and discussed.

To date the literature has mainly focused on analyzing specific aspects and issues of the CDS market but a comprehensive analysis is still missing. Stulz (2010) for instance examines the impact of CDSs on the current credit crisis and the role of counterparty risk in the CDS market and Kiff et al. (2009) analyze the systemic risk inherent in the CDS market. Only Anderson (2010) provides a brief theoretical analysis of different forms of CDSs, such as corporate CDSs, sovereign CDSs and index CDSs. Thus, I contribute to the literature by providing a comprehensive cost and benefit analysis of

the CDS market and by deriving appropriate policy recommendations as well as by critically evaluating the already proposed initiatives by regulatory bodies. This chapter, therefore, provides regulators with an enhanced understanding of the issues that must be addressed from a theoretical as well as empirical perspective and discusses the subsequent ramifications for regulatory initiatives. In addition, market participants gain a better understanding of the benefits and risks inherent in the CDS market and the characteristics of the intended policy initiatives.

The findings of this chapter show that the identified risks of the CDS market are numerous and particularly detrimental in times of financial crises. This condition of the CDS market, thus, calls for effective policy arrangements such as creating an adequate market infrastructure, incentivizing the use of standardized CDS contracts, improving market transparency and increasing loss piece retention.

In Chapter III, I turn to new regulatory requirements in the CDS market. As a result of post-crisis regulatory initiatives the importance of central counterparties (CCPs) has considerably increased and has a significant impact on the CDS market. The purpose of this chapter is, therefore, to analyze the design of CCPs in the CDS market and to assess the impact of the introduction of CCPs on participants in the CDS market. In doing so, I focus on three essential design elements: (1) market infrastructure, (2) risk management and financial resources and (3) ownership, governance and regulatory oversight.

The literature analyzing the impact of CCPs on the CDS market is rather limited. Cecchetti, Gyntelberg and Hollanders (2009) discuss regulatory challenges related to CCPs in the CDS market and Duffie and Zhu (2011) as well as Cont and Kokholm (2011) examine the netting benefits of CCPs and look into the question whether the introduction of a CCP for the CDS market increases or reduces counterparty exposure. The contribution of this chapter is, therefore, to extend the literature by offering crucial insights explicitly for CDS market participants to enable them to understand how they are affected by the introduction of central clearing and to provide them with an analysis of the major differences between the three CCPs in the European CDS market.

The findings show that central clearing may provide several major benefits for CDS market participants but poses at the same time a systemic risk to the financial system due to the concentration of counterparty risk. As a result, a CCP faces a delicate trade-off between promoting and ensuring the stability of the financial system on the one hand and optimizing the efficient use of market participants' financial resources –such as margins– on the other.

In Chapter IV, I turn to the use of CDSs by non-financial corporations. Even though the credit derivatives market has grown to become the third largest OTC derivatives market to date, non-financial companies only account for a market share of 1% on a global basis, suggesting that CDSs are not part of the armory of corporate treasurers yet. Therefore, the questions arise why CDSs have not played a larger role in the risk management tool set of non-financial companies and how CDSs could add value for non-financial firms in the future.

The existent literature on the use of credit derivatives by non-financial corporations is relatively limited. Freeman, Cox and Wright (2006) explore the possible uses of credit derivatives by corporate treasurers whereas Smithson and Mengle (2006) primarily discuss the reasons why the use of credit derivatives by non-financial corporations has failed. I contribute to the literature by examining the promises and perils of CDSs for non-financial corporations against the background of new regulatory requirements in the CDS market which will be implemented from the beginning of 2013 onwards.

I find that CDSs provide a number of promising uses for non-financial corporations that have the potential to add value to the firm even though there are still several obstacles that need to be dealt with in order to increase the acceptance of CDSs by non-financial corporations. Furthermore, the introduction of a new regulatory framework will increase the liquidity in the CDS market and strengthen the use of standardized CDS contracts but at the same time intensify the demand for collateral leading to increased cash-flow volatility when using CDSs by non-financial companies.

Finally, I conclude the dissertation with a summary of the main results.

Credit Default Swaps and the CDS Market

When making an investment, investors face different types of risk that can be grouped into different risk categories. For instance, a European fund manager who buys five-year bonds of General Electric denominated in US dollars faces a) currency risk, i.e. the risk that the US dollar might devalue relative to the Euro, b) interest rate risk, i.e. the risk that the US might pursue a contractionary monetary policy, and c) credit risk, i.e. the risk that General Electric might not meet its obligations or liabilities on time.

All credit derivatives have the same primary goal in common: To help investors manage the credit risk they face by isolating this risk from the contract and transferring it to another party who is willing to bear this risk for a pre-determined fee. Credit derivatives can, thus, be simply thought of as bilateral agreements that transfer credit risk from one party to another. The value of credit derivatives is derived from the credit performance of an underlying asset such as a financial liability of a corporation or a sovereign entity. As a result, credit derivatives allow investors to trade credit risk in much the same way that market risk is traded (Chacko et al. 2006).

The various instruments used to transfer credit risk can be classified along two key dimensions (see Table 1), namely, whether the transferred credit risk is associated with a single borrower (single name) or multiple borrowers (multi name), and whether the underlying asset is sold (funded) versus not sold (unfunded) (BIS 2003).

Table 1: Characteristics of Credit Risk Transfer Instruments

	Funded Risk Transfer	Unfunded Risk Transfer
Single Name	<ul style="list-style-type: none"> ▪ Loan trades 	<ul style="list-style-type: none"> ▪ <i>Single-name credit derivatives such as credit default swaps</i> ▪ Financial guarantees and letters of credit
Multi Name	<ul style="list-style-type: none"> ▪ Asset-backed securities and Securitization 	<ul style="list-style-type: none"> ▪ Credit default swap indexes and basket default swaps ▪ Synthetic collateralized debt obligations

In contrast to traditional securitization and loan trades, which involve the transfer of credit risk through the actual sale of the underlying asset, credit derivatives transfer the credit risk of a single asset or a pool of assets from the originator to investors but the

originator keeps the underlying asset(s) on its books, that is, credit derivatives involve the transfer of credit risk through synthetic securitization (Choudhry 2010). There is also another important distinction between credit derivatives and traditional securitization: If a financial institution securitizes an asset, it keeps the first-loss piece (i.e., the tranche with the highest default risk) on its books, whereas if it synthetically securitizes an asset's credit risk through the use of credit derivatives, the first-loss-piece is priced and sold to investors (Spremann and Gantenbein 2007).

What Are Credit Default Swaps?

Given their tradability, credit derivatives are used in a wide range of applications where investors trade credit risk as a separate asset class. In terms of credit derivatives, the credit default swap (CDS) is the most popular instrument for trading credit risk. A CDS is essentially a bilateral OTC agreement used to transfer credit risk of a reference entity from one party to another.

A "plain vanilla" CDS consists of a contract between two parties whereby the protection buyer of the CDS pays a predetermined fixed periodic premium to the seller until the end of the life of the CDS or until a predefined credit event occurs. When a credit event occurs, the protection buyer receives a payment that is either based on physical or cash settlement. If no credit event occurs until maturity of the CDS contract, the protection seller pays nothing. These two cash flow streams of a CDS contract are typically named the fixed leg (the fixed periodic premium paid by the protection buyer) and the contingent or default leg (the payment contingent on the occurrence of a credit event) according to the nature of the payment. Figure 1 provides an illustration of the functioning of a CDS contract.

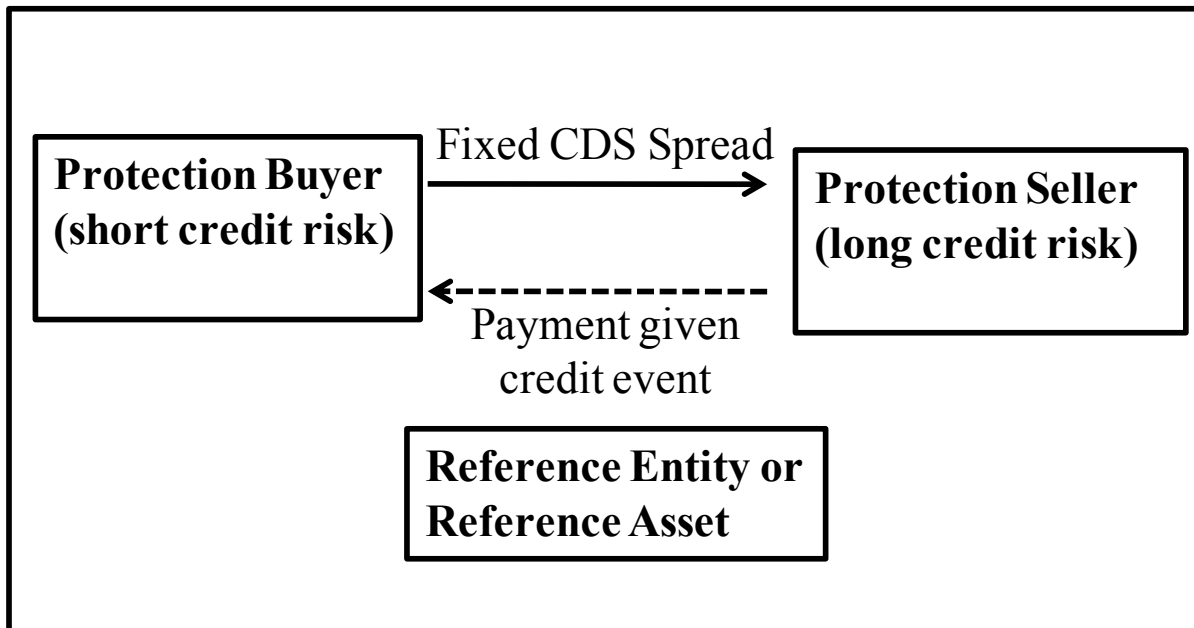


Figure 1: Credit Default Swap Contract

The terminology used here views a CDS transaction as a purchase or sale of protection rather than as a sale or purchase of credit risk. Therefore, the protection buyer could alternatively be viewed as a seller of credit risk, since he could -instead of buying protection- sell the underlying asset in the cash market and thereby reduce its credit risk exposure. Likewise, selling a CDS or selling protection is equivalent to buying credit risk since an investor who sells a CDS could also buy the underlying asset in the cash market and thereby assume credit risk of the reference entity (Francis et al. 2003).

The fee that the protection buyer pays periodically to the protection seller is calculated as a percentage of the notional amount of the underlying asset (e.g. the face value of a bond). Nowadays, CDS premiums are typically paid in quarterly installments. The notional amount is also known as the credit default swap's notional principal. The total fee paid per year by the protection buyer as a percent of the notional principal is referred to as the CDS spread or CDS premium and is quoted in basis points.¹

¹ Due to a change in market conventions by the International Swaps and Derivatives Association described under the name "CDS Big Bang" and "CDS Small Bang" protocol that took place in 2009, the standard CDS contract is no longer traded on a par basis, where the counterparties agree upon a fixed-coupon level that makes the net present value of the contract to zero at its inception. Instead, CDS trade now at inception with a combination of a standard fixed rate-coupon (Europe: 25bp, 100bp, 500bp and 1000bp; USA: 100bp and 500bp) and an up-front payment. The upfront payment can be in either direction and is a compensation for the difference between the standard fixed rate-coupon and the fair premium that would make the contract worth zero. In the market place, the CDS contract is still quoted on the basis of the fair CDS premium/running spread (Barclays Capital 2010, 7).

A key aspect of an OTC CDS contract negotiated between the two parties is the explicit definition of possible credit events that trigger the conditional payment from the protection seller to the protection buyer as well as the clarification of the settlement mechanism and the specification of a number of criteria that must be fulfilled by a deliverable underlying asset in case a credit event occurs.

CDS contracts generally include some or all of the following credit events, which specify the terms that must take place to trigger the protection payment by the protection seller (Bomfim 2005):

- **Bankruptcy:** The reference entity becomes insolvent or generally unable to repay its debt. However, the general inability to repay debts by the reference entity must be accompanied by a judicial, regulatory or administrative proceeding or filing in order to be considered as a credit event.
- **Failure to Pay:** This requires the reference entity to default on due payments such as principal or interest and is typically subject to a materiality threshold of \$1 million.
- **Obligation Acceleration:** This occurs when an obligation of the reference entity has become due prior to maturity and has been accelerated because of default.
- **Repudiation/Moratorium:** This credit event is triggered when a reference entity refuses or challenges the validity of its obligations or imposes a moratorium which prevents the entity from making any payment.
- **Restructuring:** This implies a change in the terms of a debt obligation that is materially unfavorable to creditors such as lowering the coupon or lengthening the obligation maturity.

The parties to the contract decide which credit events to include and which not. Repudiation and moratorium are usually applied in contracts where the reference entity is a sovereign borrower. For newly negotiated CDS contracts obligation acceleration is commonly excluded as a credit event by the majority of market participants (Bomfim 2005).

Other essential terms that need to be specified in a CDS contract are the settlement method, the reference entity, reference obligation and deliverable obligations. Once the occurrence of a credit event is confirmed by a central decision-making body, the Determination Committee,² a CDS can be either physically or cash settled. The

² In response to the growing concern about the appropriate determination of a credit event, a central decision-making body has been established in the market place (the so called Determination Committee) in 2009 that is

settlement method is determined upfront in the confirmation letter when the contract is entered by the counterparties. In a physically settled contract, the protection buyer has the right to sell a range of deliverable obligations to the protection seller who in turn has the obligation to pay the full face value of the obligation. In a cash settled contract, the protection seller pays the difference between face and market value of the reference obligation to the protection buyer. For cash settlement, the market value of the reference obligation is typically determined by an auction mechanism, whereby a number of participating dealers provide two-way prices on an agreed obligation, which leads eventually to a final market price or recovery value of the obligation, which is used to cash settle all CDS contracts. Cash settlement is the standard method used today (Chaplin 2010).

With regard to the reference entity, it is important to define precisely which entity's credit risk is being transferred. For instance, large corporations are usually comprised of a network of subsidiaries and a default by a subsidiary generally does not trigger a CDS contract written on the parent company.

The reference obligation is a particular obligation issued by the reference entity that is specified in the CDS contract and it determines the seniority of the CDS in the capital structure of the reference entity at which default protection is traded. Typically, the reference obligation is a senior unsecured bond of the reference entity. In case of a credit event, deliverable obligations comprise any obligation as long as it ranks *pari passu* with the reference obligation. Thus, the protection buyer is generally allowed to deliver obligations that have the same rank in the reference entity's capital structure as the reference obligation (Bomfim 2005).

For completeness there are to mention two other products traded in the marketplace that are similar to a plain vanilla CDS. The first one is a digital (or sometimes called binary) CDS. It is almost identical to a vanilla CDS except that the payoff in case of a credit event is a fixed dollar amount. Thus, the payoff in case of a default is independent of the market value of the deliverable obligations at default. Digital CDS are typically settled through cash settlement (Chacko et al. 2006).

The second one is the Loan-only credit default swap (LCDS), which is a more specific type of a credit default swap, where the reference obligation is a syndicated secured loan and deliverable obligations are limited to such loans rather than to any other form of debt securities such as bonds or unsecured loans. Thus, in general a

responsible for determining whether a credit event has occurred, the settlement procedure and the type of deliverable obligations (Chaplin 2010, 75).

LCDS can be applied for loans the same way as a plain vanilla CDS for bonds. There are, however, some fundamental differences in the way a LCDS is used and traded in the US as compared to Europe. In the US the LCDS is commonly used as a trading product as part of an investment strategy by institutional investors. In contrast, the European LCDS is used to provide banks -as the main originators of syndicated secured loans- with a hedging product. This enables the banks to manage their loan books and reduce regulatory capital (Bartlam and Artmann 2007).

With regard to multi name credit derivative instruments, CDS indexes have developed into the most liquid financial instruments in the credit market. CDS indexes refer to portfolios of single-name CDSs. The most popular credit default swap indexes are members of either the CDX or itraxx index family. CDX indexes contain North American and Emerging Market companies and itraxx indexes consist of either European or Asian companies. The indexes are standardized contracts trading under standardized rules. CDS indexes have substantially enhanced the investment strategies available to market participants by allowing investors to transfer credit risk of a broad spectrum of credits in a more efficient manner than by buying or selling single-name CDSs. In particular, they allow investors to quickly execute directional views in the credit market by either positioning long or short trades. CDS indexes can also be used as a hedging tool within the credit market to hedge market-wide spread moves. Further applications imply the use as a building block for structured products such as index tranches and index swaptions (Skarabot and Bansal 2007).

Dynamics of the CDS Market

The CDS market has experienced tremendous growth rates until the break out of the current financial crisis, which started in 2007. The rapid growth is confirmed by various data sources such as the Bank for International Settlements (BIS) and the International Swaps and Derivatives Association (ISDA) even though there is still some dispersion across the different data providers (see Figure 2).

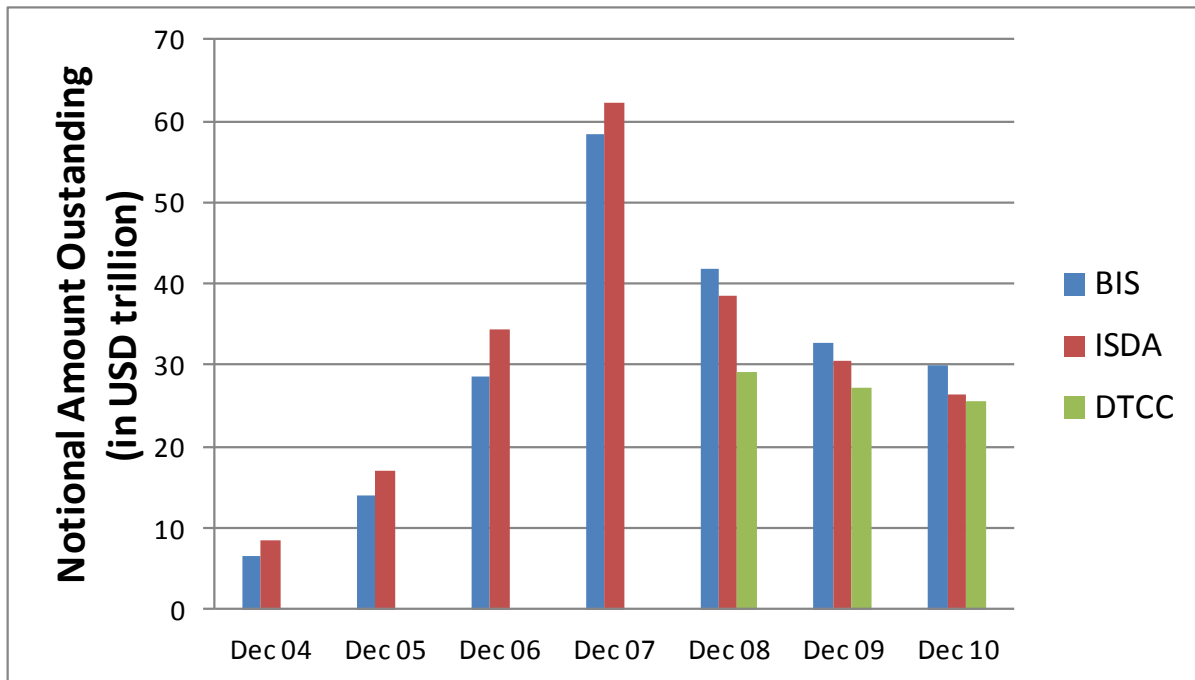


Figure 2: Notional Amount Outstanding of Credit Default Swaps³

Historically, this has been due to the fact that CDSs are traded OTC rather than on exchange, which made it difficult to obtain data from market participants resulting in datasets based on surveys that vary from source to source. Nowadays, a CDS trade repository administered by the DTCC (Depository Trust & Clearing Corporation) collects data on basically all cleared and non-cleared CDS contracts and thereby harmonizes the data-collection process.

One factor that has additionally contributed to the remarkable growth rates until 2007 is the common technique used by OTC market participants to terminate a former contract by entering an offsetting new trade, which has further fueled the growth in terms of notional amounts outstanding. The decline of notional amounts outstanding starting in 2008 is mainly due to three factors. First, portfolio compression by banks played a major role leading to the compression of redundant offsetting positions. Portfolio compression reduces the notional amount outstanding as well as the number of outstanding contracts in a market participant's derivatives portfolio by replacing the existing trades with a smaller number of replacement trades that carry the same risk profile and cash flows as the initial portfolio. Second, following the failure of Lehman Brothers and other investment banks in 2008, a reduced number of market participants led to a declining number of contracts. Third, the decline of the Euro and Pound Sterling against the US dollar in 2008/2009 by 30% and 12%, respectively may have

³ Source: BIS, ISDA, DTCC

had an additional impact on the notional amount outstanding reported in US dollar equivalents on a global basis (ECB 2009).

In comparison to other OTC derivative markets, the CDS market accounted for 5% or USD 32.4 trillion of total OTC derivatives outstanding in terms of notional amounts by June 2011. The notional value is, however, only part of the story with regard to the significance and risk involved in the CDS market. The notional value of a CDS is established at the time of contract creation when the market value of a CDS is zero. The value of a CDS is zero to both counterparties at inception because the present value of expected payments the protection buyer has to make is equal to the present value of expected payments obtained in case of a default and the market value varies subsequently with the market conditions over time. After inception, the market value of a CDS falls (increases) if default becomes less (more) likely or the expected recovery rate in case of a credit event increases (decreases) so that protection becomes less (more) valuable (Stulz 2010).

The gross market value of CDS contracts is, thus, a better indicator for the economic significance of CDSs because it better reflects the magnitude of risk embedded in the market. Figure 3 shows the evolution of market values of OTC derivatives from 2005 until 2011. The CDS market increased from USD 133 billion by the end of 2004 to USD 1.4 trillion in December 2011 in terms of gross market value and is now the third largest derivatives market. Thus, since 2004 market values of CDS contracts grew at a higher rate as compared to notional amounts outstanding, which is not surprising because default risk increased substantially for many reference entities with the start of the financial crisis in 2007 resulting in the repricing of credit risk.

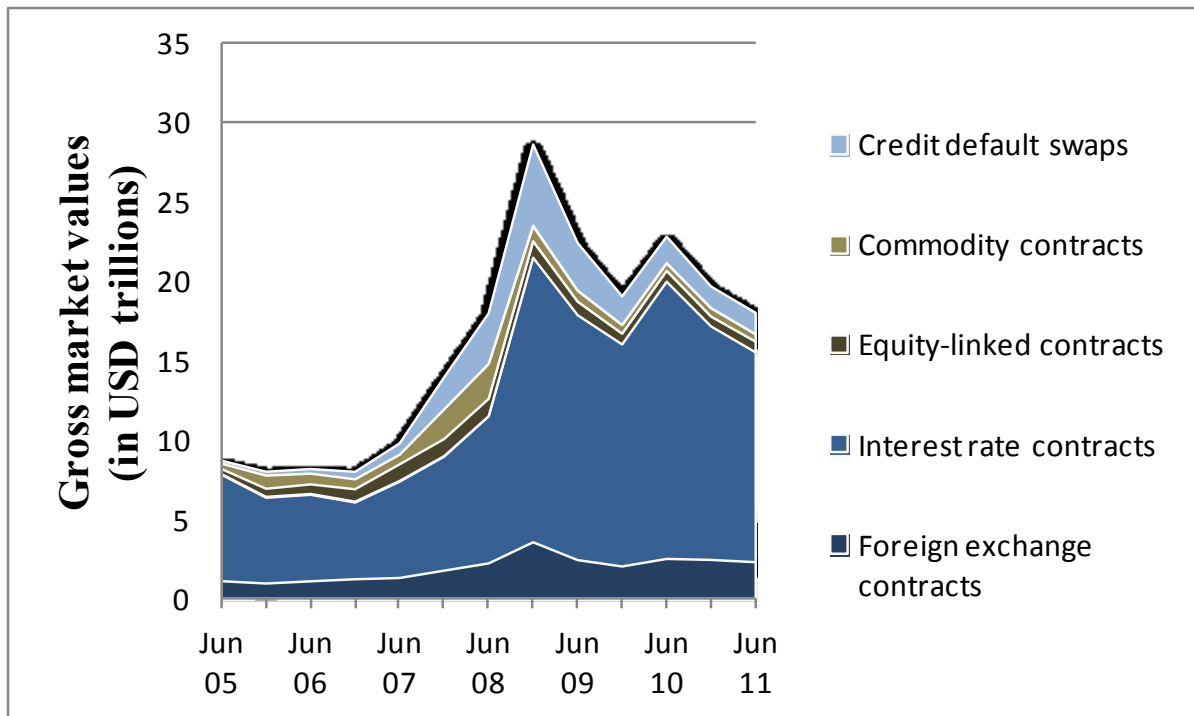


Figure 3: Gross Market Values for OTC Derivatives Market⁴

Over the last few years, the range of market participants has developed along with the growth of the credit derivatives market itself. Market participants include banks, hedge funds, pension funds, insurance and re-insurance companies, mutual funds and corporations. According to BBA (2006), banks were once the primary participants in the credit derivatives market and their activity accounted for 81% of protection buyer and 63% of protection seller positions in 2000. At this time, banks were mainly involved in managing and diversifying credit risk exposure of their overall loan portfolio, using credit derivatives as a hedging vehicle, which made them net protection buyers. Their market share has, however, constantly declined as the application of credit derivatives has broadened and other market participants such as hedge funds became active in the market. Moreover, banks have expanded their activity in the market by trading and structuring activities as well as assuming intermediary roles as market makers helping investors to diversify their portfolio and enhance yields. According to a survey by Fitch (2010), hedging/risk management, trading and market-maker/dealer are the top three activities of banks within the credit derivatives market. Figure 4 below shows the share of the different market participants since 2007 subdivided into protection buyer and protection seller position.

⁴ Source: BIS

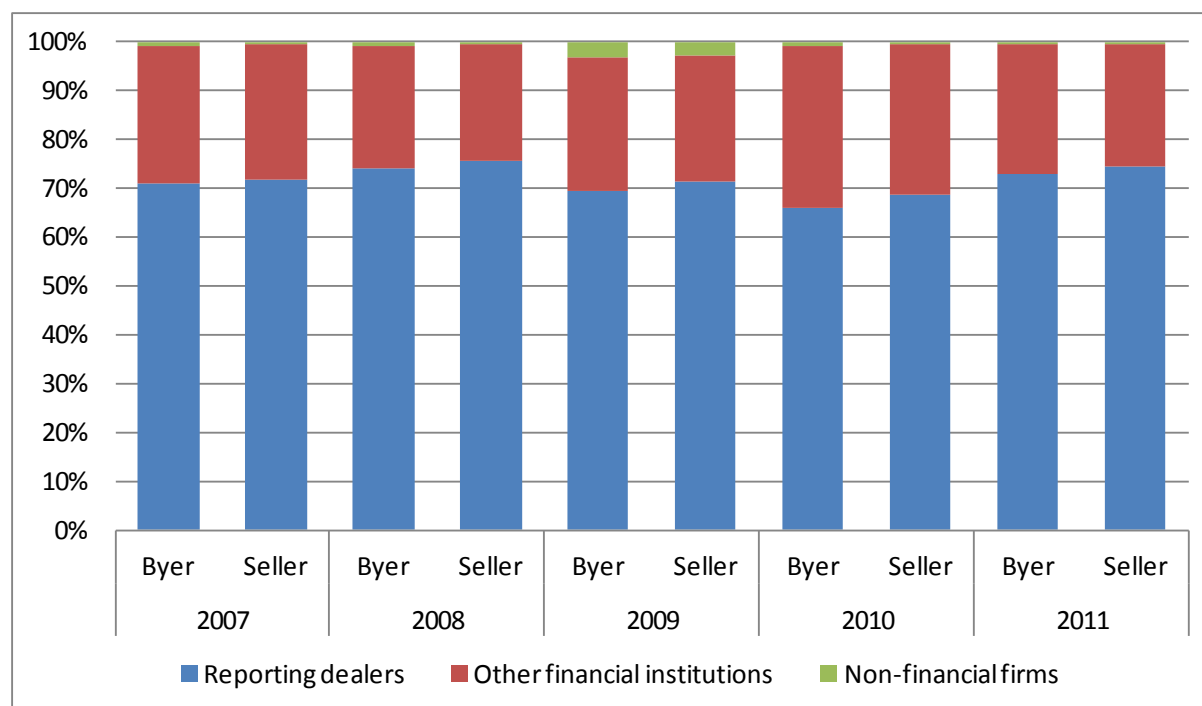


Figure 4: Market Share by Notional Amount Outstanding⁵

As shown in Figure 4, none of the market participant categories is either a major net protection buyer or seller. For every year, all categories have approximately netted out their positions.

In terms of reference entities, corporate reference entities account for the majority of reference entities traded. However, sovereign entities have experienced increased demand by market participants in recent years due to heightened market perception of sovereign failure risk caused by problems in countries of Western and Central Europe such as Greece, Ireland, Italy, Portugal and Spain. According to BIS (2010) the use of sovereign CDS in terms of notional amounts outstanding has almost doubled from 2006 (4.6%) to 2009 (8.9%).

With regard to the rating of reference entities, Figure 5 shows the development of investment-grade, below investment-grade and non-rated reference entities between 2006 and 2011. All three categories increased until the first half of 2007 –the outbreak of the credit crisis. The increase was supported by a credit environment of favorable default rate conditions and tight credit spreads raising investors' demand for higher yields by selling additional CDS. Since 2007, rating changes as a result of increasing default probabilities as well as heightened risk-aversion had a negative impact causing

⁵ Source: BIS. According to BIS, other financial institutions comprise smaller banks, hedge funds, insurance firms and SPVs.

a decrease in all three rating categories.

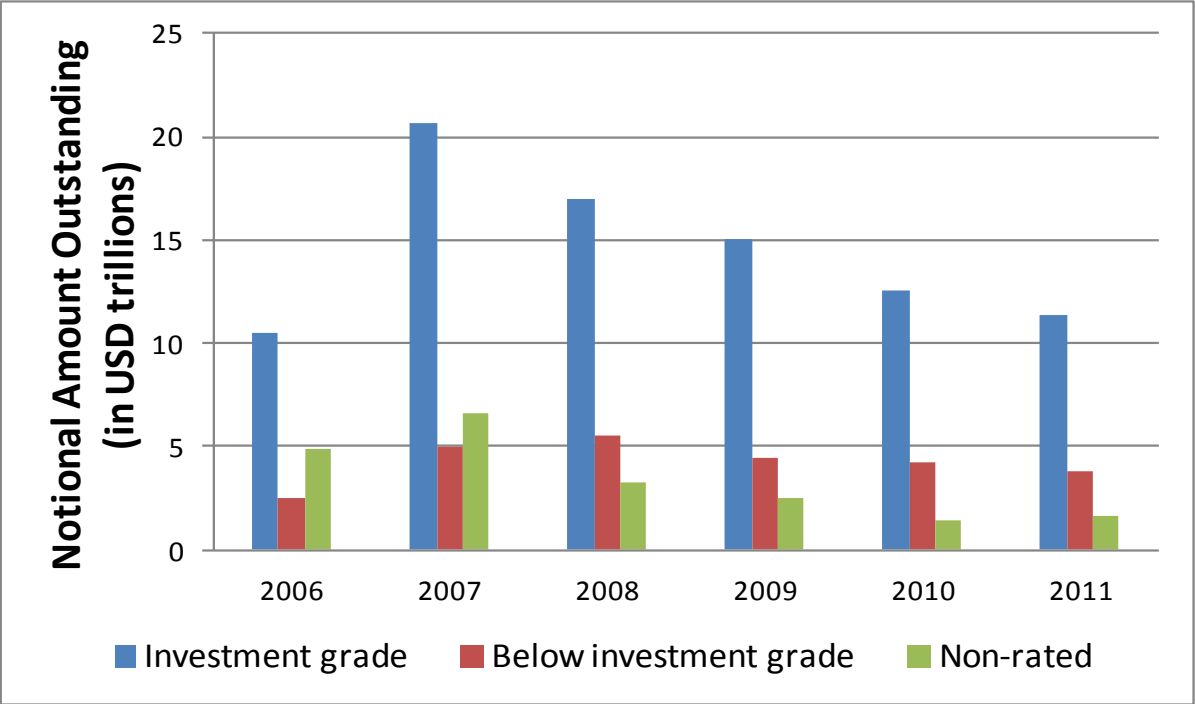


Figure 5: Market Share of Reference Entities classified by Rating⁶

⁶ Source: BIS

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I CREDIT RISK MODELS AND THEIR APPLICATION⁷

1 Introduction

Credit risk management is an essential part of the business of banks and other corporations that deal with a large number of credit counterparties and have large amounts of credit outstanding. Before credit risk can be managed, however, it first must be measured. Credit risk models form an integral part to measure credit risk and play an increasingly important role in the management of credit risk.

In the past years, many sophisticated credit risk models have been developed. The rapid progress in this area is due to the increased importance regarding the management of credit risk as well as the result of the growth of innovative financial products such as credit derivatives and other structured products with payoffs tied to credit-related events. Factors such as regulatory concerns, the availability of empirical data on default as well as rating changes have also heightened the attention to credit risk models.

The world of credit risk models is basically divided into two main approaches, the so-called structural or firm value approach and the reduced-form approach. The two approaches have in common that both assume that a borrower i is at every point of time t at a distance D_{it} from default. The distance to default (D_{it}) follows a stochastic process with volatility V_{it} . Default probability is, therefore, the probability that the value of D_{it} becomes zero at any point in the time interval $[t, t+n]$. The main difference between structural and reduced-form models lies in the definition of the distance to default (D_{it}) as well as the assumptions concerning the nature of the underlying stochastic process (Carey and Hrycay 2001). Structural models usually trace their roots back to the seminal papers of Black and Scholes (1973) as well as Merton (1974) whereas reduced-form models refer to the seminal work of Jarrow and Turnbull (1995).

A third class of models mentioned in the literature are the so-called empirical

⁷ Theis, Christoph. "Credit Risk Models and Their Application." In *Asset Management*, by Roman Frick, Pascal Gantenbein and Peter Reichling, 476-491. Bern: Haupt Verlag, 2012.

models of default or credit scoring models. Probably the best known models based on this approach are the Z-score model developed by Altman (1968) and its successor, the ZETA model (Altman et al. 1977), which use a number of variables to produce a credit score that provides information about the credit quality of a firm or liability. However, empirical models do not produce default probabilities that can be directly used for modeling credit risk and are, therefore, excluded from the analysis in this paper.

2 The Structural Approach and the Merton Model

All structural models share the common approach of replicating the firm and its economic structure whereas the distance to default (D_{it}) is defined as the difference between the market value of the firm's assets and a certain default value. Thus, the basic idea is that a company defaults if the firm's asset value falls below the pre-defined default value. The stochastic process of D_{it} is determined by a diffusion process of the firm's asset value, while liabilities are considered to be constant over the short term horizon (Henn 2001). Due to the characteristics of the structural model, the stochastic process of D_{it} is observable and it is, thus, possible for investors to predict the company's likelihood to default (given the necessary inputs required by the model) (Chacko et al. 2006, 65).

In order to understand the structural approach I will focus on the pioneering work of Black and Scholes (1973) as well as Merton (1974) and I will address some of the important extensions thereafter. The Merton model⁸ uses the market value identity which states that the market value of the firm's assets is equal to the market value of equity and liabilities:

$$A(t) = E(t) + D(t, T) \quad (1)$$

where $A(t)$ stands for the market value of the firm's assets, $E(t)$ for the market value of equity and $D(t, T)$ for the market value of the firm's liabilities becoming due at time T . The basic idea of the Merton model is that default occurs in the event the firm's debt with face value K , becomes due at time T , *and* the value of the firm's assets falls below K :

$$A(T) < K \quad (2)$$

⁸ Some authors also refer to the Merton model as the Black-Scholes-Merton model in order to give credit to the work of Fischer Black and Myron Scholes. However, I will use the term Merton model hereafter.

Thus, the firm does not default as long as the value of the firm, A , remains above K at time T , in which case the creditors receive the face value of the liabilities, K , and the shareholders keep the residual $A(T) - K$. However, in case A falls below K at time T , the firm defaults, the firm is taken over by the creditors, which receive the remaining firm value $A(T)$, and the shareholders receive nothing. Hence, depending on the firm value at time T , the bondholders either receive K or $A(T)$, whichever is lower and the shareholders either receive $A(T) - K$ or nothing (Bomfim 2005, 172).

Table 2: Payoffs to Claim Holders Depending on the Firm's Asset Value

	Shareholders	Debtholders
$A(T) > K$	$A(T) - K$	K
$A(T) < K$	0	$A(T)$

Table 2 summarizes the payoffs to the share- and bondholders depending on the asset value of the company at time T . Thus, the payoffs for the shareholders can be written as:

$$E(T) = \text{Max}(A(T) - K, 0) \quad (3)$$

and for the bondholders as:

$$D(T) = K - \text{Max}(K - A(T), 0) \quad (4)$$

Equations (3) and (4) illustrate the key insights of the Merton model, because the given payoff structure allows applying an option-theoretic approach in order to value defaultable bonds and equity (Bomfim 2005, 174).

When relating equations (3) and (4) to an option pricing approach, there are two possible interpretations depending on the assumption *to whom the firm belongs*. The original Merton Model (1974) assumes that the firm belongs to the bondholders and the equity holders own a European call option on the firm's assets. Thus, the stockholders "optionally" own the firm, but if at maturity (T) of the firm's debt, the firm value falls short of the debt's face value (K), they will not exercise their option to "buy" the firm (Caouette et al. 1998). This interpretation is equivalent to equation (3), which is the payoff at maturity for being long a call option. If it is assumed that the firm belongs to the bondholders and the shareholders are long a call option, then the bondholders must be long the firm's assets and short a call option on the assets of the firm. This interpretation of the payoff structure for equity- and bondholders can be illustrated as follows (Chacko et al. 2006, 82):

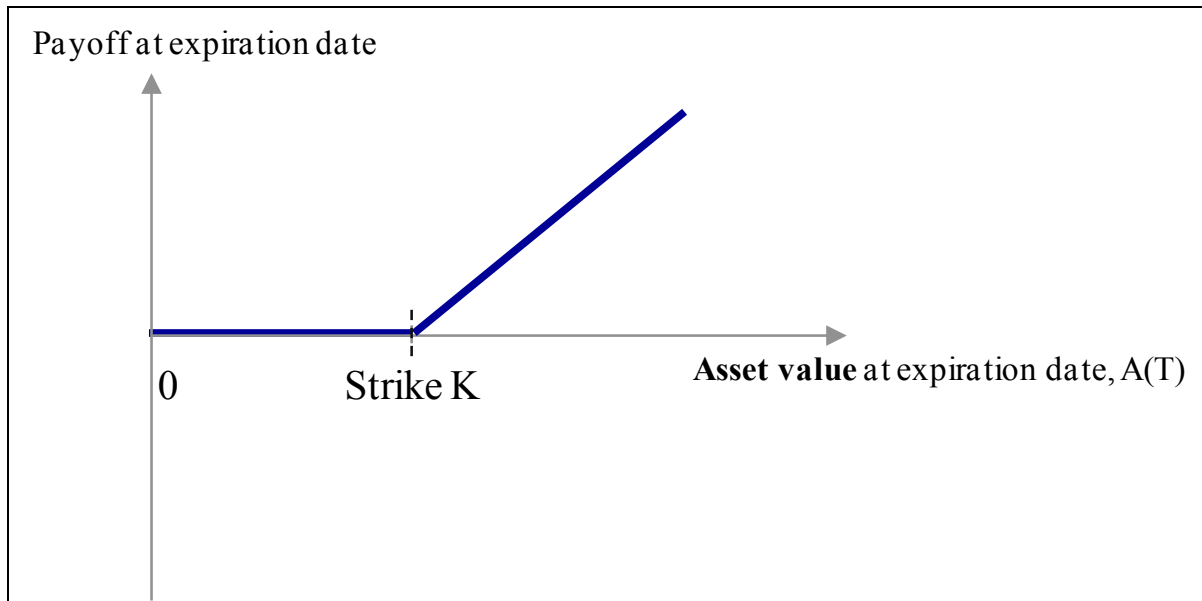


Figure 6: Payoff to Equity Holders

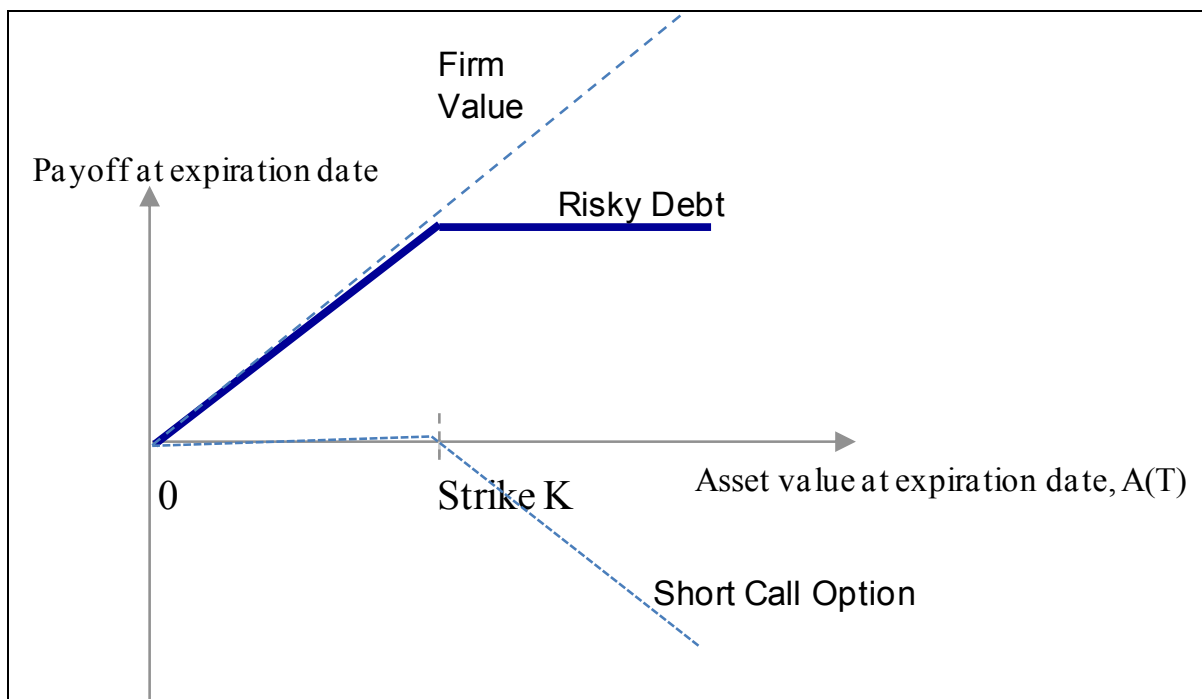


Figure 7: Payoff to Bondholders

If it is, however, assumed that the firm's assets are owned by the equity holders, then the equity holders are long the firm's assets, finance them by borrowing K from the bondholders, and are long a put option with strike price K that enables them to pay back the debt by transferring the assets to the bondholders in case the firm value falls short of K . Regarding the bondholders, the payoff structure of risky debt is interpreted as being long a risk-free zero-coupon bond with a face value of K and being short a put option written on the firm's assets, with a strike price equal to the debt's face

value, K (as illustrated in Figure 8). This interpretation is equivalent to the payoff structure in equation (4). Thus, the bondholders will be repaid in full only if the firm value exceeds the face value of the liabilities at maturity, implying that the put option is out-of-the-money and expiring worthless. If, however, the firm value falls short of the debt's face value, the firm defaults and the equity holders will exercise the in-the-money put option (written by the bondholders). By exercising the put option, the stockholders will deliver the firm's assets (A) to the bondholders for strike price K , which enables the stockholders to pay back the debt (Caouette et al. 1998, 143).

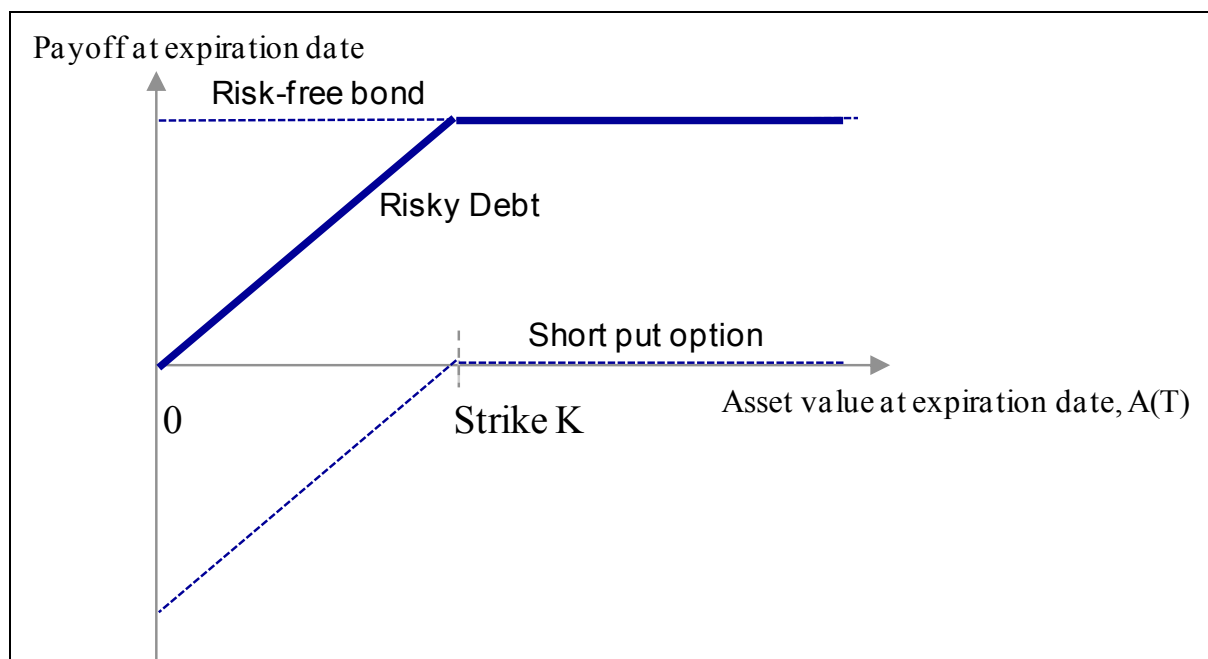


Figure 8: Payoff to Bondholders

As Figure 8 illustrates, the payoff structure for risky debt is the same as the payoff in Figure 7, concluding that the assumption whether the firm belongs to the bond- or equity-holders leads to the same economic payoff structure for risky debt. The equivalence of the two economic interpretations can also be seen when applying the Put-Call Parity, $C - P = A - K$, where C is the price of a European call option, P is the price of a European put, A is the price of the firm's asset value (the underlying) and K is the face value of a risk-free bond which is also equal to the strike price of the call- and put-option. Solving for C in the Put-Call Parity leads to:

$$C = A - K + P, \quad (5)$$

showing that the two different interpretations for equity are equivalent. Regarding the interpretation for risky debt, the first interpretation led to the result that risky debt is

equal to being long the firm's assets and short a call option on the firm's assets with strike price K . Hence, $D = A - C$, which is equivalent to $D = K - P$ when plugging in equation (5) for C , which in turn is the result of the second interpretation for risky debt, showing that the two interpretations lead to equivalent results.

Thus far, I have shown the link between the Merton model and option pricing, which is the key insight of the Merton model. This connection allows us now to derive a price for risky debt by applying any option pricing model. Merton (1974) originally applied the first ever created option pricing framework by Black and Scholes (1973) in order to value risky debt.

Another core assumption in the Merton model as well as in all other structural models, besides applying a specific option pricing framework, is the process describing the value of the firm. Merton (1974) uses a diffusion-type stochastic process to model the dynamics of the firm value (A):

$$dA = (\alpha A - C)dt + \sigma A dz \quad (6)$$

where α is the expected rate of return on the firm per unit of time, C is the total dollar payout by the firm per time unit (e.g. dividends or interest payments), σ is the standard deviation of the return on the firm per unit time and dz is a standard Gauss-Wiener process.

When applying the Merton model in a Black-Scholes world, the price of a put option, p , is given by:

$$p = Ke^{-r(T-t)}N(-d_2) - A(t)N(-d_1) \quad (7)$$

with

$$d_1 = \frac{\ln(A(t)/K) + (r + \sigma_A^2 / 2)(T - t)}{\sigma_A \sqrt{T - t}} \quad (8)$$

and

$$d_2 = d_1 - \sigma_A \sqrt{T - t} \quad (9)$$

where A is the firm's asset value, K is the face value of debt, T the time to maturity, σ_A is the asset price volatility, r is the risk-free interest rate and $N(\cdot)$ is the cumulative standard normal distribution.

Recall that the price of a risky bond (B) is composed of being long a risk-free zero-coupon bond with face value K and being short a put option on the firm's assets with strike price K . Hence:

$$B = PV(K) - p \quad (10)$$

which gives us the price of a risky bond in the Merton model.

Extensions and Empirical Validation of the Merton Model

The original Merton model (1974), even though known for its simplicity and intuitive appeal, uses several restrictive assumptions:

- The borrower's liabilities consist of only one single homogenous class of debt that pays no coupon
- The term structure of riskless interest rates is flat and known with certainty
- Default can only occur at maturity
- Default is only triggered if at maturity the firm's asset value falls short of the face value of debt. Thus, defaults due to liquidity problems are not possible
- Volatility of the firm's assets is constant over time
- The firm follows a continuous path with no jumps
- Perfect markets exist which are complete, efficient and frictionless (including no transaction costs, taxes or indivisibility of assets)

Several authors have modified the Merton model in order to relax some of its restrictive assumptions:

Black and Cox (1976) introduced the first extension of the Merton model. They allow for the occurrence of default prior to maturity of the debt (a so-called first-passage model) and default can occur as soon as the firm's asset value falls short of a certain threshold, which does not have to be the debt value. These extensions enable the inclusion of safety covenants and subordinated bonds into the model.

Geske (1977) modified the model by including coupon bonds. Ramaswamy and Sundaresan (1986) as well as Kim et al. (1993) allow for default not only at maturity but also on coupon payment dates and use the model by Cox, Ingersoll and Ross (1985) in order to include stochastic instead of constant interest rates.

Longstaff and Schwartz (1995) introduce another first passage model that allows default to be triggered at anytime. Further, they include time varying interest rates that follow a stochastic, mean-reverting process and they allow for fixed as well as floating rate debt.

Zhou (1997) models the dynamics of firm value as a jump-diffusion process that has two components: a continuous component that is similar to Merton's (1974) diffusion-type stochastic process and in addition a discontinuous jump component, which allows the firm value to change unpredictably and by a considerable size.

Empirical evidence on structural models has focused on both the shape of the term structure of credit risk spreads and its general level. So far empirical tests show mixed evidence. Regarding the level of credit spreads, for instance Jones, Mason and Rosenfeld (1984) as well as Ramaswamy and Sundaresan (1986) found that the Merton model cannot fully explain observed default premia and that the model tends to overprice corporate bonds. In contrast, Titman and Torous (1989) find a good empirical fit for the Merton model explaining the level of credit risk spreads for commercial mortgages and Longstaff and Schwartz (1995) show evidence that their model does a good job explaining the observed credit risk spreads in the US market (Bomfim 2005, 181).

Regarding the term structure of credit spreads, for instance Sarig and Warga (1989) find good explanatory power for the shape of the term structure when applying the Merton model, whereas Helwege and Turner (1999) do not find empirical support.

3 The Reduced-form Approach and the Jarrow/Turnbull Model

As illustrated in the previous section, the structural approach tries to specify at what credit spread corporate bonds should trade based on numerous input parameters of company specific information such as capital structure and value of the firm's assets. Thus, structural models require internal information about the balance sheet of the firm, which are at most four times per year available to the public. In addition, the firm's assets are often thinly traded or private, which makes it difficult to observe their value over time. This makes the estimation of the input parameters problematic, hence, structural models are hard to calibrate for external users. Moreover, the structural approach requires all liabilities senior to the corporate bond in question to be valued simultaneously, which makes it computationally burdensome (Jarrow and Turnbull 1995).

In contrast to structural models, the reduced-form approach or so-called default-intensity model, bypasses these model-calibration problems by dealing directly with

observable market data (Kao 2000). The reduced-form approach relies on market data instead of company-specific parameters and it does not model default as directly dependent on the firm value. Hence, it assumes that there is no direct relationship between firm value and default. Default is instead seen as fully unpredictable and the result of a sudden, inexplicable loss in the market value of the firm.⁹ Hence, the firm can default at any time with a certain probability. Instead of assuming a diffusion process for the firm value as in structural models, the reduced-form approach is based on a stochastic jump-process and default typically happens at the first jump of the stochastic process. In contrast to structural models where a firm never defaults by surprise and default is predictable to a certain amount, reduced-form models assume that default is unpredictable at any time, and, thus, the probability of default is greater than zero at any point in time. Hence, the reduced-form approach models the distance to default (D_{it}) as a stochastic process that is exogenously specified and can be seen as an external signal indicating when default has occurred. Therefore, it is worth noting that no economic modeling goes into the development of the exogenously given stochastic process with random intensity that determines default probabilities in reduced-form models (Chacko et al. 2006, 131).

The main discrepancy among the different reduced form models breaks down to different assumptions regarding the specification of the default process, the recovery rate and the default trigger as well as the process of the risk-free interest rate. Thus, the family of reduced-form models basically falls into three major branches: default-based, rating-transition and spread models.

The default-based approach relates the price of a defaultable bond to a default-free bond by applying an exchange rate that is dependent on the default and recovery rate. The default process is described by a jump diffusion process with jump intensity assumed to be either constant or time varying and the recovery rate is assumed to be either a fraction of face value or market value of a risk-free security at termination. Jarrow and Turnbull (1995) is the best known model falling into this category (Kao 2000).

The rating-transition approach developed by Jarrow et al. (1997) is mainly an extension of the default-based approach and the main difference lies in the assumption that default is treated as the result of credit migration rather than as a sudden, unexpected occurrence as in a jump diffusion process. The rating-transition approach

⁹ An exception to this assumption within the family of reduced-form models is the rating-transition model by Jarrow et al. (1997), which treats default as a result of credit migration rather than as a sudden occurrence.

assumes that credit spreads vary without default occurrence and that the payoff might depend on the credit rating or the occurrence of other credit events besides default.

The spread approach, first developed by Duffie and Singleton (1999), values a risky bond as if it were risk-free by replacing a conventional risk-free interest rate process with a default-adjusted yield process on a risky debt instrument: $R = r + q(1 - \phi)$, where R is the risk-adjusted discount rate, r is the risk-free interest rate, q is the default rate and ϕ is the recovery rate. Risk-free interest rate and default rate (and in some cases also the recovery rate) are assumed to be stochastic and to follow a standard Wiener process. Therefore, the pricing process is basically the sum of three stochastic processes (Kao 2000).

I will now focus on one of the most widely used models within the family of reduced-form models: The model by Jarrow and Turnbull (1995), which falls into the category of default-based approaches. It is known as the first model that uses the concept of default intensity where the term structure of default-free interest rates and the term structure for risky debt are assumed to follow a stochastic process that are exogenously specified.

Central to the model of Jarrow and Turnbull (1995) is the pricing function for defaultable zero-coupon bonds, which relates the price of a defaultable zero-coupon bond to the price of a risk-free zero-coupon bond by applying an exchange rate or conversion factor¹⁰:

$$v(t, T) = p_0(t, T)E_t(e(T)) \quad (11)$$

where $v(t, T)$ is the time t value of a defaultable zero-coupon bond with maturity T , $p_0(t, T)$ is the time t value of a risk-free zero-coupon bond with maturity T , $E_t(\cdot)$ is the time t conditional expected value (conditional on surviving to time t) and $e(T)$ is analogous to an exchange rate converting risk-free to defaultable values with maturity T .

Thus, the price of a defaultable zero-coupon bond is essentially its discounted expected payoff at time T , where the discount factor is the price of a risk-free zero-coupon bond, $p_0(t, T)$. Hence, in order to price a defaultable zero-coupon bond, one needs to specify the two input factors in equation (11), namely the default-free term structure that defines the value of the risk-free zero-coupon bond, $p_0(t, T)$, and the

¹⁰ Here, due to illustration purposes the model is presented in a discrete time setting, but it can be easily extended to a continuous-time setting as shown in Jarrow and Turnbull (1995).

term-structure of risky debt that defines the bankruptcy process that models the evolution of the exchange factor over time, $e(T)$, which results in a conditional expected value, $E_t(e(T))$ (Jarrow and Turnbull 1995).

Concerning the underlying assumptions of the model, Jarrow and Turnbull (1995) assume the risk-free interest rate process and the bankruptcy process to be independent. Further, it is assumed that no arbitrage opportunities exist and that markets are complete. With regard to $p_0(t, T)$, the price of a risk-free zero-coupon bond is assumed to depend only on the spot risk-free interest rate, which is assumed to follow a stochastic process.

The stochastic process is illustrated in Figure 9 for a two-period economy. The process is described by a binomial tree over the time periods 0, 1 and 2. The price of a risk-free zero coupon bond is the reciprocal of the risk-free interest rate. For instance, the current one period interest spot rate is defined by $r(0) = 1/p_0(0, 1)$. Further, $p_0(t, T)_u$ and $p_0(t, T)_d$ are the time t prices of a zero-coupon bond for the up- and down-state and $r(t)_u$ or $r(t)_d$, respectively are the spot interest rates at time t given an up- or down-state, whereas π_0 is the risk-neutral probability. It is worth noting that the current spot interest rate, $r(0)$, is known at time t and only the spot rate at $t+1$, $r(1)$, is not known with certainty at time t (Jarrow and Turnbull 1995).

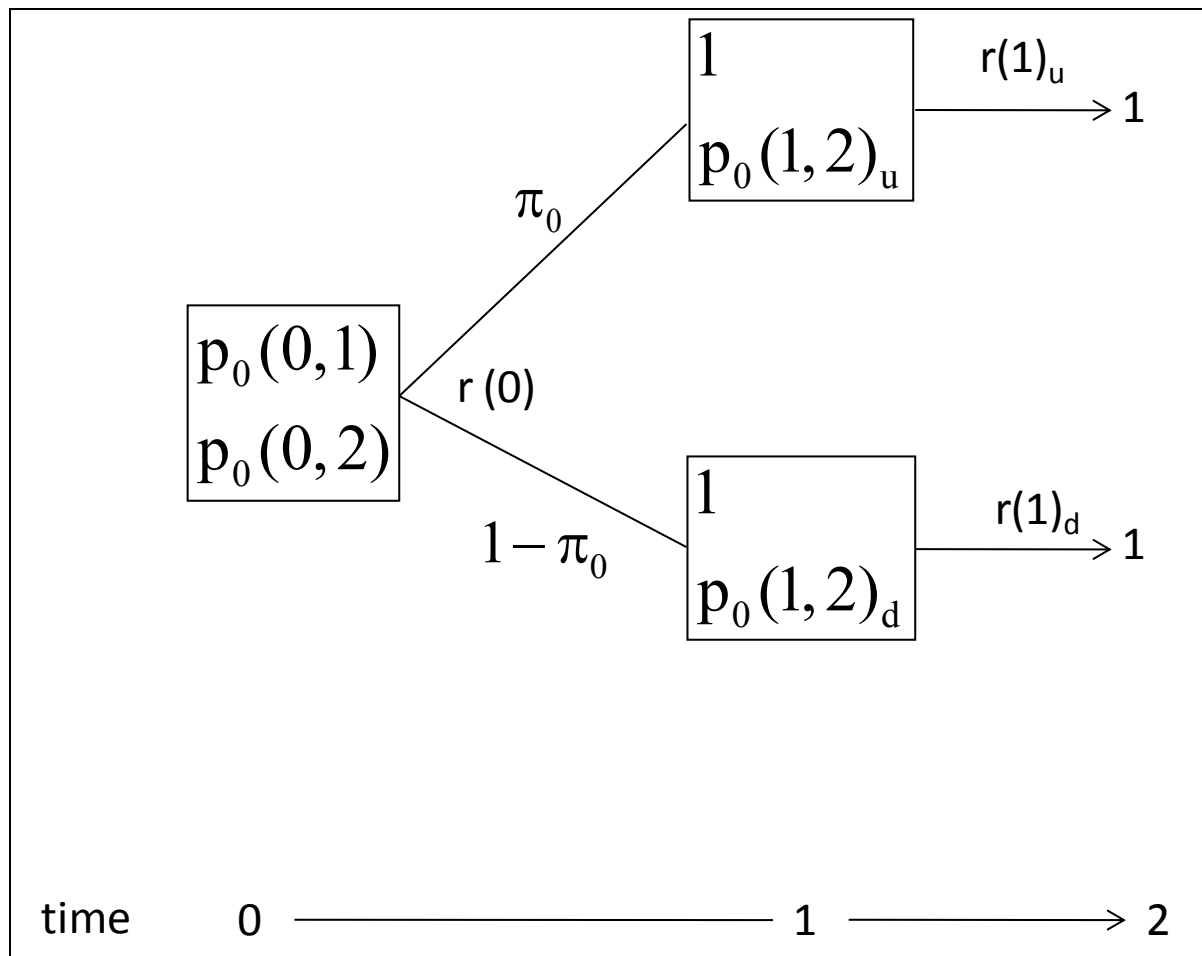


Figure 9: The Risk-Free Zero-Coupon Bond Price Process for a Two Period Economy¹¹

With regard to the second input factor in equation (11), the time t conditional expected value of the exchange rate, $E_t(e(T))$, the specification of the exchange rate process, which is equivalent to modeling the default process, is a crucial element in the Jarrow and Turnbull (1995) model. The exchange rate process consists of the following two factors: 1) the (risk-neutral) default probability and 2) the recovery rate once default has occurred.¹² The stochastic exchange rate process is illustrated in Figure 10 as a discrete-time binomial process for a two-period economy.¹³ With risk-neutral probability of $\lambda\mu$ default occurs and $(1 - \lambda\mu)$ is the probability that no default occurs, where λ is called the default intensity.¹⁴ The recovery rate in case of default, δ , is assumed to remain constant over time since Jarrow and Turnbull (1995) find it difficult

¹¹ Jarrow and Turnbull 1995.

¹² The current spot exchange rate, $e(t)$, can be thought of as the payoff ratio for a defaultable zero-coupon bond that is either 1 if no default occurs or less than 1 in case of default.

¹³ In the continuous-time setup Jarrow and Turnbull (1995) use a Poisson distribution to model default probability, which is approximated by the binomial tree in discrete-times.

¹⁴ In the continuous-time setting λ is the mean arrival rate or default intensity of a Poisson distribution.

to model the actual payoff in case of default due to several factors such as violation of the priority rules, relative bargaining power of the stakeholders and percentage of managerial ownership. Thus, δ is an exogenously given constant which is the payoff per unit of face value.

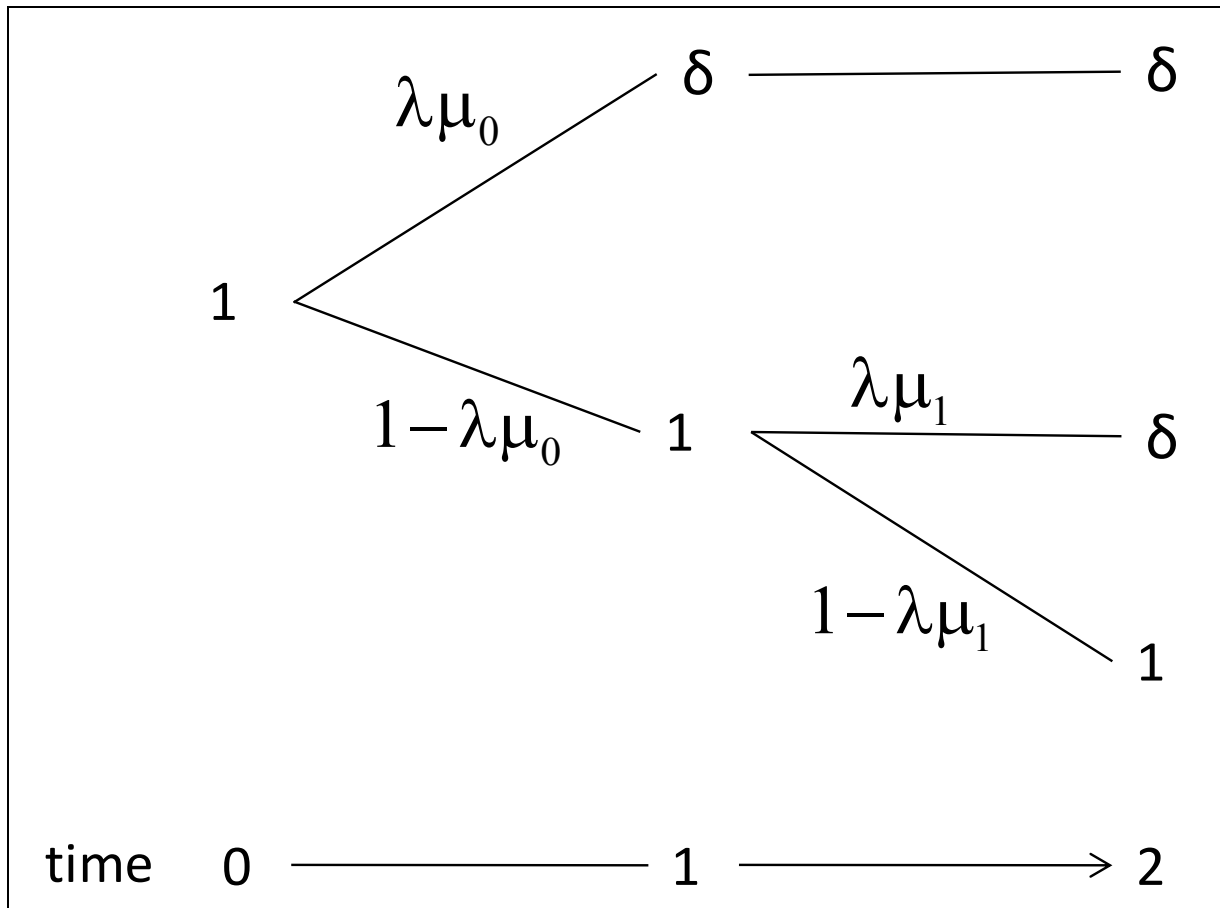


Figure 10: The Exchange Rate Process for Defaultable Zero-Coupon Bonds¹⁵

For the two-period economy, the conditional expected value at time $t=0$ is calculated as follows:

$$E_0(e(2)) = \lambda\mu_0\delta + (1-\lambda\mu_0)[\lambda\mu_1\delta + (1-\lambda\mu_1)] \quad (12)$$

Thus, the price of a defaultable zero-coupon bond, $v(0,2)$, is determined by discounting expression (12) by the price of a risk-free zero-coupon bond, $p_0(0,2)$.

For a continuous-time setup, Jarrow and Turnbull (1995) derived the following expression to value a defaultable-zero-coupon bond:

¹⁵ Jarrow and Turnbull 1995.

$$\begin{aligned}
v(t, T) &= \left(e^{-\lambda\mu(T-t)} + (1 - e^{-\lambda\mu(T-t)})\delta \right) p_0(t, T) & \text{if } t < \tau^* \\
&= \delta p_0(t, T) & \text{if } t \geq \tau^*
\end{aligned} \tag{13}$$

where the default process is assumed to follow a Poisson distribution with λ as the default intensity, which is assumed to be constant over time and $\lambda\mu$ is the risk-neutral default probability. The time of default of the bond is defined as τ^* .

Since Jarrow and Turnbull (1995) assume the risk-free term structure, the term structure of defaultable debt as well as the recovery rate as exogenously specified, equation (13) can be solved. These assumptions require, however, that a sufficient number of bonds with the same risk characteristics and default probabilities but different maturities are traded in order to extract these information from the market.

Empirical Validation of the Reduced-Form Approach

Madan and Unal (1999) applied the reduced-form approach to certificates of deposit and found that the model's estimated spreads are too low when the company is far from default and too high when it is close to default. Duffee (1999) examined individual bonds and found that the model fits market prices well but has difficulties at the same time in simultaneously explaining the level and slope of the credit curve for investment-grade bonds. Monkkonen (1998) performed a study that compared six different variations of the default-based approach. Empirical tests of the six models show similar results for short-maturity bonds but dissimilar results for long-maturity bonds. In particular, the model by Jarrow and Turnbull (1995) did well on the basis of one-step-forward predictive errors (Kao 2000).

4 Conclusion

The determination of whether the structural or reduced-form approach is the appropriate model to use is not a clear-cut decision because the applicability of the specific model also depends to a large extent on the situation at hand.

The structural approach models explicitly the firm's fundamentals and, thus, relies on company specific information, which is advantageous if one tries for instance to assess how a change in the capital structure of a given firm might affect its financing costs. However, taking the structural model to the data is not an easy task since a firm's liabilities do not solely consist of zero-coupon bonds and balance sheet

information are at most on a quarterly basis available to the public and can sometimes be noisy indicators of the true state of the firm. Furthermore, the value of the firm, which plays a central role in the structural approach, is difficult to observe in practice for privately held companies or companies that are thinly traded. These data challenges make the estimation of the input parameters problematic and, therefore, structural models are hard to calibrate for external users (Bomfim 2005, 178).

Regarding the reduced-form approach, most critics argue that the reliance on traded debt and market prices is a critical limitation to the model since this makes it difficult to apply to private debt. Furthermore, the reduced-form approach only uses aggregated market data, ignoring company-specific risk.

To conclude, before deciding which model is given preference, the advantages and drawbacks of each approach have to be analyzed in the context in which the model is applied. Jarrow and Protter (2004) argue that the key distinction between the two different approaches is in terms of the assumed information set known by the modeler. Thus, structural models should be applied if the modeler has the same information set as the firm's manager, i.e. complete knowledge of all the firm's assets and liabilities, whereas reduced-form models assume that the modeler has the same information set as the market, i.e. incomplete knowledge of the firm's condition. Hence, when investors price credit instruments that are traded in the market, the information set observed by the market is the relevant one and preference should be given to reduced-form models.

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II ARE CREDIT DEFAULT SWAPS ‘FINANCIAL WEAPONS OF MASS DESTRUCTION’?

LINKING THEORETICAL CONCEPTS AND EMPIRICAL FINDINGS

1 Introduction

Credit derivatives are one of the most significant financial innovations of the last decade and have experienced tremendous growth rates, with the credit derivatives market becoming one of the largest and most complex derivatives markets to date. Among credit derivatives, the credit default swap (CDS) is the most popular instrument for trading credit risk. As of June 2011, according to the Bank for International Settlements (BIS), the CDS market is the third-largest derivatives market in terms of gross market value, accounting for USD 1.3 trillion.

A CDS consists of a contract between two parties whereby the protection buyer of the CDS pays a predetermined fixed periodic premium to the seller until the end of the life of the CDS or until a predefined credit event occurs. When a credit event occurs, the protection buyer of the CDS has the right to sell the underlying asset for its face value to the protection seller of the CDS, and the seller of the CDS has the obligation to buy the underlying asset for its face value. If no credit event occurs before the maturity of the CDS contract, the protection seller pays nothing. These two cash flow streams of a CDS contract are typically named the fixed leg (the fixed CDS spread paid by the protection buyer) and the contingent or default leg (the payment contingent on the occurrence of a credit event) according to the nature of the payment streams.

Despite their great success in the past, credit derivatives and, in particular, credit default swaps, went to rack and ruin in public and have been blamed by critics for being a driver of the current financial crisis. For instance, a Reuter’s report about CDSs in 2008, headlined “Buffett’s time bomb goes off on Wall Street”, blames CDSs for the failures of Lehman Brothers, Bear Stearns and AIG, referring to Berkshire Hathaway’s annual report of 2002, where Warren Buffet describes derivatives as

“financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal”.

As opposed to the foreign exchange or interest rate derivatives market, the CDS market is still relatively young. The literature has mainly focused on analyzing specific aspects of the CDS market, but to my knowledge, relatively little has been done to provide a comprehensive overview of the costs and benefits of the CDS market for the financial system and to weigh them against one another. Stulz (2010) for instance examines the impact of CDSs on the credit crisis and the role of counterparty risk in the CDS market. Kiff et al. (2009) analyze the systemic risk inherent in the CDS market and the impact on future regulations and Anderson (2010) provides a brief overview of the costs and benefits from a theoretical perspective considering different forms of CDSs, such as corporate CDSs, sovereign CDSs and index CDSs.

Relative to these papers, the main contribution of this paper is to provide a comprehensive overview of the major benefit and cost factors of the CDS market, connecting theoretical findings with an assessment of empirical evidences. So far, no research has been found that surveyed and linked the existent theoretical and empirical literature on the CDS market to the extent that this study does. This paper furthermore will discuss the implications for appropriate policy recommendations and review and evaluate proposed initiatives by the regulatory bodies.

The paper, thus, offers crucial insights for both policy makers and market participants. In addition, it provides regulators with an understanding of the issues in the CDS market that must be addressed from a theoretical as well as empirical perspective and discusses the implications for regulatory initiatives. Furthermore, market participants gain a better understanding of the benefits and risks inherent in the CDS market and the characteristics of the intended policy initiatives.

The remainder of this paper proceeds as follows. Sections 2 and 3 examine the theorized and empirically evidenced benefits and costs of CDSs, respectively. Section 4 discusses the policy implications resulting from the preceding cost-benefit analysis and evaluates proposed initiatives. Section 5 concludes.

2 The Benefits of Credit Default Swaps

The tremendous growth of the CDS market over the last decade did not emerge accidentally; CDSs were welcomed by policy makers due to their assumed benefits for the credit markets, which I will outline in the following.

2.1 The Standardization Benefit

As is common to all derivatives traded in over-the counter (OTC) markets, the implementation of certain market standards is an important step toward investors’ acceptance and market growth. Gale (1992) highlights the gains of standard securities with which investors are already familiar because investors can avoid the informational costs of learning about the design of new securities.

The definitions in CDS contracts are currently streamlined by the International Swap and Derivatives Association (ISDA), which developed the 2003 ISDA Credit Derivatives Definitions. These definitions were amended by the Big Bang Protocol and the Small Bang Protocol, which took effect in 2009. One important amendment, created in response to growing concern about the appropriate determination of a credit event, is the establishment of a central decision-making body in the marketplace, the so-called Determination Committee, which is responsible for determining whether a credit event has occurred, the settlement procedure and the type of deliverable obligations (Chaplin 2010). Another important standardization improving the operational robustness of the CDS market was the introduction of the cash settlement method as the standard settlement procedure. The reason for the popularity of cash settlement is that the CDS market has grown tremendously in the past and that the outstanding notional amount in CDS contracts is for some reference entities as much as ten times the amount of bonds actually available to settle trades in case of a credit event. Therefore, physical settlement may provoke a so-called short squeeze for the protection buyer in these cases, as the bond prices would be bid up by protection buyers who must deliver into their CDS contracts (Mengle 2007).¹⁶ However, as I will

¹⁶ A well-known example of a short squeeze in the CDS market is the bankruptcy of Delphi Corp., where the notional amount of credit derivatives referencing Delphi exceeded by far the notional amount of Delphi’s bonds and loans outstanding, resulting in a short squeeze of naked protection buyers, leading to an increase in the price of Delphi’s outstanding bonds after the bankruptcy announcement.

discuss later, there are some technical issues with regard to the cash settlement method that may lead to operational instability when a credit event occurs.

Because CDSs are triggered by a predefined and fairly unlikely event rather than a readily available price or rate move, as in the case of most other derivatives, a sound legal documentation is of the utmost importance for such transactions. The evolution of standard legal documentation has been a major development in the credit derivatives market and has helped to reduce legal risk to a previously entirely bilateral process. This development has contributed to the acceptance of a wide range of investors, leading to an increased number of market dealers who are willing to provide important market liquidity, resulting in the rapid growth of the credit derivatives market over the last decade (Bomfim 2005). However, standardization has the downside that buying protection through a standardized CDS may be an imperfect hedge for the specific risk to which the investor is exposed. For instance, the investor may want to offset some of the risk of a non-deliverable bond or the risk of a long position in shares of the reference entity. In such cases, the investor may lose money in case of default of the reference entity due to an imperfect hedge. However, the investor could still find the imperfect hedge attractive due to the cost-effective way provided by the standardization in terms of increased liquidity and competition among market dealers, both of which contribute to making CDS markets relatively cheap compared to customized or so-called bespoke CDS contracts (Anderson 2010).¹⁷

2.2 The Hedging and Diversification Benefit

Originally, CDSs arose in response to demand by banks to hedge and diversify their credit risk on the balance sheet, as a CDS allows a bank to hedge part of its credit exposure by buying credit protection. Before the creation of CDSs, banks' credit risk management was less flexible, making it more difficult and costly to manage outstanding loans to a specific client. Imagine, for example, that the CFO of Daimler asks to take out a new loan from Deutsche Bank, which already has lent Daimler several billion euros. If Deutsche Bank is not comfortable with granting the full amount and wishes to reduce its credit exposure to Daimler or to the entire automobile industry, it could syndicate the loan. However, syndication has the drawback of being relatively costly, as it requires managing a group of banks as well as sharing profits

¹⁷ Bespoke CDS contracts are tailored to the specific needs of an investor. Bespoke contracts are typically illiquid, which makes them difficult to value and which requires pricing to be based on a theoretical financial model.

from the lending relationship. As an alternative, Deutsche Bank could offload some of its credit exposure to Daimler through the purchase of a CDS contract written on Daimler, providing a means of actively managing credit exposure to a specific company or an industry sector. Consequently, Deutsche Bank does not have to give up a profitable lending relationship and can continue lending to a company to which it has already lent large amounts by hedging some of its credit exposure through the purchase of a CDS contract. A CDS, thus, provides a useful tool to separate credit risk, which makes it no longer necessary that the investor providing the funding has to bear the credit risk.

In addition to managing the credit exposure of outstanding loans, it should be noted that CDSs also allow banks to lay off excess credit risk resulting from counterparty credit risk in bilaterally traded OTC contracts, such as interest rate and foreign exchange derivatives. Furthermore, CDSs allow banks to diversify their credit exposure across industries more efficiently by selling protection in the CDS market, which is equivalent to buying credit risk. Through CDSs, a bank can, therefore, easily manage its credit exposure to certain industry sectors without having to grant or sell loans. Thus, CDSs have facilitated banks’ credit risk management by increasing the available tool set for managing credit risk.

Banks’ ability to hedge part of their credit exposure and to separate credit risk when making an investment helped credit markets to become more complete. In theory, the tradability of credit risk should allow financial institutions to transfer credit risk to investors who are better equipped to bear it and would result in a more efficient allocation on an aggregate level. Therefore, if risk is spread more broadly, shocks should be better absorbable, which in turn makes the financial system more resilient. Alan Greenspan (2003) makes this point by arguing that “risk is more widely dispersed, both within the banking system and among other types of intermediaries and institutional investors. Even the largest corporate defaults in history (WorldCom and Enron) and the largest sovereign default in history (Argentina) have not significantly impaired the capital of any major financial intermediary.” However, this spreading of risk must not always be the case, as I will discuss later.

Following the argument above, the fact that CDSs permit banks to manage their credit risk more efficiently and facilitate the separation of funding from credit risk exposure gives rise to the assumption that companies can receive not only more credit from banks – but at better terms – than without the use of CDSs. The current US treasury secretary, Tim Geithner (2007), made the following point: “The rapid growth in these new types of credit instruments is, of course, a sign of their value to market

participants. For borrowers, credit market innovation offers the prospect of increased credit supply; better pricing; and a relaxation of financial constraints. (...) And for lenders, innovations can help free up funding and capital for other uses; they can help improve credit risk and asset/liability management; and they can improve the return on capital and provide new and cheaper funding sources.” Partnoy and Skeel (2006) take the same line by drawing an analogy to the securitization of mortgages, arguing that the possibility of selling a mortgage through securitization in the secondary market after the bank has granted the mortgage reduces the risk on the banks’ balance sheet, encouraging banks to make more mortgages and, thus, improving liquidity as well as the terms of financing.

However, the empirical evidence concerning the effects of credit derivatives on credit supply is ambiguous. Consistent with the argument that the use of credit derivatives improves financing terms, Shim and Zhu (2010) find that CDS trading has had a positive impact under normal credit market conditions on the cost of borrowing as well as on the trading liquidity of new bond issuances in Asia. In particular, smaller and non-financial firms as well as firms with a higher liquidity in the CDS market benefit from a positive effect on the cost of debt and liquidity of bond issuances in the primary market. However, for the United States, Ashcraft and Santos (2009) do not find any evidence that CDS trading affects the cost of corporate debt for the average borrower, although they do find a small positive impact on the cost of corporate debt for relatively safe and transparent companies after their CDSs start to trade. The authors also report, in contrast to conventional wisdom, that relatively risky and informationally opaque firms, which are expected to benefit the most, have in fact been negatively affected at the onset of CDS trading, exhibiting an increased cost of corporate debt. In addition, they show that firms with liquid CDSs benefit from a significant economic reduction in the cost of corporate debt. Hirtle (2009) finds evidence, using a sample of commercial and industrial loans made by US banks between 1997 and 2006, that banks increase their credit supply when using additional credit protection through credit derivatives. However, the positive impact of credit derivatives is relatively narrow, mainly accruing to large corporate borrowers, which are likely to be a “named credit” in credit derivatives transactions, rather than to the entire business sector. Further, the results show a significant positive impact of credit derivatives on the terms of lending –longer loan maturity and lower spreads– rather than on loan volume. Taken together, even though some of the empirical findings are ambiguous, firms with high liquidity in the CDS market as well as large, relatively safe and transparent companies benefit the most in terms of lending conditions from

the CDS market. An increase in loan volume due to the onset of CDS trading cannot be confirmed for the average borrower according to extant empirical studies.

2.3 The Information Benefit

Before the introduction of credit default swaps, the most widely followed approaches to measuring the credit risk of a corporate entity have been based either on credit ratings provided by the rating-agencies or on credit spreads, measured as the observed bond yield minus the risk-free rate. With regard to credit ratings, Partnoy (1999) notes that despite their importance to the financial markets, credit ratings are flawed and do not provide any valuable information, as rating agencies have become merely after-the-fact provider of information, which are not seen as a source providing efficient information on credit risk. This finding is confirmed by Hull et al. (2004) and Norden and Weber (2009), who find evidence that the CDS market incorporates new information about credit risk before rating announcements, particularly negative rating announcements. Alternatively, the credit spread is often referred to as a proxy for the measurement of credit risk. However, even though credit spreads are more reliable and accurate than credit ratings, they are not a pure measure of credit risk. For instance, by separating the credit spread into a default and non-default component Longstaff et al. (2005) show evidence that default risk accounts for the major part of the total credit spread, but the non-default component is significant and strongly related to bond-specific illiquidity. In addition, the non-default component is time varying and mean reverting. Therefore, the variation of other important non-default components may distort the credit spread as an accurate measure for credit risk. Another disadvantage of credit spreads is that they require an assumption about an appropriate benchmark riskless yield curve to measure the credit spread of a corporate bond and, hence, the added noise arising from a misspecified model of the riskless yield curve can be avoided when using the CDS premia as a measure for credit risk, as they are already quoted as spreads.¹⁸

Moreover, advocates of the CDS market argue that the absence of short sale and funding restrictions helps to make the CDS market more liquid as opposed to the cash bond market, where short-selling large quantities of bonds can be difficult due to illiquidity in the bond market. Therefore, the absence of short sale constraints in the

¹⁸ However, it should be noted that factors such as liquidity, a cheapest-to-deliver option and counterparty risk may to some extent distort the CDS spread as a pure measure of the market’s pricing of credit risk.

CDS market helps to decrease the cost of trading and makes CDS spreads a more reliable source of information about companies' credit risk by reacting more quickly to new information as compared to the underlying bond market (Squam Lake Working Group on Financial Regulation 2009). Supporting this argument, Diamond and Verrecchia (1987) examine the speed of price adjustments with respect to short sale constraints and show that good and especially bad news are incorporated more slowly when short sale constraints exist. However, as I will discuss later, the ability of short selling credit risk may create certain drawbacks that destabilize credit markets.

With regard to empirical evidence, Blanco et al. (2005), Zhu (2006), Norden and Weber (2009) and Forte and Pena (2009) find consistent evidence that CDS spreads lead the price discovery process compared to credit spreads in the bond market and, thus, are useful indicators for analysts when analyzing companies' credit risk. More recent studies, using data during the financial crisis, generally confirm these findings. For instance, Coudert and Gex (2010), using a sample of corporate and sovereign entities from 2007 until 2010, show evidence that the CDS market leads the bond market for corporate and high-yield sovereign entities but not for low-yield sovereign entities. Fontana and Scheicher (2010) confirm these findings for sovereign entities since the start of the financial crisis, showing that price discovery takes place in the CDS market for high-yield European sovereigns, whereas price discovery is observed in the cash bond market for low-yield countries such as Germany, France and Austria. In terms of pricing accuracy, existing studies by Blanco et al. (2005) and Zhu (2006) confirm that the theoretical parity relationship for the price of credit risk between the two markets holds in the long run.¹⁹ However, these studies also find clear evidence that the price for credit risk within the cash bond market and the CDS market differs substantially in the short run, which can persist for an extended period of time due to slow convergence of the two prices for credit risk.²⁰ In addition, as Zhu (2006) and Coudert and Gex (2010) note, during volatile periods, such as credit shocks or the current financial crisis, price discrepancies are even more pronounced and the response of the derivatives market is even stronger to a change in credit quality. As I will elaborate later in further detail, the question remains open whether price discrepancies during volatile periods are due to the efficient pricing role of the CDS market or due to speculation and an overreaction in the CDS market.

¹⁹ CDS premia and credit spreads in the bond market are linked by a theoretical arbitrage relation that should keep the prices for credit risk in the two markets in line, suggesting that the bond and CDS market should price credit risk (approximately) equally in practice.

²⁰ Zhu (2006) for instance finds that price discrepancies can last for as long as 2-3 weeks.

In sum, despite being economically comparable to the bond market, the CDS market generally improves the pricing of credit risk during ordinary market circumstances, as the CDS premium is a direct measure for the protection against credit risk and reflects changes in credit risk more quickly than the bond market. This characteristic helps to increase market transparency and in turn enhances market participants’ ability to assess companies’ credit risk, especially in situations when the bond market is illiquid and subject to stale prices. Therefore, the increased market transparency of credit risk helps to reduce the information premium in credit markets.

3 The Costs of Credit Default Swaps

With the emergence of the ongoing financial crisis, the risks and costs of the CDS market have become apparent, which were accompanied by a public outcry blaming the CDS market as the main culprit behind the crisis. In the following, I will examine in detail the main drivers behind these risks and associated costs and what the empirical findings tell us. This analysis, thus, provides the rationale for the discussion regarding policy initiatives in the following section.

3.1 Settlement Risk and the Empty Creditor Problem

As mentioned above, the physical settlement of CDS contracts had caused short squeeze problems in the past due to a shortage in the supply of bonds that need to be delivered into the CDS contracts, leading to bond prices in the market that did not reflect actual recovery rates, leaving the *naked* protection buyer with a smaller contingent payment than justified by the recovery rate, whereas the *covered* protection buyer was not affected in a physical settlement by a short squeeze. As a consequence of the shortcomings of physical settlement, the ISDA introduced a cash settlement procedure, where the recovery rate is determined through a centralized auction mechanism. The auction methodology is designed to discover a single price that reflects the fair recovery value that can be referred to when applying a cash settlement. The intention of this procedure is to eliminate the need for naked protection buyers to source bonds in the market, thereby mitigating the problem of short squeezes. Today, for CDS contracting parties using the ISDA Master Agreement as the legally binding documentation, the auction methodology is the obligatory procedure for bankruptcy and failure-to-pay credit events (ECB 2009). A study by Helwege et al. (2009),

examining auction results for 43 credit events between 2005 and 2009, finds that the auction settlement procedure has been efficient in most cases, with the auction prices close to the bond prices observed in the secondary market before and after the auction has occurred.

However, the credit events of the two government-sponsored entities, Fannie Mae and Freddie Mac, in 2008 indicate some anomalies with regard to the auction procedure, as the final auction price of subordinated bonds exceeded that of senior bonds, which is not logical from a capital structure perspective. Helwege et al. (2009) argue that there was a large open interest in the auction to buy subordinated debt, which led to a final recovery rate that caused these puzzling results. However, this explanation seems to be only one part of the full story. In particular, it cannot resolve the fact that recovery prices for senior debt of Fannie Mae and Freddie Mac differed substantially, even though both have been put under identical “conservatorship” by the US Treasury, causing the ultimate default risk in both cases to be borne by the US government.

Market participants noted that these anomalies can be partly explained through the interaction of a wide range of deliverable obligations and the full backing by the US Treasury through “conservatorship”. Conservatorship as a credit event makes the settlement more complicated, as the reference entity is still solvent, meaning that there exists a price curve for outstanding debt that depends on the maturity and design of the deliverable obligations. This distinguishes conservatorship (as well as the restructuring credit event) from other credit events where the only relevant feature to determine the value of the bond is the seniority within the capital structure. Therefore, a key problem to a CDS contract when triggered due to conservatorship is that not all deliverable assets within one seniority class trade at the same price. This characteristic becomes particularly severe when deliverable assets include long-dated zero-coupon or convertible bonds that trade at a substantial discount to shorter maturity coupon-paying bonds. In such cases, the CDS contract contains a cheapest-to-deliver option and the CDS spread is, therefore, not a pure measure of credit risk and the recovery rate set by the auction mechanism does not reflect a price where the bulk of the bonds trade, but rather reflects a price close to the cheapest-to-deliver obligation (Blanco et al. 2005). In the case of Fannie Mae and Freddie Mac, the range of deliverable obligations in the senior debt auction comprised callable zero-coupon bonds,²¹ which

²¹ The complete list of deliverable obligations as determined by the ISDA can be found at <http://www.isda.org/companies/deliverableobs/deliverableobs.html>

gave rise to a significant cheapest-to-deliver option. Furthermore, the cheapest-to-deliver obligations of Fannie Mae differed from those of Freddie Mac, which explains the difference of the final recovery prices for the senior debt of both entities. With respect to the subordinated debt auction, the range of deliverable obligations did not include any zero-coupon bonds, thus, limiting the cheapest-to-deliver option for subordinated debt, which caused –in addition to the strong demand during the auction to buy subordinated debt as examined by Helwege et al. 2009– a higher recovery price for subordinated debt than for senior debt.

As in the case of conservatorship, restructuring the outstanding debt of the reference entity can give rise to a cheapest-to-deliver option. The case of Conseco is best known for the possible problems that may occur when restructuring triggers a CDS contract. In October 2000, the company and its creditors agreed to a restructuring of its loans, triggering CDS contracts written on Conseco. However, the restructured loans were trading at a significantly smaller discount than the longer-dated senior bonds issued by Conseco, even though both were deliverable obligations. Therefore, some protection buyers owning the restructured loans were more than compensated for their restructuring-related losses by delivering the cheaper long-dated senior bonds into the CDS contract and, thus, gaining a valuable cheapest-to-deliver option in their CDS position (Bomfim 2005).

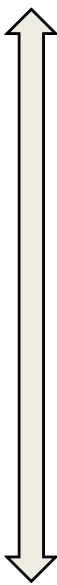
In response to this settlement issue, several alternative restructuring clauses have emerged over time depending on the geographical region where the CDS contracts are traded. The following four alternatives are possible with regard to the restructuring clause (Chaplin 2010):

1. Old restructuring (common use in the US until 2001 and in the EU until 2003/2004)
2. Modified restructuring (common use from 2001 to 2009; only in the US)
3. Modified-modified restructuring (now used predominantly in the EU and occasionally in the US)
4. No restructuring trigger (rarely used until 2009, but now standard for US CDS)

The key differences among the four alternatives refer to the range of deliverable obligations, the multiple-holder obligation requirement and the transferability of deliverable obligations when a contract is triggered by a restructuring event. The definition of the different restructuring clauses gives rise to differences in the value of the cheapest-to-deliver option embedded in a CDS contract, as shown in Table 3. In

the US, the restructuring clause has been completely eliminated from most CDS contracts since 2009, whereas the so-called modified-modified restructuring clause continues to be used in European markets since the amendment by the Small Bang Protocol in 2009.

Table 3: Restructuring Types

Contract Value (Cheapest-to-deliver Option)	Clause	Multiple Holder Obligation Requirement	Deliverable Obligations	Transferability of Deliverable Obligations
Most Valuable	Old Restructuring	Applies	Maturity of 30 year maximum is typically selected	No restriction
	Modified Modified Restructuring	Applies	Subject to maturity bucketing rules (Caps the maturity of deliverable obligations)*	Must be conditionally transferable
	Modified Restructuring	Applies	Subject to maturity bucketing rules (Caps the maturity of deliverable obligations)*	Must be fully transferable
	Least Valuable	No Restructuring	Not applicable	Not applicable

* Since 2009, maturity bucketing rules apply for contracts using Modified or Modified Modified Restructuring. Under maturity bucketing, deliverable obligations are determined by reference to the maturity bucket into which the relevant CDS contract falls according to the remaining maturity of the CDS contract. The bucket's end date provides an upper limit for the maturity of deliverable obligations.

The introduction of the Small Bang Protocol along with the modified-modified restructuring clause helps to mitigate the cheapest-to-deliver option by assigning the deliverable obligations into five different maturity buckets. The eligible obligation can be delivered into the respective maturity bucket if its final maturity falls on or before the bucket's maturity date. For each maturity bucket, a recovery price is determined by an auction mechanism, which is used for the cash settlement of the CDS contract.

However, a problem may arise when the recovery rate of the bond held by the *covered* protection buyer is significantly different from the recovery rate determined in the auction. This inequality gives rise to an over- or under-hedged position by the covered protection buyer, thereby exposing him to hedging- or so-called recovery basis risk. Although Helwege et al. (2009) find, in general, little empirical evidence of a large recovery basis, the case of Fannie Mae and Freddie Mac illustrates that the credit event of conservatorship can lead to a large recovery basis, which is likely to impair investors’ confidence in the CDS market. Therefore, it would be advisable to introduce a similar treatment for conservatorship as for restructuring through the use of different maturity buckets to mitigate the cheapest-to-deliver option and the associated recovery basis risk.

A further concern that is related to the restructuring clause is the possibility that CDSs can change the incentives of investors when a firm becomes financially distressed. Hu and Black (2008) demonstrate that if an investor hedges his bond or loan position by buying protection in the CDS market, being a so-called empty creditor,²² he may have a strong incentive to drive the firm into bankruptcy and, thus, trigger payments under the CDS contract even if a private workout of a refinancing plan together with the management of the company would be efficient. As Stulz (2010) notes, this morally hazardous behavior could be particularly pronounced if the CDS contract excludes restructuring as a credit event, giving the hedged bondholder of a financially distressed firm a strong motive to favor bankruptcy to trigger payments under the CDS contract. As a possible result, the distorted incentives of empty creditors to favor bankruptcy could in particular reinforce the downturn in a credit cycle, thereby intensifying pro-cyclicalities (ECB 2009).

However, Bedendo, Cathcart and El-Jahel (2011), analyzing a sample of US reference entities over the period 2008-2009, find no empirical support for the argument that the presence of CDS contracts favors bankruptcy over private workouts (so-called out-of-court restructurings), indicating that in practice, CDSs have not significantly affected the debt renegotiation process of financially distressed firms. In contrast to Bedendo, Cathcart and El-Jahel (2011), Danis (2011) finds support for the empty creditor hypothesis by analyzing a sample of private workouts in the US, using the participation rate in a distressed exchange offer as a measurement of firms’ success in an out-of-court restructuring. It should be noted that these studies use US sample

²² The investment strategy of buying a bond and insuring against credit risk by buying CDS protection is also known as a negative basis trade which tries to exploit the pricing differences between the CDS and the bond market. The basis is usually defined as the difference between the CDS spread and the Asset Swap Spread.

data and because most restructuring is implemented under Chapter 11 bankruptcy provisions in the US, restructuring qualifies in many cases as a bankruptcy credit event anyway, thereby triggering the CDS contract automatically. This is one of the reasons why under the standard North American contract, the restructuring clause is excluded as a credit event, as the clause is regarded by many market participants as being redundant and of not much economic value. This gives the empty creditor in the US little incentive to avoid restructuring under Chapter 11, even though he will try to avoid a private workout, which is not considered a credit event. This exclusion may also explain the disagreement of the empirical studies by Bedendo, Cathcart and El-Jahel (2011) and Danis (2011). The latter considers only the effect of CDSs on private workouts, whereas the former compares the impact of CDSs on the likelihood of private workouts relative to filing for Chapter 11.²³ Because private workouts are uncommon in the US relative to in-court restructuring under Chapter 11 bankruptcy law, the results of Bedendo, Cathcart and El-Jahel (2011) do not find that the availability of CDSs has a statistically significant effect in determining the debt renegotiation process.

In Europe, however, there is no legal equivalent of Chapter 11 bankruptcy protection. Therefore, bankruptcy is in many cases preceded by out-of-court restructuring, giving the restructuring clause a more relevant existence compared to the US. The inclusion of the restructuring clause in European CDS contracts is, thus, beneficial for mitigating the empty creditor problem (ECB 2009).

3.2 Counterparty- and Concentration Risk

The problem of counterparty risk within the CDS market and its repercussions became especially apparent during the current financial crisis.²⁴ Whereas counterparty risk is common to all OTC derivative markets, the CDS market in particular has been subject to claims that counterparty risk associated with CDSs exacerbated the financial crisis. Counterparty risk inherent in CDSs is associated and reinforced through concentration risk, i.e., a high concentration of dealers and sellers within the market. According to a

²³ Danis (2011) analyzes the participation rate for out-of-court restructuring events only, whereas Bedendo, Cathcart and El-Jahel (2011) use a binary variable classifying every out-of-court restructuring as a success and every Chapter 11 filing as a failure. However, Bedendo, Cathcart and El-Jahel (2011) do not consider that filing Chapter 11 includes not only bankruptcy but also in-court-restructuring.

²⁴ Counterparty risk reflects the risk of holding a contract with a counterparty that could potentially fail to fulfill its obligations when they become due (Duffie, Li, Lubke 2010).

survey by the European Central Bank (2009), for each large bank in Europe participating in the survey, its top ten counterparts accounted for 62% to 72% of its CDS exposure (measured in terms of gross market value), and a survey by Fitch (2009) indicates that 96% of credit derivative exposure at the end of Q1 2009 of one hundred surveyed firms in the US was concentrated among JP Morgan, Goldman Sachs, Citigroup, Morgan Stanley and Bank of America. With the failure of important dealer banks such as Lehman Brothers and Bear Stearns, dealer concentration became even more pronounced than before the crisis.

With regard to counterparty risk exposure, the gross market value of a CDS contract is generally viewed as a better measure compared to the notional value, as it better reflects the costs associated with replacing the contract. However, it should be noted that the gross market value as a measure of counterparty risk disregards the possibility of mutual netting in case a counterparty fails, and it also does not consider collateral, which lowers the amount at stake. Therefore, gross market value provides only an upper threshold for counterparty risk exposure (Weistroffer 2009).

In general, the possible threats of counterparty and concentration risk are threefold and can have an enormous impact on the financial stability. First, if a large dealer defaults, systemic risk is increased, as the dealer's counterparties may become more likely to default due to the domino effect. Second, in case of a credit event of a large reference entity, potentially large payments by the protection sellers are triggered, increasing the correlation of default among the highly interconnected group of dealer in the market. Therefore, when a large amount of risk is shared among a small number of dealer, the probability increases that all banks will jointly fail (Liu 2010). Third, difficulties in assessing counterparty risk due to an opaque OTC market and a high concentration among major dealer banks may create a high degree of uncertainty among market participants when a large counterparty or reference entity defaults or finds itself in a run-up to default, increasing the probability for a severe liquidity dry-up. Next, I will discuss these threats in further detail.

First, I distinguish three different cases that may occur if a counterparty fails. In addition to the normal case of orderly settlement when a CDS contract is triggered by a credit event, Table 4 provides an overview of the three different cases that are linked to counterparty risk.

Table 4: Credit- and Counterparty-Risk²⁵

Reference Entity	Protection Buyer	Protection Seller	Consequences
X			Orderly Settlement
	X		Replacement
		X	
X		X	Uncovered Loss

X = Default

Orderly settlement is given in case a CDS contract is triggered by a credit event and the protection seller provides compensation to the protection buyer. However, when a counterparty fails, either the protection seller loses the outstanding premiums or the protection buyer loses coverage, and the respective surviving party must replace the contract. In times of constrained and very volatile markets, it may be difficult for the surviving party to replace the contract at an adequate price.

3.2.1 Replacement Costs and the Domino Effect

With respect to the two replacement cases, when either the protection buyer or seller defaults but the reference entity remains intact, I pay special attention to the case of the protection seller defaulting. The required payments resulting from the failure of a protection seller can be much larger than in the case of default by the protection buyer. In addition, the concentration of large net exposure of protection sold by a few interconnected financial institutions, which became apparent during the financial crisis, makes the CDS market notably prone to contagion and systemic risk. High concentration among protection sellers is an important concern to regulators as well as market participants because the use of OTC derivatives leads to a huge web of interconnected exposures across financial institutions. In this case, the failure of a major institution can lead to the collapse of some of its counterparties and eventually to a domino effect and contagion across the financial system. Therefore, buyers of credit protection in effect replace credit risk with counterparty risk.

²⁵ Based on Weistroffer (2009)

A case in point is the failure of AIG, a large international insurance company. AIG had been very active in the CDS market, predominantly as a protection seller. As of September 30, 2008, the outstanding net notional amount of credit derivatives sold by AIG was USD 372 billion. The net notional amount was almost double the aggregate net notional amount sold by all other major dealers combined at the end of October 2008. When AIG’s credit rating was downgraded due to a deterioration of its conditions, its counterparties required it to post additional collateral, which contributed to AIG’s liquidity crisis, finally resulting in the bailout by the US government.²⁶ One major concern by the Federal Reserve and the US government that led to the decision to rescue AIG was AIG’s position as a “one-way seller” in the CDS market. This position was regarded as systematically too important and too interconnected to fail given the complex chains of counterparty risk in the CDS market (ECB 2009).

The case of AIG illustrates the misconception before the crisis that net protection sellers such as AIG and monoline insurance companies were thought to be best capable of bearing credit risk, as credit risk is assumed to be carried by investors who are best equipped to bear it. As it turned out, these net protection sellers ultimately did not have the ability to manage all of the credit risk they took (Stulz 2010). Instead, the high concentration of net protection sellers increased counterparty risk even further, leading to high uncertainty in the opaque web of interconnected market participants.

A different aspect of the high concentration of net protection sellers in the CDS market is analyzed by Biais, Heider and Hoerova (2012). According to their model, the large exposure of a net protection seller can lead to a moral hazard problem, incentivizing the protection seller to reduce his risk-prevention efforts and to speculate on the total assets of the firm, leading to endogenous counterparty risk. Biais et al. (2012) argue that a moral hazard problem arises when the protection seller discovers that his CDS positions are likely to be loss-making due to the occurrence of bad news, turning the CDS contracts into a liability for the protection seller. Similar to the concept of debt overhang by Myers (1977), assuming that no adequate risk management is in place and the losses on the CDS contracts are large, the liability embedded in the CDS trade undermines the incentive of the protection seller to exert effort to reduce the downside risk of his total assets, as he bears the full cost of such efforts, whereas part of the benefits accrue to the protection buyer. In addition, because the protection seller bears limited liability, it not only prevents him from monitoring his risky assets but even increases incentives to enlarge the firm’s risk exposure and to

²⁶ Later, I will examine, in more detail, the interdependence of counterparty risk and liquidity.

speculate on the assets of the firm. This morally hazardous behavior increases the probability of default of the protection seller, thereby creating endogenous counterparty risk.

3.2.2 Uncovered Losses and Joint Failure

Turning now to the case of an uncovered loss in Table 4, that is, a joint default of both the reference entity and the protection seller, the protection buyer loses protection when exposed to a default of the reference entity and bears a large uncovered loss (not including offsetting bilateral netting and collateral). In this case, it is important to note that the two analytical concepts of credit risk and counterparty risk are not independent of each other, as the two can influence each other and lead to negative feedback loops, possibly resulting in contagion and instability within the financial system. Credit risk affects the two parties of a CDS contract asymmetrically, as an increase in the credit risk of the reference entity will lead to a reduction in the CDS's market value for the protection seller while increasing it for the protection buyer. Therefore, an increase in the credit risk of the reference entity may have a negative impact on counterparty risk of the protection seller, resulting in a higher probability that the protection seller will fail to fulfill his side of the contract (Weistroffer 2009). In addition, CDS contracts are particularly sensitive to counterparty risk, as they differ from other derivatives in that they can experience large jumps in market value if a credit event takes place, in which case the protection seller is suddenly asked to pay huge amounts to the protection buyer to settle the contract. Therefore, the binary nature of a CDS contract gives rise to jump-to-default risk, in which case a credit event can result in large swings in the value of the CDS contract and the need to post large and increasing amounts of collateral or to fund the contract settlement payment. In this case, the run-up to default or the default of a reference entity could put a severe capital strain on the protection seller, leading to the possible failure of the protection seller to honor his payment obligations (Brown 2010).

The risk that the credit quality of the reference entity is correlated with the protection seller's willingness or ability to pay is called "wrong-way risk".²⁷ According to data by the DTCC, six of the major CDS dealers were among the top ten

²⁷ Another form of "wrong-way risk" exists when counterparty risk affects credit risk. An extreme example would be if Deutsche Bank sells protection on the sovereign credit risk of Germany. Assuming that Deutsche Bank is backed by German tax-payers, the deterioration of Deutsche Bank's credit standing would significantly affect the credit risk of Germany, the reference entity (ECB 2009).

non-sovereign reference entities at the end of July 2009, illustrating the inherent “wrong-way risk” in the CDS market. Therefore, the high-degree of “wrong-way risk” increases the likelihood that several dealer banks jointly fail, caused by the default of a large reference entity. Furthermore, given the high concentration of dealers in the CDS market, a default of a large reference entity increases the default correlation among CDS dealers, as a large amount of risk is shared among a small number of protection sellers, increasing the probability of a joint default of bank dealers even further.

3.2.3 Lack of Transparency and Liquidity Dry-up

The interconnectedness of dealers in the opaque web of the CDS market and the uncertainty in assessing counterparty risk exposure, which is common to all OTC derivatives markets, may also cause liquidity dry-ups, thereby further increasing the probability of contagion and financial instability. As Caballero and Simsek (2009) note, in normal times, dealers and other market participants must only understand the financial health of their direct counterparties. However, in times of financial distress and increasing counterparty risk, it becomes crucial for market participants to also understand the health of the counterparties’ counterparties as well as the health of the counterparties of the counterparties’ counterparties, and so on. Therefore, the complexity of understanding the network effects and the costs of information gathering become unmanageable for dealers and other market participants, resulting in high uncertainty or even panic, which consequently leads to withdrawals from loan commitments, higher margins and flight to quality.²⁸ Subsequently, second-order effects may evaporate funding liquidity and market liquidity, where funding liquidity describes the ease with which investors can obtain funding and market liquidity describes the ease to sell the asset in the market to generate cash.²⁹ Brunnermeier and Pedersen (2009) show that an increase in margins as well as the withdrawal of loan commitments forces fire sales by leveraged investors, de-leveraging their positions,

²⁸ When market participants become worried about the counterparty risk of their trading partners, they also try to protect themselves against the default of counterparties by buying CDSs written on the respective counterparties, as noted by Brunnermeier (2009). As a consequence, all major dealers buy CDSs against each other when uncertainty about counterparty risk is very high, resulting in a significant price hike of CDS spreads of major dealers and banks. This rational behavior at the micro level increases however the network complexity and concentration risk within the CDS market even further.

²⁹ The concepts of funding liquidity and market liquidity are not disconnected but rather interconnected. For instance, when buyers have difficulties raising funds and may be forced to de-leverage their positions, it becomes hard for market participants to liquidate their assets. Conversely, market illiquidity may make investors reluctant to fund a dealer or a bank that has trouble liquidating assets on its balance sheet (Tirole 2011).

which may increase margins further and force more sales due to large price drops, leading to the possible emergence of a vicious cycle. This effect is well illustrated by the textbook example of de-leveraging and fire sales by several financial institutions during the current financial crisis.

In addition, the existence of large net protection sellers in the CDS market creates concentration risk, which further increases uncertainty about network effects and the failure of a major market participant. These rational fears about a possible failure of a major net protection seller can quickly lead to the refusal of funding in terms of higher margins, creating a “margin run” on the net protection seller that may eventually result in a self-fulfilling prophecy and the protection seller’s default. In September 2008, AIG faced such a “margin run” due to concerns about its credit standing. Several counterparties requested additional collateral from AIG for its CDS positions, which led to AIG’s liquidity crisis and potential bankruptcy had the US government not injected additional funds (Brunnermeier 2009).

When financial distress arises somewhere in the network of the interconnected CDS market, the uncertainty about counterparty risk and the complexity of network effects may also lead directly to market illiquidity. The purchase of protection in the CDS market relies on trust about the quality of the protection seller to pay in case a credit event triggers the contract. Therefore, the increase in uncertainty about counterparty risk may lead to the disappearance of trust among the trading partners, resulting in the evaporation of market liquidity.

Relatively little empirical work has been conducted so far regarding the impact of counterparty risk on financial stability and contagion. Jorion and Zhang (2009) analyze a sample of over 250 public bankruptcies over the period 1999 to 2005 and confirm that the failure of a counterparty leads to credit contagion and to a general increase in the counterparty risk of the creditors of the defaulting counterparty. Cont, Moussa and Santos (2010) analyze contagion and systemic risk in a network of interlinked financial institutions by using data from the Brazilian financial system, considering the connectivity and systemic importance of a financial institution and whether financial institutions are subject to correlated market shocks in default scenarios. Their findings show that market shocks such as the default of a large reference entity play an essential role in spreading the default across the financial network and that only highly connected financial institutions with large balance sheets pose a significant risk of contagion.³⁰ Therefore, they provide evidence that concentration risk and network

³⁰ Following these findings, it would be more appropriate to coin the expression “too big *and* too interconnected

effects play an important role when a large reference entity defaults.

With regard to liquidity effects, Adrian and Shin (2010) provide evidence that investment banks actively adjust their balance sheets, finding a strong positive relationship between changes in leverage and changes in balance sheet size; that is, leverage is procyclical. In particular, they show evidence that these balance-sheet fluctuations affect the ease with which market participants can obtain funding for trades, which has a direct impact on asset prices, providing consistent evidence that margin spirals force dealers to de-leverage during downturns, resulting in large price drops. Furthermore, Mitchell, Pedersen and Pulvino (2007) find that funding constraints by main liquidity providers in the convertible bond market lead to forced sales, resulting in the divergence of prices from fundamentals.

To summarize, like other OTC derivative markets, the CDS market entails long and complex chains of unknown counterparty- and concentration risks that prove to be problematic in times of financial distress, as the transfer of risk in an OTC market assumes that all parties along the chain fulfill their contractual obligations. In contrast to other OTC derivative markets, counterparty risk is even more pronounced in the CDS market due to the binary nature of a CDS, which gives rise to jump-to-default risk and the sudden demand for large payments. In addition, the large exposure of a few net protection sellers causes concentration risk in the market. As a result, a few large net protection sellers are highly leveraged to a specific event, namely, the default of a reference entity. Therefore, the triggering of a credit event may suddenly cause the financial system to become gridlocked as uncertainty about counterparty risk restricts normal trading (Das 2010). The rise in uncertainty may also increase volatility in the CDS market as well as in the underlying cash bond market, which may intensify a liquidity dry-up. Therefore, the failure of a large and interconnected counterparty or of a large reference entity can be quickly transmitted throughout the financial system, causing additional counterparties to fail. This phenomenon implies that for protection buyers, the hedge may diminish exactly when it is most needed.

3.3 Moral Hazard and Insider Trading

Because the monitoring of loans made to borrowers is costly and regulators require banks to hold a minimum percentage of capital against risk-weighted loans on their balance sheet (capital charges), banks have an incentive to avoid or reduce these costs

by transferring credit risk. There are several available credit risk transfer (CRT) instruments, such as asset securitization, the outright sale of loans and the purchase or sale of CDSs, that allow banks to manage their credit exposure. The advantage of transferring credit risk through the purchase of CDSs as compared to other CRT instruments is that CDSs provide banks with an effective method to sever their links to the borrower in a fashion unobservable to the borrower and other investors, giving rise to asymmetric information. Critics argue that this might lead to moral hazard, as a bank uses a CDS to insure itself against the default of a loan that it has made to a firm, resulting in lower incentives to monitor the borrower, to control the borrower's risk taking and to exit the lending relationship in a timely manner. Moreover, there are concerns that because a CDS seller cannot monitor the firm in the same way that a bank would be able to do (because CDS sellers have no contractual relationship with the firm), the CDS market may lead to the less-than-optimal monitoring of the borrower and, thus, to inefficient economic activities by the borrower (Duffie 2007).

Asymmetric information between the buyer and the seller of protection may also lead to the problem of insider trading. As Acharya and Johnson (2007) explain, banks have inside information about the performance and creditworthiness of reference entities to which they make loans and which they can exploit through the use of the CDS market.³¹ For example, if bank X, the creditor of company A, has private information about the likelihood of default of company A, then bank X could try to exploit this private information by buying protection on company A from a less-informed counterparty. Compared to other markets, the problem of asymmetric information and insider trading is particularly pronounced in the CDS market, as most of the major bank dealers in the CDS market are insiders, due to their close lending relationships with some of the reference entities.

Furthermore, Akerlof (1970) explained in his seminal paper how asymmetric information can lead to a market breakdown when the quality of an asset is only known to one side of the contracting parties. In such an environment, where asymmetric information leads to uncertainty about asset quality, market liquidity may evaporate quickly. Accordingly, when insider trading exists in the CDS market, a loss in liquidity may arise, especially in uncertain and volatile situations, when market participants perceive the likelihood of private information to be high. Therefore, market illiquidity may occur exactly when hedging needs are the most pronounced.

³¹ However, the asymmetric information problem should be mitigated through the existence of "Chinese walls" in banks, which are designed to prevent improper trading.

With regard to empirical evidence, Minton, Stulz and Williamson (2008), analyzing the period from 1999 to 2005, find that 23 large banks in the US with total assets in excess of USD 1 billion use credit derivatives. The majority of CDS positions held by banks is due to dealer activity rather than loan hedging. The authors further show that banks hedge less than two percent of loans outstanding with credit derivatives. These results suggest that the banks' use of credit derivatives as a hedging instrument is relatively limited. Credit derivatives are used mainly as a hedging tool against credit exposures to large companies but not against exposures to smaller companies, to which banks extend the majority of loans. However, these results should be interpreted carefully because the time span of the empirical study covers only the years until 2005, and the authors cannot rule out morally hazardous behavior by banks for large companies as reference entities.

Beyhaghi and Massoud (2010) analyze which different credit risk transfer instruments banks use to hedge the credit risk of their outstanding loans. Examining the sample period from 2006 until 2008, they find evidence that loan hedging through CDSs is mainly used for investment-grade corporations rather than for non-investment-grade corporations. Representing one explanation for this result are the problems of moral hazard and asymmetric information, which are more pronounced for non-investment-grade entities, making hedging through CDSs more expensive and causing banks to be less likely to hedge such loans. Furthermore, Beyhaghi and Massoud (2010) show that banks are more likely to use CDSs to insure against the credit risk of investment-grade borrowers when the monitoring costs of a borrower are high.

Acharya and Johnson (2007), studying the period from January 2001 until October 2004, report evidence of the existence of insider trading within the CDS market. The issue was particularly pronounced for reference entities that experienced credit deterioration during the sample period and whose CDS levels were high. Moreover, their findings show that insider trading in the CDS market is one-sided, related exclusively to the occurrence of bad news. Surprisingly, however, they do not find evidence that the degree of insider activity has a negative effect on market liquidity in the CDS market.

In sum, even though the majority of banks' CDS positions are driven by trading activity, the empirical findings provide some support for the fact that banks use CDSs to systematically protect their loan portfolios against default risk of large investment-grade corporations, especially when monitoring costs are high. In addition, there is support for the existence of insider trading in the CDS market, which, however, does

not appear to have a measurable effect on market liquidity.

3.4 Price Distortion and Manipulation

Two theoretical points support the hypothesis that the existence of CDSs leads to increased volatility and price distortion in credit markets. First, the built-in leverage effect of CDSs can amplify movements of the price discovery process, as CDSs are unfunded and, thus, allow investors to take a riskier position than they could otherwise do in the bond market, leading to price distortions (Stulz 2010). This point is in line with anecdotal evidence offered by several market dealers stating that even though the CDS spread is an important information transmitter, they find it less reliable than the credit spread in the cash bond market. Second, buying protection in the CDS market allows investors to take a short position against a bond (the reference asset) at a better risk/reward ratio compared to shorting the underlying bond, as buying a CDS implies limited risk but almost unlimited profit potential, whereas shorting a bond exhibits an inferior risk/reward ratio. The payoff structure of CDSs, thus, encourages investors to buy “naked” CDS contracts to speculate on higher CDS spreads in times of distress, thereby pushing up CDS spreads, which implies a worsening of the reference entities’ financial situation. In line with this argument, several critics, such as George Soros (2009), claim that during the current financial crisis, speculators bought CDSs in large amounts, amplifying downward pressure on the underlying bonds and sending negative signals to the financial markets, reinforcing each other. This line of argument has also motivated politicians to blame the CDS market as the main culprit for the deterioration of sovereign debt, making it more difficult for distressed sovereign entities to access the debt markets (Cont 2010).

The argument of a downward spiral initiated by investors in the CDS market has been taken even further by critics who claim that powerful investors manipulated the markets through well-placed trades in a fairly illiquid CDS market. The idea is that these investors tried to create the impression that the reference entity was in trouble by driving up the CDS spread, which would then drive the reference entity’s stock and bond prices down. During the peak of the financial crisis, reference entities of the financial sector may have been particularly vulnerable to such actions.

The empirical evidence regarding the price discovery process is rather limited; Shim and Zhu (2010) find some support that during the current financial crisis, the CDS market in Asia contributed to higher credit spreads of the underlying bonds and, thus, had negative spillover effects. In contrast, a study by the German Bundesbank (2010),

analyzing the European sovereign bond and CDS-market between 2007 and 2010, does not find empirical evidence for price distortion effects caused by the CDS market.

Taken together, it remains an open question whether the CDS market caused some of the current market turmoil or whether the CDS market was simply an efficient information transmitter that rapidly incorporated information into the credit markets.

4 Policy Implications

In response to the previous analysis of the risks inherent in the CDS market, the following section discusses important regulatory initiatives that address these risks. The introduction of central counterparties (CCP) and data repositories are important policy initiatives that aim to mitigate counterparty risk and to increase market transparency, respectively.

4.1 Counterparty Risk and Central Counterparties

Counterparty risk in a bilaterally cleared CDS market is a major concern to market participants and regulators due to its possible contagion effects and its impact on financial stability. To mitigate the problem of counterparty risk with bilateral clearing, market participants can employ several measures. Basic means of reducing counterparty risk include conducting sound due diligence and diversifying counterparties, although the latter can be difficult to implement in practice due to the small number of dealers and major CDS market participants. Counterparty risk can also be reduced through the use of collateral, with the amount of collateral required typically increasing with the value of the contract. In addition, bilateral netting can be put into place, whereby in the event of default, all OTC derivative contracts between two counterparties are terminated, and the positions are netted to a single payment. Bilateral netting ensures that only the net exposure of an OTC derivative portfolio between two counterparties is payable, less any collateral posted, which prevents cherry-picking, as no party can default on just one single OTC contract and walk away (ECB 2009).

A measure that has been proposed to avoid the drawbacks of clearing contracts bilaterally is the development of central counterparties (CCPs). Central counterparties have become a focus of regulatory attention for the CDS market. A CCP acts as a seller to every buyer and as a buyer to every seller. Its objective is to remove the

counterparty risk that exists in a bilateral OTC market by concentrating the counterparty risk in a central location, the CCP. In terms of counterparty risk, market participants are then exposed only to the risk of the CCP defaulting. Therefore, the CCP eliminates the domino effect that may occur when a large counterparty such as a CDS dealer defaults, thereby reducing systemic risk. This finding in turn helps to reduce uncertainty about counterparty risk exposure among market participants and fosters market and funding liquidity.

In addition, a CCP facilitates multilateral netting among its clearing members, which is an effective instrument to further reduce counterparty risk by eliminating redundant contracts in the market. A simple illustration of how multilateral netting works is shown in Figure 11. Panel A shows contracts between four counterparties that all apply bilateral netting but no multilateral netting. Each counterparty faces a maximum counterparty risk exposure (E) of either 5 EUR or 10 EUR. For instance, D loses 10 EUR if A and B fail. When introducing multilateral netting or so-called trade compression, one could eliminate four redundant contracts, as shown in Panel B. This technique reduces the individual counterparty risk exposure of all parties, thus, also reducing system-wide counterparty risk and making the CDS market more resilient (IMF 2009).

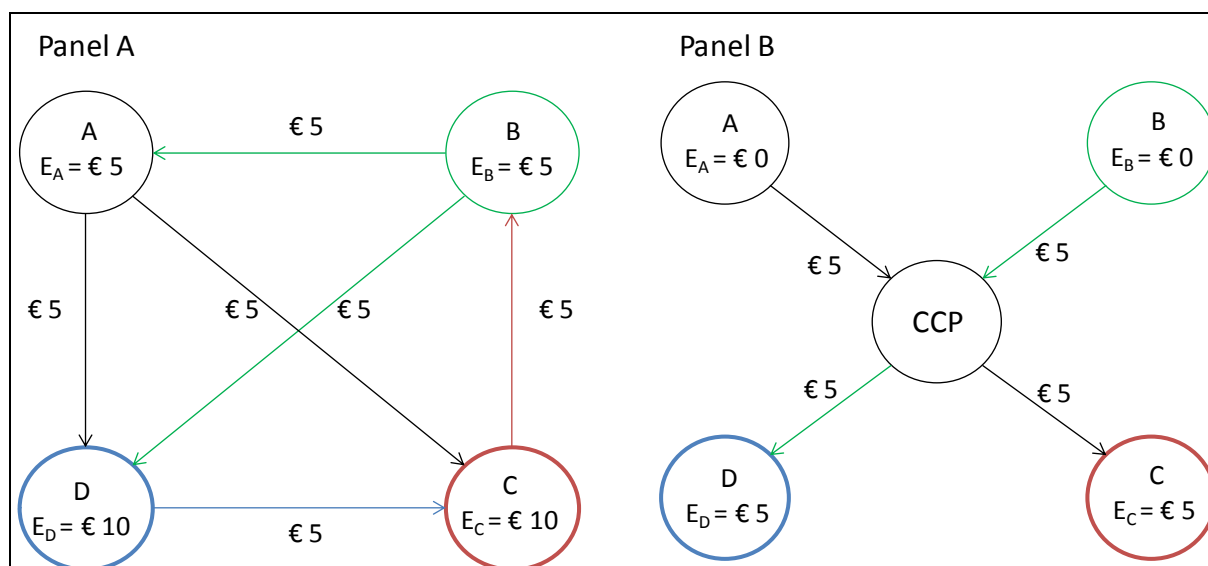


Figure 11: Central Counterparty and Multilateral Netting

Whereas companies such as TriOptima and CreditEx already provide multilateral netting services, which are called trade compression, in the OTC market, the existence

of a CCP facilitates the identification of redundant contracts. Moreover, a CCP can achieve netting benefits beyond those available through trade compression, as a CCP can net payments to be made in opposite directions on the same day and not only offset long and short positions on the same named reference entity (Duffie, Li, Lubke 2010).

Given its role as a bulwark against counterparty risk, a CCP must implement several defense lines to avoid becoming a source of systemic risk. The first requirement is the introduction of high standards for the amount of margin that a CCP collects from its members. Initial margins on a given derivative position should absorb the potential costs of unwinding the position of a defaulting member in an extreme but plausible scenario, recognizing the time horizon it may take for the CCP to unwind the position. Variation margins are then adjusted daily with respect to the estimated change in the market value of the position. Furthermore, margins should be held in liquid assets such as Treasury bills (Financial Economists Roundtable 2010). In addition, because margins are an important risk management tool of the CCP, they should be ring-fenced from the contracting parties. Doing so helps to mitigate the latent morally hazardous behavior by large protection sellers to speculate on their total assets once their CDS contracts create huge liabilities (similar to a debt overhang problem, as argued above). Therefore, through ring-fencing, protection sellers are incentivized to increase risk-prevention efforts and not to engage in excessive risk-taking. It should be noted that the collateral held by dealers of *bilaterally cleared* OTC derivative positions is typically not ring-fenced, which provides an important funding source for them. Therefore, ring-fencing could lead to increased funding costs for dealers.

However, the required margins for CDSs may not be sufficient to cover the losses of a defaulting counterparty due to the binary nature of a CDS payoff. Compared to other derivatives, such as interest rate swaps, the binary nature of a CDS gives rise to jump-to-default risk, which can lead to the failure of the protection seller if he lacks adequate financial resources when a credit event triggers the CDS contract. Therefore, Cont (2010) suggests computing adequate margins for protection sellers based on *loss given default* and not on *expected loss*, as is often done in OTC margin agreements. However, loss given default implies large and costly collateral requirements, especially for naked protection sellers. This characteristic in turn could strongly discourage these sellers from providing important market liquidity.

Beyond the determination of appropriate margin levels, the guarantee fund constitutes a second defense layer of the CCP to cover losses from a defaulting member after margins have been used to unwind the failed member's position. Each

CCP member is required to contribute capital to the pooled guarantee fund. To determine the adequate guarantee fund requirements, Cont (2010) suggests that CCPs should apply a stress-testing approach and identify plausible worst-case scenarios. As I have analyzed above, the CDS market exhibits high interconnection among bank dealers as well as a high degree of “wrong way risk”, which could lead to the simultaneous failure of multiple counterparties. Therefore, it would be advisable to include the failure of multiple members into the stress-testing scenarios and adjust the size of the guarantee fund accordingly. However, even with the necessary adjustments, the joint failure of large CDS dealers could still pose a potential threat to the functioning of a CCP and, thus, to the stability of the financial system. Therefore, Kress (2010) suggests an additional layer of defense by giving CCPs access to emergency credit from central banks as a lender of last resort.³²

A further challenge to the stability of the CDS market is the use of bespoke CDS contracts, as they cannot be moved to CCPs due to their customization and lack of liquidity. A CCP requires standardized and fungible products that have enough market liquidity to ensure that prices are representative and to allow the CCP to manage and hedge its risks taken as a counterparty in a timely manner. The proposal to ban bespoke CDS contracts altogether, however, is not a practicable answer, as customization to the specific needs of end-users provides major benefits such as hedging default risk that is not close to match through standardized CDSs or to satisfy hedge accounting standards. Moreover, customized financial products have been the foundation for financial innovation and have led to products such as interest-rate swaps and other currently standardized derivatives that are no longer viewed as innovative from today’s perspective. However, it is necessary to implement regulatory incentives that account for the higher counterparty and systemic risk inherent in non-cleared bespoke CDS contracts as opposed to centrally cleared CDSs by forcing dealers and other market participants to internalize the associated social costs. A useful measure to internalize the negative externality of systemic risk associated with non-cleared CDS contracts is the introduction of higher capital requirements and collateralization standards (Financial Economists Roundtable 2010). Because the provision of higher collateral and capital is costly, dealers have an additional incentive to move part of their non-cleared CDS contracts to CCPs and to stop using

³² Kress (2010) examines the possible consequences of a lack of immediate central bank access for the case of Hong Kong’s main clearinghouse in the aftermath of Black Monday in October 1987. The reluctance of Hong Kong’s central bank to immediately protect the country’s main clearinghouse led to the collapse of the clearinghouse’s associated guarantee fund, exacerbating the crisis in the region.

unprofitable bespoke CDS contracts under the new regulatory initiatives. In this regard, the Basel Committee on Banking Supervision is at the time of writing under way to implement higher capital requirements for non-cleared transactions than for those cleared through CCPs.³³ However, to ensure the efficacy of these initiatives, it is critical to harmonize regulations across jurisdictions to avoid regulatory arbitrage.

4.2 Market Transparency and Data Repositories

Increasing market transparency is another regulatory initiative that has been proposed to improve the stability of the CDS market. However, increased market transparency is a double-edged sword, and one must differentiate between transparency for regulators and transparency for market participants. For regulators, increased market transparency helps to detect concentration risk to a reference entity or to a protection seller. This ability to detect helps regulators to limit risk exposure in the CDS market when necessary and to ensure that large protection sellers meet capital and liquidity requirements. Transparency is particularly important for bespoke CDS contracts that are not cleared by a CCP due to a lack of standardization and market liquidity.³⁴ Therefore, increased transparency and the surveillance of bespoke contracts by regulators would be an important step towards improving the stability of the CDS market.

However, much of the information available to regulators should not be made public to market participants for two main reasons. First, following Grossmann and Stiglitz (1980), if information gathering is costly in the CDS market, then market makers in an OTC market must earn a return on their acquired information compared to uninformed traders to have an incentive to provide market liquidity. Therefore, a situation of increased transparency and a reduction of asymmetric information between dealers and other market participants would reduce the information value, thereby having a negative impact on market liquidity. Second, if post-trade transparency is increased, liquidity could deteriorate because dealers and other market participants may have difficulties in unwinding large positions (Avellaneda and Cont 2010). As noted by Chen et al. (2011), the CDS market may be especially vulnerable to an increase in post-trade transparency, as typical trades are rather large, with a notional size of 5 million for both dollar- and euro-denominated single-name CDS contracts

³³ For detailed information, please visit the following website: <http://www.bis.org/publ/bcbs164.htm>

³⁴ Cont (2010) notes that bespoke CDS contracts were at the center of AIG's failure and that bespoke CDSs continue to account for a large portion of the CDS market.

and trades happen on a low-frequency basis. Therefore, CDS dealers play an important role under these circumstances to facilitate trading, and market liquidity depends to a large extent on their willingness to intermediate trades. Anecdotal evidence indicates that dealers would not be willing to enter large positions in the CDS market when their trades become transparent to the market because competitors would try to exploit the situation by charging unfavorable prices when a dealer tries to unwind a large position. Therefore, increased transparency of the CDS market to regulators is desirable and could be enforced through the existence of CCPs and data repositories such as the DTCC trade information warehouse, whereas increased transparency to market participants could deteriorate market liquidity if it is inappropriately provided.³⁵

Increased transparency is also useful for mitigating the aforementioned asymmetric information problems because the full access of regulators to data repositories could help to detect insider trading activity and market manipulation.³⁶ Furthermore, increased transparency in combination with loss piece retention by the loan originator should help to align incentives and mitigate the problem of moral hazard. Similar to what Franke and Krahen (2008) propose for the securitization market, incentives could be aligned in the CDS market through loss piece retention by the loan originator to increase his exposure and, thus, to internalize to a certain extent the externalities in the originate-and-distribute model caused by the loan originator. Doing so would require the originating bank to keep a certain percentage of a specific loan position unhedged on its books, which leads to a more efficient decision-making process as in the bank-based model, in which banks make the lending decision and retain the loan on their books, leaving themselves fully accountable for the consequences. In addition, transparency about the extent to which the originating bank retains an unhedged position with a specific borrower would inform the market about the incentives of the originator. Therefore, appropriate transparency requirements would lead to efficient CDS spreads that naturally enforce the alignment of incentives in the market through the market price mechanism. To avoid the problem of deteriorating market liquidity due to increased transparency to market participants as explained above, it is advisable to introduce a minimum percentage of a loan position that must be held unhedged by the loan originator. Therefore, regulators should make the exact unhedged position

³⁵ Currently, the DTCC collects and provides detailed information of CDS transactions to regulatory authorities. On an aggregated level, it also provides data to market participants. However, it does not report data on bespoke contracts, which account for approximately 15 percent of the CDS market (IMF 2010).

³⁶ To supervise and analyze the trades in the CDS market effectively, it may be necessary for regulators to have access to a wide range of data repositories of various derivatives and asset classes such as the cash bond market and the stock market, which requires standardized data structures (Financial Economists Roundtable 2010).

publicly available only in case the position falls below a minimum threshold.³⁷

Table 5: Policy Initiatives for Mitigating CDS Risks

Risk	Policy Initiative	Suggested Implementation
Counterparty Risk	<p>Central Counterparties</p> <ul style="list-style-type: none"> ▪ act as a seller to every buyer and as a buyer to every seller ▪ concentrate counterparty risk in central location ▪ facilitate multilateral netting ▪ reduce system-wide counterparty risk ▪ make CDS market more resilient ▪ pooled guarantee fund covers losses from defaulting member 	<ul style="list-style-type: none"> ▪ high standards for amount of margin that CCP collects from its members ▪ margins should be held in liquid assets ▪ margins should be ring-fenced from contracting parties ▪ computing adequate margins for protection sellers based on <i>loss given default</i> and not on <i>expected loss</i> (Cont 2010) ▪ in order to determine adequate guarantee fund requirements CCPs should apply a stress-testing approach and identify plausible worst-case scenarios (Cont 2010) ▪ CCPs should be given access to emergency credit from central banks (Kress 2010) ▪ in order to internalize negative externalities of non-cleared CDS contracts higher capital requirements and collateralization standards should be introduced (Financial Economists Round-table 2010)

³⁷ To avoid the problem where originators try to circumvent regulations by hedging “unhedged” positions with a proxy hedge, regulators could introduce higher capital requirements for unhedged positions (not allowing proxy hedges), which would incentivize the loan originator to use a direct hedge that allows him to decrease the capital requirements.

Risk	Policy Initiative	Suggested Implementation
<p>Concentration Risk, Asymmetric Information</p>	<p>Increased Market Transparency and Data Repositories</p> <ul style="list-style-type: none"> ▪ transparency particularly important for bespoke CDS contracts ▪ transparency mitigates asymmetric information (help to detect insider trading activity and market manipulation) ▪ transparency in combination with loss piece retention by loan originator should help to align incentives and mitigate problem of moral hazard 	<ul style="list-style-type: none"> ▪ increased transparency of CDS market to regulators is desirable, whereas increased transparency to market participants could deteriorate market liquidity if inappropriately provided ▪ to mitigate the problem of moral hazard, a minimum percentage of a loan position that must be held unhedged by the loan originator should be introduced ▪ regulators should make the exact unhedged position publicly available only in case the position falls below a minimum threshold

5 Conclusion

At the inception of CDSs, the intention was to help financial institutions and companies trade credit risk by isolating an asset's credit risk and transferring it to another party who is willing to bear this risk. Therefore, CDSs allow their users to trade credit risk in much the same way that market risk is traded. From a theoretical perspective, the benefits include both facilitating risk-sharing among investors and the improvement of the price discovery process for credit risk. These attributes as well as the increased standardization of contractual terms have contributed to the tremendous growth of the CDS market over the last decade. From an empirical perspective, however, the evidence is rather mixed. The positive effect of CDSs on the terms of lending is ambiguous and cannot be empirically confirmed in general, whereas consistent evidence is found that CDS spreads provide an information benefit when analyzing credit risk.

However, the benefits of the CDS market come at a cost that became especially

apparent during the current financial crisis. Whereas the identified costs existent in the CDS market are numerous, the factors causing them are rather limited and provide a clear picture of what issues must be addressed by regulators. As is the case with other derivatives, CDSs are highly levered contracts that are especially vulnerable to situations of distress due to their characteristic as OTC contracts that have been bilaterally cleared in the past, which causes counterparty risk. The leverage effect inherent in CDS contracts is even more pronounced through the CDS-specific binary nature that gives rise to jump-to-default risk. Therefore, a CDS contract is highly levered to a specific event, namely the default of the underlying reference entity. In addition, the infrastructure of the CDS market exhibits a high degree of concentration among dealers and especially protection sellers, which leads to a further increase in systemic risk and uncertainty among market participants during times of distress. The lack of transparency, the misalignment of investors’ incentives and inappropriate contract design increase the costs in the market even further and add to uncertainty among market participants. A major consequence is, thus, an increase in systemic risk, as these factors have the potential to deteriorate liquidity, and the CDS market can quickly become gridlocked, causing contagion and instability within the financial system. Moreover, the protection provided to the buyer of a CDS contract may diminish exactly in times of distress when it is most needed.

The findings presented herein have important policy implications for the CDS market. First, an adequate market infrastructure is required that mitigates counterparty risk as well as the concentration to a certain counterparty or reference entity. The introduction of a central counterparty facilitates the management of counterparty risk but is by no means a panacea, as the CCP itself poses a systemic risk to the financial system. Therefore, appropriate risk-management and supervision of the CCP will be highly important for the stability of the CDS market such as an adequate management of margin requirements to account for the leverage and jump-to-default risk inherent in CDS contracts. In addition, the creation of a guarantee fund, which covers losses from a defaulting member after margins have been used to unwind the failed member’s positions, provides an important financial layer of protection for a CCP. To determine the appropriate size of the guarantee fund, stress-testing scenarios should include the simultaneous failure of counterparties due to the high level of interconnection and “wrong-way risk” among market dealers.

Second, the use of standardized CDS contracts should be promoted over bespoke CDS contracts, as the latter cannot be moved to CCPs, due to their customization and lack of liquidity. An appropriate measure would be the introduction of higher capital

requirements and collateralization standards for bespoke CDSs to internalize the associated social costs to some extent.

Third, market transparency should be increased to mitigate uncertainty about counterparty risk and to detect market manipulation and insider trading. However, increased market transparency is a double-edged sword, and one must distinguish between transparency for regulators and transparency for market participants, as the latter may have negative effects on market liquidity if it is inappropriately implemented.

Fourth, the alignment of incentives in the case of an originate-and-distribute model could be improved through loss piece retention by the loan originator, which requires the originating bank to retain a minimum percentage of a loan unhedged on its books. This increases the bank's own exposure and, thus, internalizes to a certain extent the externalities that may otherwise be caused through morally hazardous behavior.

With regard to future research, a pressing question that remains open is whether the CDS market caused some of the current market turmoil or whether the CDS market was merely an efficient information transmitter that rapidly incorporated information. Therefore, further research is needed to determine whether the CDS market has contributed to price distortions, increased volatility and negative spillover effects in the underlying cash bond markets. Furthermore, a whole new set of regulatory initiatives is under way, and it will be highly relevant to analyze the impact of those initiatives both theoretically as well as empirically.

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III THE IMPACT OF CENTRAL COUNTERPARTIES ON CDS MARKET PARTICIPANTS

1 Introduction

In the wake of the recent financial meltdown, over-the-counter (OTC) derivative markets, in particular the credit default swap (CDS) market, are being blamed for exacerbating the crisis through excessive risk taking and limited market transparency.³⁸ A case in point is the collapse of AIG, which was the dominant protection seller in the CDS market and possessed large outstanding unhedged positions. In 2008, the insurance company had to be bailed out by the US government because it was regarded as too big and too interconnected to fail as part of the complex chains in the OTC derivative markets.

Due to concerns over the role of OTC derivative markets during the recent financial crisis, the G-20 leaders agreed on the following at a summit in Pittsburgh in September 2009:

“All standardized OTC derivative contracts should be traded on exchanges or electronic platforms, where appropriate, and cleared through central counterparties by end 2012 at the latest” (G-20 2009, 9).

The implementation of the G-20 declaration is currently under way at the European level and is expected to come into effect at the beginning of 2013. As a result of these post-crisis regulatory initiatives, the importance of central counterparties (CCPs) has increased considerably, which significantly affects OTC derivative markets such as the CDS market. According to a survey by PricewaterhouseCoopers (2012), market participants expect decreasing volumes and increasing costs for trading derivatives. The survey further shows, however, that a large fraction of survey respondents has not begun implementing the regulatory requirements. The purpose of this paper, therefore,

³⁸ For a detailed analysis how CDSs have contributed to the current financial crisis see Stulz (2010).

is to analyze the design of central counterparties in the European CDS market and their impact on market participants.

Thus far, the relevant literature has focused mainly on the impact of the introduction of CCPs on OTC derivative markets in general and has compared the effects of CCPs with other clearing alternatives. For instance, Bliss and Steigerwald (2006) analyze how the clearing and settlement structures of different clearing alternatives affect the functioning of financial markets. Since the breakout of the recent financial crisis and the subsequent quest for tighter regulation of OTC derivative markets, the literature has focused predominantly on the macroeconomic implications of CCPs and the issues associated with the introduction of CCPs. Pirrong (2011) discusses how CCPs are structured and the impact that the increased use of CCPs will have on the financial system. Kiff et al. (2010) discuss key policy issues related to the introduction of CCPs in OTC derivative markets, and Milne (2012) examines the costs and benefits of introducing CCPs in OTC derivative markets.

With respect to the CDS market, the literature on central counterparties is rather limited. Cecchetti, Gyntelberg and Hollanders (2009) consider how CCPs address financial stability issues in OTC derivative markets and discuss regulatory challenges related to CCPs in the CDS market. In an influential paper by Duffie and Zhu (2011), they examine the netting benefits of central clearing and whether the introduction of a CCP for a specific asset class such as CDSs increases or reduces counterparty exposure. Cont and Kokholm (2011) expand the analysis by applying a wider set of assumptions.

Relative to these papers, the main contribution of this paper is to provide the reader with an analysis of the status quo of CCPs in the European CDS market and to examine the impact of CCPs' current design on market participants. In doing so, I focus on three essential design elements: (1) market infrastructure, (2) risk management and financial resources and (3) ownership, governance and regulatory oversight. This paper offers crucial insights for CDS market participants in understanding how they are affected by the introduction of central counterparties and provides them with an analysis of the major differences between the three CCPs in the European CDS market.

2 Intended Benefits and Status Quo

The problem of counterparty risk inherent in the CDS market became particularly apparent during the recent financial crisis.³⁹ Historically, the CDS market has been a decentralized market in which participants trade and clear contracts bilaterally. Therefore, similar to other OTC derivative markets, the CDS market entails long and complex chains of unknown counterparty risk that prove to be problematic in times of financial distress because the transfer of risk in an OTC market assumes that all parties along the chain perform their contracts. In case a chain link fails, systemic risk may increase as the counterparties become more and more likely to default in a chain reaction, creating a so-called domino effect. This outcome may further lead to a liquidity dry-up due to a lack of transparency among market participants in assessing counterparty risk exposure in the opaque web of an OTC market.⁴⁰

In contrast to other OTC markets, counterparty risk in the CDS market was even more pronounced before the introduction of central counterparties due to a high concentration and interconnectedness among dealers as well as due to the binary nature of a CDS that gives rise to jump-to-default risk. The high concentration in the market around a few large players is best illustrated by the fact that by September 30th 2008, the American insurance company AIG had sold a notional amount of credit derivatives that was almost double the net notional amount sold by all other major dealers combined (ECB 2009). Since CDS contracts can experience large jumps in market value in a run-up to default or when a CDS is triggered by a credit event, the protection seller is particularly vulnerable to a capital strain, which might lead to the possible failure of the protection seller to honor its obligations, making the CDS market prone to contagion and systemic risk. A further characteristic of the CDS market is the interconnectedness among a small group of major market dealers as well as the high degree of “wrong-way risk” in the market.⁴¹ “Wrong-way risk” is best illustrated by the fact that according to data by the DTCC (Depository Trust and

³⁹ Counterparty risk reflects the risk of holding a contract with a counterparty that could potentially fail to fulfill its obligations when they become due (Duffie, Li, Lubke 2010).

⁴⁰ Brunnermeier and Pedersen (2009) show that the evaporation of funding liquidity and market liquidity may further lead to margin- and loss-spirals, reinforcing each other, where speculators are forced to sell, causing large price drops as experienced during the recent financial crisis.

⁴¹ “Wrong-way risk” is defined as the risk that the credit quality of the reference entity is correlated with the counterparty’s willingness or ability to pay.

Clearing Corporation), six of the major dealers were among the top ten non-sovereign reference entities at the end of July 2009, thereby making the CDS market extremely vulnerable to a default by a major dealer. It is important to note that “wrong-way risk” is even more pronounced in the CDS market in times of uncertainty about counterparty risk because dealers and other market participants try to protect themselves against the default of their counterparties by buying CDSs (Brunnermeier 2009). This rational behavior on a micro-level, however, increases the network complexity, concentration and “wrong-way risk” in the CDS market even further.

As a result of the inherent counterparty risk in the CDS market, the focus of regulatory attention has been on the introduction of central counterparties (CCPs) to mitigate counterparty risk and the associated risks of contagion and financial instability. A central counterparty (CCP) is an independent legal entity that serves as a clearinghouse in order to replace the bilateral contracts between the two initial counterparties, acting as a seller to every buyer and as a buyer to every seller. As illustrated in Figure 12, the original OTC trade is still negotiated between the initial counterparties but is then replaced by new contracts between the CCP and each of the contracting parties (Cecchetti, Gyntelberg, Hollanders 2009). Consequently, the CCP becomes the sole counterparty for all other market participants and concentrates the counterparty risk in a central location.

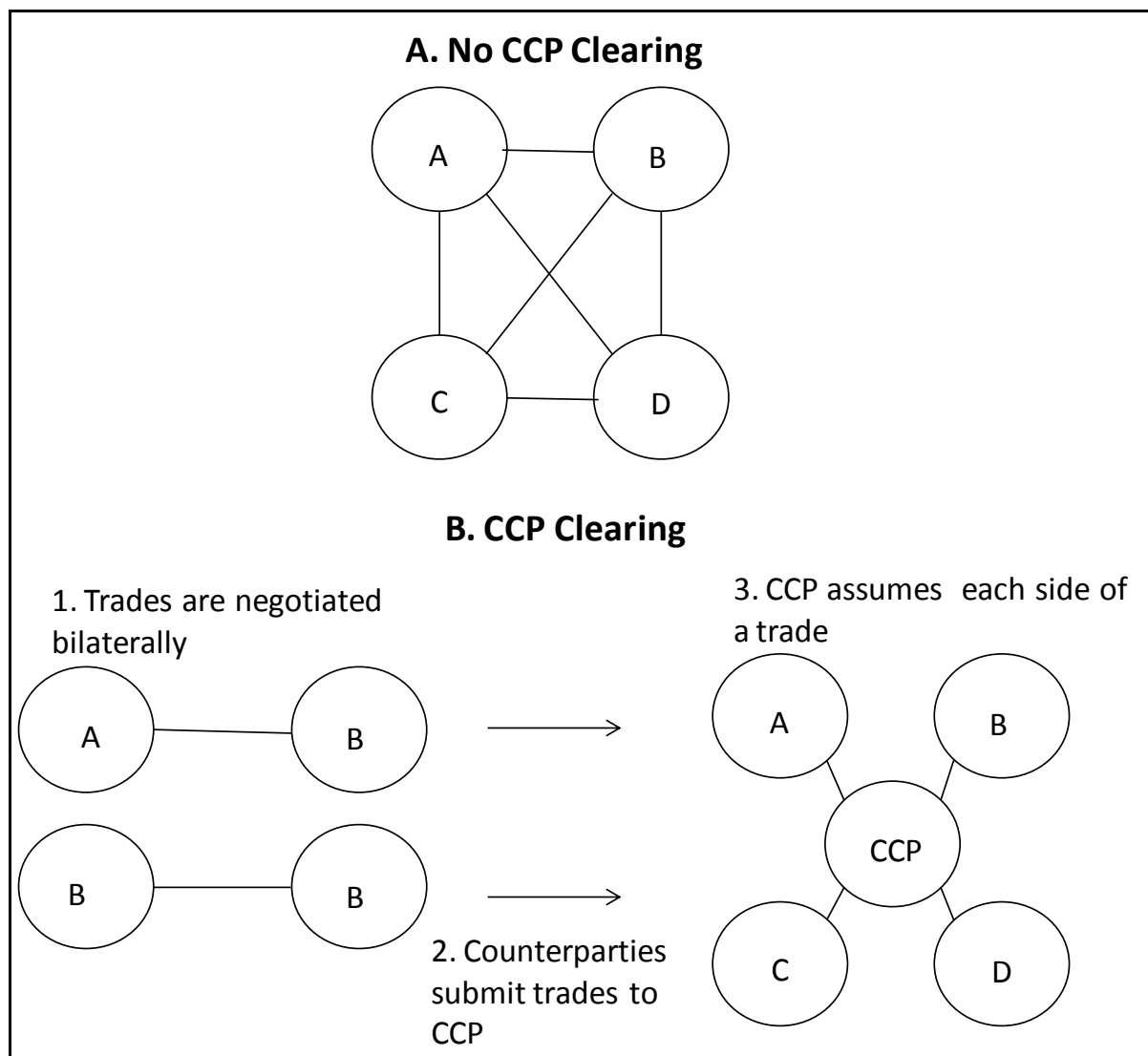


Figure 12: Bilateral and Central Counterparty Clearing⁴²

In general, the regulatory initiative of central counterparty clearing intends to create three main benefits. First, centralized clearing facilitates the management of counterparty risk and acts as a break on interconnectedness, thereby mitigating the risk of a chain reaction once a systemically important financial institution has failed (Scott 2010). Second, a CCP facilitates multilateral netting of exposures and payments among its clearing members. Third, it helps to increase transparency by providing information on market activity and exposures (i.e., prices and quantities to regulators and, to some extent, to the public) (Cecchetti, Gyntelberg, Hollanders 2009).

⁴² Based on Duffie, Li, Lubke (2010).

It is important to note, however, that the CCP itself poses a systemic risk to the financial system because it concentrates the counterparty risk of all its clearing members. Therefore, the design and organization of a CCP becomes a crucial element for regulators and market participants from a financial stability perspective.

As of the end of 2011, there are three entities acting as CCPs for the European CDS market: Eurex Credit Clear, ICE Clear Europe and LCH.Clearnet SA. As of end-June 2011, the Bank for International Settlements (BIS) estimated that CCPs were counterparties to a notional amount of \$5.5 trillion, or 17% of outstanding CDS. These figures represent an increase of 83% from end-June 2010 with a notional amount of \$3 trillion, or 10% of outstanding CDS cleared by CCPs. Table 6 further shows that a higher proportion of multi-name CDSs, in particular CDS indices and index tranches, are held with CCPs rather than single-name CDSs, which reflects the greater acceptance of CDS indices by CCPs as a result of superior liquidity. The higher proportion of CDS indices cleared by CCPs may also partly explain the lower market share of 6.4% in terms of market values because indices demonstrate lower price volatility compared to single-name CDSs (Vause 2010).

Table 6: Proportion of Outstanding CDS with CCPs⁴³

Proportion of Outstanding CDS with CCPs				
By notional amounts and gross market values (as of end-June 2011)				
	Type of CDS	Total outstanding (\$ trillions)	With a CCP (\$ trillions)	Proportion with CCPs (in per cent)
Notional amounts	All	32.4	5.5	17.0
	Single-name	18.1	2.2	12.2
	Multi-name	14.3	3.3	23.1
Gross market values	All	1.4	0.09	6.4
	Single-name	0.9	0.05	5.6
	Multi-name	0.5	0.04	8.0

The role of CCPs has been further strengthened due to new regulatory initiatives, which are a result of the G20 commitment at the Pittsburgh summit in 2009 on OTC

⁴³ Source: BIS

derivative markets. The European Market Infrastructure Regulation (EMIR) has been designed to complement market infrastructure regulations in Europe.⁴⁴ EMIR, which is expected to be implemented from beginning of 2013 onwards, aims to reinforce the role played by CCPs in the OTC derivatives market by making clearing through CCPs mandatory for *eligible* OTC derivatives. The clearing obligation applies in general to “financial counterparties” as well as “non-financial counterparties”.⁴⁵ Furthermore, EMIR aims to define stringent requirements on CCPs’ risk management, conduct of business and organization as well as to increase the transparency in the OTC market by requiring detailed information on *every* OTC derivative transaction, which must be reported to trade repositories that are accessible for supervisory authorities. The classification of *eligible* OTC derivative contracts is determined by the European Securities and Markets Authority (ESMA) which is tasked by the European Commission to make a proposal by September 30, 2012. The ESMA will apply the following criteria to classify OTC derivatives as eligible for clearing: the degree of standardization of the contract, liquidity and volume of contracts as well as availability of fair, reliable and generally accepted price information (European Commission 2012). According to a survey among market participants by Adsatis in 2010, most participants believe that the vast majority of CDSs (indices and major single names) will be required to clear through CCPs.

With respect to the design and main characteristics of the three European CCPs for CDS, the following tables provide a comprehensive overview of the status quo as of May 2012:

⁴⁴ Other important regulations at the European level are the Markets in Financial Instruments Directive (MiFID) and the European transposition of the Basel III capital requirements, the Capital Requirements Directive IV (CRD IV).

⁴⁵ Non-financial counterparties may be exempted from the clearing obligation if the sum of their derivative position in a derivative class does not exceed a certain threshold that is yet to be specified by ESMA.

Table 7: Design of CCPs for CDS - General Characteristics and Membership Requirements⁴⁶

	Eurex Credit Clear	ICE Clear Europe	LCH.Clearnet SA
Headquartered in	Frankfurt	London	Paris
Launch	July 2009	July 2009	March 2010
Products	itraxx indices and 16 single-names	42 itraxx indices and 121 single-names	itraxx indices only
Gross Notional cleared since launch (billions)	n/a	Index: € 8,032; Single-names: € 1,269	Index: € 59
Open Interest (billions)	Index: € 0.085; Single-names: € 0.010	Index: € 183; Single-names: € 384	Index: € 4.6
Number of clearing members	2	16	9
General requirements for clearing members	Domiciled in EU, Switzerland or US; regulated entity; fulfill capital requirements; contribution to CDS Guaranty Fund; must have adequate systems and operational support in place	Have a credit rating of at least "A"; fulfill capital requirements; have adequate technical and operational systems in place; contribution to Guaranty Fund; member of industry organization such as ISDA or DTCC Deriv/Serv	Credit institutions and investment firms rated single "A" or higher that meet capital and liquidity requirements; contribution to Guaranty Fund; have the appropriate operational capability; personnel and software systems in place
Capital requirements	Each clearing member must have and maintain a minimum of € 1 bn of Tier 1 equity capital	Each clearing member must have and maintain \$ 5 bn of Tier 1 equity capital	Each clearing member must have and maintain € 3 bn of capital

Among the three European CCPs for CDS, which are headquartered in Frankfurt, London and Paris, ICE Clear Europe (hereafter: ICE Europe) is the market leader in terms of market share by having cleared a gross notional volume of more than € 8 trillion index-products and € 1.2 trillion single-names since its launch in July 2009. In addition, ICE gained the strongest support by market makers because its 16 clearing members consist entirely of major dealers in the European CDS market.⁴⁷ LCH.Clearnet has recently launched an initiative to promote its clearing service, which

⁴⁶ Sources Table 8 and Table 9: ISDA Survey (2010), ISDA questionnaires for Eurex, ICE Europe and LCH. Clearnet (2009), Eurex Credit Clear (2012), ICE Clear Europe (2012) and LCH.Clearnet (2012), LCH.Clearnet Clearing Rulebook (2012).

⁴⁷ The clearing members are: Bank of America, Barclays, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, JP Morgan, Merrill Lynch, Morgan Stanley, Nomura, Societe Generale, RBS, UBS and Unicredit.

is backed by nine of the largest derivatives dealers, intending to increase competition and to capture a significant market share in the CDS market (Stafford 2012). In terms of cleared products, all CCPs focus on standardized and mainly liquid products, such as itraxx indices and major European single-name reference entities. ICE Europe offers the widest range of products with 42 itraxx indices and 121 single-names.

With respect to membership requirements, the CCPs set high standards that must be fulfilled. In addition to the general requirements that vary among the CCPs, such as a high credit rating or being a regulated entity, the members of all CCPs must fulfill certain capital requirements, contribute to the Guaranty Fund and have adequate technical and operational systems in place. The capital requirements for clearing members vary significantly among the three CCPs, from a minimum of EUR 1 billion of Tier 1 equity capital (Eurex) up to USD 5 billion of Tier 1 equity capital (ICE Europe).

To protect themselves against counterparty risk, the CCPs require posting a margin for every transaction. As shown in Table 8, margin requirements consist of an initial margin and a variation margin. The initial margin accounts for specific risk characteristics of the CDS contract, such as jump-to-default risk or concentration risk, whereas the variation margin accounts for the changing market value of the position held. Margins are calculated on a daily or intra-day basis if necessary.

Table 8: Design of CCPs for CDS - Collateral Requirements and Risk Management

	Eurex Credit Clear	ICE Clear Europe	LCH.Clearnet SA
Margin requirements	Initial margin+Variation margin; Calculation of Initial Margin accounts for jump-to-default risk of CDS (for protection seller only) as well as fat tail risk and liquidity risk	Initial margin+Variation margin, Calculation is based on portfolio margin approach that accounts for jump-to-default risk and captures co-movements among CDS products, liquidity risk as well as concentration risk	Initial margin+Concentration risk margin+Credit event margin (for protection seller only)+Variation margin
Margin movement	Daily mark to market and possible intra day margin call	Daily mark to market and possible special intra day margining	Daily mark to market and possible intra-day margining if necessary
Accepted Collateral	Cash collateral in EUR, CHF, USD, GBP and secure, liquid and accessible securities	Cash collateral in USD, EUR and GBP; non-cash collateral include UK, French, German, US, Belgian and Netherlands government bonds (subject to different haircuts)	Cash collateral in EUR, USD and GBP; non-cash collateral include UK, French, German, US, Belgian, Dutch, Italian, Spanish and Portuguese government bonds (subject to different haircuts)
Guaranty Fund	Minimum contribution of € 50 mn per member to separate CDS Guaranty Fund; cash collateral and eligible securities are accepted	Separate CDS Guaranty Fund: \$ 2,697 mn in total; fund expected to cover simultaneous default of 3 largest single name exposures of clearing members; guaranty fund is dynamically adjusted according to positions held, market movements and volume cleared; cash collateral accepted only	Separate CDS Guaranty Fund, fund should cover a theoretical loss equal to a default of the two clearing members with the highest uncovered risks; minimum contribution of € 10 mn cash collateral per member
Risk buffers	Position limits, Margins, Guaranty Fund, Reserve Fund of Eurex Clearing, transfer of remaining positions to non-defaulting clearing members, Eurex Clearing equity capital	Margins, Guaranty Fund, non-defaulting clearing members	Margins, Defaulter's own Guaranty Fund contribution, Remaining Guaranty Fund, LCH.Clearnet SA's own capital
Netting	Multilateral netting and cross product margining within CDS asset class; No cross-asset margining offered	Multilateral netting and cross margining between CDS products; No cross-asset margining offered yet	Multilateral netting and cross margining between CDS products offered; a multi-jurisdictional cross-asset margining is planned

In terms of risk management procedures, each CCP is required to establish a separate CDS Guaranty Fund, which is funded by the CCP and its clearing members. The Guaranty Fund provides an additional line of defense in case a defaulting clearing member generates losses in excess of the margins posted. The design and size of the Guaranty Fund, as well as the minimum contribution by each clearing member, varies among the different CCPs.

The collateral accepted by the CCPs consists of cash collateral and liquid non-cash collateral, such as government bonds, that are subject to different haircuts according to the credit standing of the specific country. Furthermore, CCPs offer multilateral netting for each product as well as cross product margining (i.e., single-name CDS positions can be netted with CDS index positions). However, positions and margins cannot be netted across asset-classes.

With regard to the ownership structure, all CCPs for CDS are held privately. Eurex and, most recently, LCH.Clearnet are held by stock exchanges, whereas the parent company of ICE Europe, the IntercontinentalExchange (ICE), is listed on the NYSE. Thus, all CCPs are profit-oriented organizations.

Table 9: Design of CCPs for CDS – Ownership and Regulatory Oversight⁴⁸

	Eurex Credit Clear	ICE Clear Europe	LCH.Clearnet SA
Ownership	Ultimate Owner: 50% Deutsche Börse AG and 50% SIX Swiss Exchange	Owned by IntercontinentalExchange (ICE); ICE is listed on New York Stock Exchange with 87% held by institutional investors; largest shareholders are: T. Rowe Price, Macquarie Group, Sands Capital Management	Operating entity of LCH.Clearnet Group; 83% of shares are owned by its users and 17% are owned by exchanges; London Stock Exchange is expected to takeover 60% of LCH.Clearnet Group by end of 2012
Regulatory Authority	Supervised by German Federal Bank and Federal Financial Supervisory Authority (BaFin) and recognized by FSA as Overseas Clearinghouse	Supervised by the Financial Service Authority (FSA) in UK	Supervised by regulatory authorities (market regulators and central banks) of France, Netherlands, Belgium and Portugal (so called regulatory college)

⁴⁸ Source: ISDA Survey (2010), Eurex Credit Clear (2012), ICE Clear Europe (2012) and LCH.Clearnet (2012)

The CCPs are supervised by the regulatory authorities of the country where the CCP's headquarters is located with the exception of LCH.Clearnet, which is currently supervised by a regulatory college, comprising regulatory authorities of France, the Netherlands, Belgium and Portugal.

3 The Impact on Market Participants

To distinguish between different market participants in the CDS market, I follow the definition by EMIR, which distinguishes between “financial counterparties” and “non-financial counterparties”.⁴⁹ Under EMIR, financial counterparties include credit institutions, insurance and reinsurance companies, investment firms, alternative investment funds, UCITS funds and pension funds. Within the group of financial counterparties, I further distinguish between clearing members of CCPs that directly clear with the CCP and non-clearing members, or so-called “clients”, which have no direct relationship with the CCP and clear their trades through a clearing member. Non-financial counterparties that are required by EMIR to centrally clear are not financial counterparties whose OTC derivative position within a specific class of derivatives exceeds a certain threshold that is yet to be specified by ESMA. Non-financial counterparties are, in general, non-clearing members.

To measure the impact of CCPs on market participants, I apply the following two criteria: efficiency and financial stability. Efficiency is defined as the efficiency in terms of collateral used as well as the efficiency of the distribution of risk among market participants. The efficient use of collateral and the distribution of risk are crucial for market participants because collateral is costly and risk should be borne by market participants who are best capable of bearing it to avoid excessive risk taking that may cause negative effects in the long-run. Financial stability is defined “as a condition in which the financial system (...) is capable of withstanding shocks and the unraveling of financial imbalances” (ECB 2011). In this context, I examine in particular the stability and functioning of the CDS market and the impact of CCPs on systemic risk.⁵⁰ As the recent financial crisis has illustrated, financial stability plays a

⁴⁹ In contrast to EMIR, the Dodd-Frank Act in the US distinguishes between market participants based on their role in the CDS market as dealers, major participants or end-users (Peterman, Tarbert and Weil 2010).

⁵⁰ Systemic risk is the risk that the failure of an important market participant can cause, or significantly contribute, to the failure of other market participants and the risk that an exogenous shock may simultaneously

crucial role for the functioning of financial markets, and the overall economy and the absence of stability may cause large negative repercussions on market participants.

It should be noted that the two criteria are not independent of one another. For instance, the inefficient distribution of risk can pose a risk to the stability of the financial system, and the absence of financial stability may cause the inefficient allocation of collateral.

3.1 Market Infrastructure

There are two possible clearing models that determine the market infrastructure. The first model is the gross-clearing model where all market participants clear directly with the CCP and place their margins with the designated clearing house. The second possibility is the net-clearing model, which is the current setup for the CDS market. As illustrated in Figure 13, this model consists of clearing members that clear directly with the CCP and non-clearing members, or so-called clients, which clear their trades via a clearing member. Clearing members place their margins directly with the CCP, whereas clients' margins are either placed with the CCP or with the clearing member.

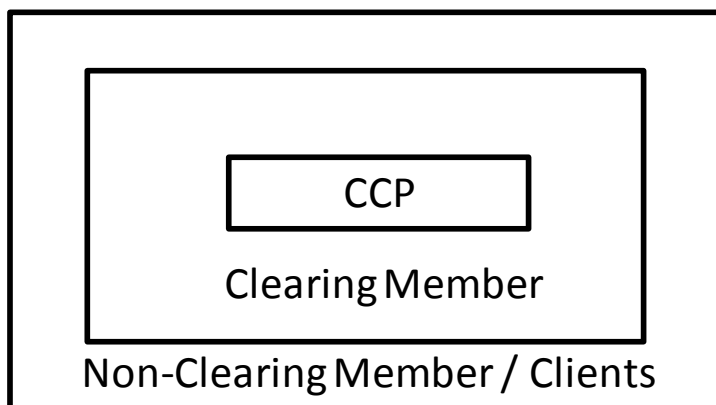


Figure 13: Market Infrastructure with Net-clearing

To become a clearing member CCPs have stringent membership requirements as shown in Table 7 that must be fulfilled. CCPs view these access restrictions as a central component to managing their risk exposure, which helps them to filter out market participants who fail to meet the standards for creditworthiness or minimum

capital requirements or do not have adequate technical and operational systems in place (Bliss and Steigerwald 2006). These access restrictions are an important tool for a CCP's risk management. Lowering the standards would not only allow access for participants with a lower credit standing and smaller equity capital, which implies a higher default risk, but their membership would also pose a risk to the CCP and all of its members because their failure would put the entire system at risk.⁵¹ Furthermore, access restrictions enable CCPs to limit the number of clearing members, which permits them to reduce their exposure to a manageable number of participants they are able to monitor.

The stringent membership requirements, however, have also had less desired effects because only few market participants are capable and have the resources to meet the requirements. The clearing members of all three CCPs for CDS currently consist exclusively of major market dealers. Therefore, all non-clearing members have to clear their trades with one of the clearing members. This effect is especially noteworthy in the CDS market because it will not contribute to a reduction of the already high concentration among market participants, but will instead reinforce concentration risk. Therefore, the high entry barriers in terms of membership requirements set by the CCP have, on the one hand, a positive impact on the financial stability by increasing the creditworthiness of clearing members; however, on the other hand, these barriers increase concentration risk by strengthening the position of major dealers (Das 2010). It is therefore in the interest of major dealers to opt for strict membership requirements to sustain their dominant position, which will in turn weaken the position of smaller dealers and brokers who might not be able to meet the CCP's membership requirements.

A further issue of concern with respect to the market infrastructure is the optimal amount of CCPs that should be used to clear OTC derivatives. In an influential paper by Duffie and Zhu (2011), these authors make the case that the introduction of central clearing can reduce netting-efficiency for market participants, leading to a higher

⁵¹ A good example of what happens when a large group of weak market participants joins a market is the mortgage sector in the US and the resulting subprime crisis that eventually led to the current financial crisis. In a speech in 2007 Bernanke stated: "The expansion of subprime mortgage lending has made homeownership possible for households that in the past might not have qualified for a mortgage (...) minority households and households in lower-income census tracts have recorded some of the largest gains in percentage terms." Consequently, the high vulnerability of financially weak households led eventually to dramatic sales in the housing market and a plunge in housing prices that affected the entire market.

average counterparty exposure and an increase in collateral demands compared to bilateral trading. When introducing a CCP for a certain asset class such as CDS, there is, in general, a tradeoff between two opposing effects: the possibility of multilateral netting across market participants in a single asset class resulting in increased netting-efficiency and a decrease in collateral requirements versus a loss in bilateral netting across different asset classes resulting in a loss of netting-efficiency and an increase in collateral requirements. Hence, Duffie and Zhu (2011) argue that the introduction of a CCP for CDS is effective only if the benefits of multilateral netting dominate the loss in bilateral netting. This tradeoff can best be illustrated by a stylized example as shown in Figure 14.

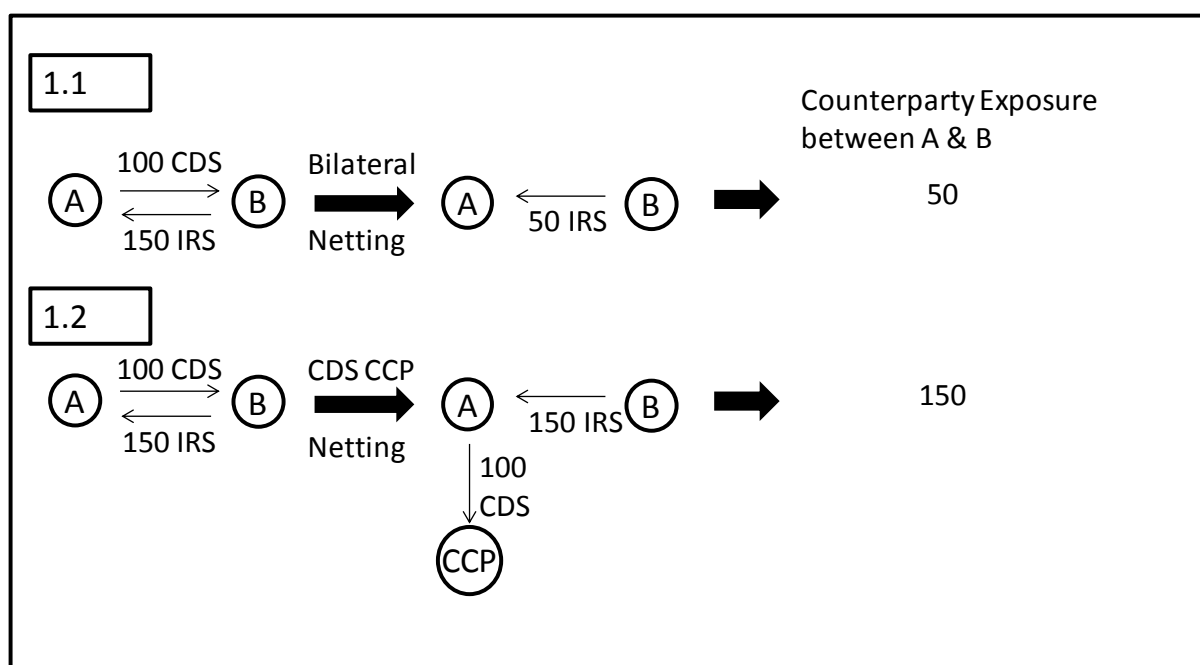


Figure 14: Netting Efficiency with and without a CCP (I)⁵²

Counterparty A is exposed to counterparty B by 100 million EUR on CDS and counterparty B is, at the same time, exposed to counterparty A by 150 million EUR on interest rate swaps (IRS). When netting the positions bilaterally in scenario 1.1, B is exposed to A by 50 million EUR. With the introduction of a CCP for CDS in scenario 1.2, however, the bilateral netting effect across asset classes is no longer possible, resulting in an exposure of 150 million EUR between A and B, which leads to higher collateral requirements. Hence, the introduction of a CCP in this example creates a loss

⁵² Source: Based on Duffie and Zhu (2011)

in bilateral netting that dominates the potential benefit of multilateral netting.

In contrast to the previous example, Figure 15 provides an example where the multilateral netting effect dominates bilateral netting and the introduction of a CCP for CDS reduces the total exposure between the counterparties.

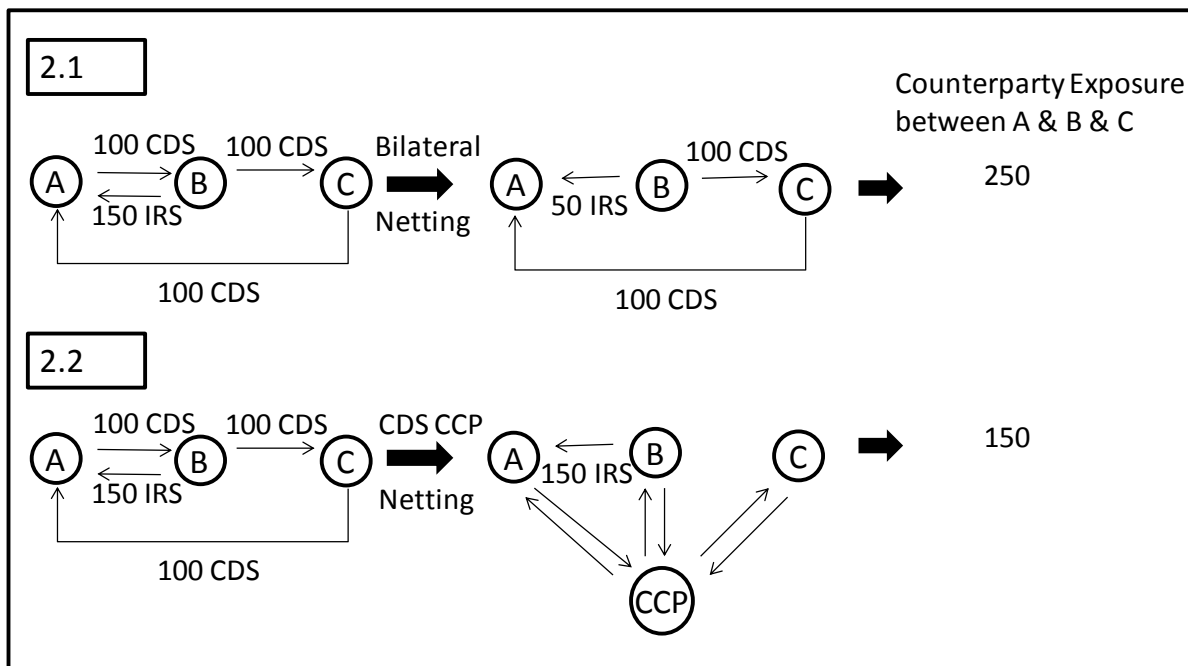


Figure 15: Netting Efficiency with and without a CCP (II)⁵³

As in the previous example, counterparty A is exposed by 100 million EUR on CDS to counterparty B, whereas B is exposed to A by 150 million EUR on IRS. In addition, B is exposed to C by 100 million EUR on CDS and C is exposed by the same amount on CDS to A. Here, the introduction of a CCP can eliminate the unnecessary circle of exposures in CDS through multilateral netting as shown in scenario 2.2, and the benefit of multilateral netting dominates the loss in bilateral netting because the exposure between the counterparties is reduced to 150 million EUR compared to the 250 million EUR with bilateral netting in scenario 2.1.

In general terms, according to the model by Duffie and Zhu (2011), the introduction of a CCP for CDS increases netting efficiency and reduces average expected counterparty exposure only in comparison to the base case of bilateral netting if the following condition holds:

⁵³ Source: Based on Duffie and Zhu (2011)

$$R > \frac{2\sqrt{N-1}}{N-2}, \quad (14)$$

where N is the number of CCP clearing members and R is the ratio of a typical clearing member's pre-CCP expected exposure with a given counterparty in CDSs to the total expected exposure with the same counterparty in all other derivative classes combined. R is defined as the following:

$$R = \frac{E[\max(X_{ij}^k, 0)]}{E[\max(\sum_{k < K} X_{ij}^k, 0)]}, \quad (15)$$

where $\max(X_{ij}^k, 0)$ is the exposure of counterparty i to j in derivative class k . Duffie and Zhu (2011) assume that all (X_{ij}^k) are of the same variance and are independent across asset classes and pairs of counterparties.

As an example, I take the case of $N=16$, which is the current number of clearing members of ICE Europe, and I assume further that ICE Europe is the only CCP for clearing credit default swaps. Applying these assumptions to equation (14), clearing CDS through a CCP improves netting efficiency only compared to the base case scenario, where all derivatives are bilaterally netted, if the fraction of a typical entity's expected exposure in CDS is greater than 55.3% of the total expected exposure of all remaining bilaterally netted derivative classes. To give an approximation of the current situation, as of the end of 2011 the CDS market accounted for only 6.1% of the remaining derivative classes in terms of gross market values (BIS 2012). In addition, central clearing in the CDS market is fragmented through the existence of several CCPs globally and dominated by five major dealers, which further reduces the multilateral netting benefit of central clearing in comparison to bilateral netting and leads to a threshold that is even higher than the 55.3% calculated above.

The derived results from equation (14) should however be handled with care because approximately half of all interest rate swaps (IRS) are currently centrally cleared. Since IRS account for 73% of all OTC derivatives outstanding in terms of gross market values, the bilateral netting effect across derivative classes is significantly reduced, which in turn lowers the threshold size calculated above that justifies the introduction of a CCP for CDS compared to bilateral netting.

Furthermore, Cont and Kokholm (2011) show that the netting efficiency of a CCP derived by Duffie and Zhu (2011) depends largely on their assumption of independent

and homogenous exposures across derivative classes. When assuming a positive correlation of exposures and heterogeneity of riskiness across derivative classes, the introduction of a CCP for CDS becomes more beneficial in comparison to bilateral netting. Empirical findings indicate a higher volatility of CDS compared to other derivative classes, such as IRS, which has a positive effect on CCP's netting efficiency as discussed by Cont and Kokholm (2011). In terms of correlation of exposures across derivative classes, CDSs are often used by dealers to hedge against counterparty risk in other derivative classes. It is therefore reasonable to assume a *negative* correlation of exposures between CDS and other derivative classes, which benefits bilateral netting relative to central clearing. Hence, it is not clear whether the benefits of centrally clearing CDS are significantly increased when taking into account heterogeneity of risk and correlation of exposures across derivative classes.

Even though the introduction of a separate CCP for CDS seems to be debatable from a netting efficiency point of view, it is unambiguous that the optimal solution in terms of netting efficiency is a single CCP clearing all classes of derivatives on a global scale as shown by Duffie and Zhu (2011), Cont and Kokholm (2011) and Heller and Vause (2012). In this case, a single CCP combines the benefits of multilateral and bilateral netting and increases netting efficiency significantly. Furthermore, for the case of a separate CCP for CDS, it is always more efficient to have one CCP clearing all CDS globally compared to the case where each geographical region, such as Europe, the US and Asia, clears CDS separately. The current situation, however, provides evidence that central clearing of CDS is fragmented on a global scale because the different jurisdictions do not want to lose influence and oversight of their CCPs. This political dimension can also be observed within the European landscape, where three different CCPs for CDS exist, headquartered in Frankfurt, London and Paris (see Table 7).

It should be further noted that netting efficiency is not the single decision criterion that determines the optimal number of CCPs. Other criteria, such as the diversification of operational and counterparty risks and deadweight losses arising through monopolistic behavior, should also be considered when discussing the optimal number of CCPs for CDS globally.

With respect to the numerous CCPs in the CDS market and other derivative classes, netting efficiency could be improved by linking the CCPs to achieve some of the benefits of joint clearing across asset classes and jurisdictions. The interoperability of

CCPs, however, poses operational and legal challenges that must be addressed beforehand by regulators. Furthermore, Heller (2010) notes that even though the interoperability of CCPs increases netting efficiency, it also reintroduces contagion risk among CCPs, which is counterproductive in promoting financial stability.⁵⁴ Thus, there is no unambiguous decision with regard to the optimal number of CCPs when taking into account not only netting efficiency but also financial stability. Furthermore, aside from the number of CCPs, risk management and the financial resources of a CCP are also important aspects that play crucial roles in promoting financial stability. These issues will be discussed next.

3.2 Risk Management and Financial Resources

To promote financial stability, the financial strength of the CCP and a sound risk management are *condiciones sine quibus non*. Hence, the risk management design and financial resources must be robust enough to withstand extreme market shocks such as the failure of one or multiple clearing members. Therefore, CCPs have several layers of financial resources that serve as risk buffers from which they can draw in the case of an extreme-loss scenario. Here, I focus on the first two layers of financial resources, margins and the guarantee fund, and analyze some of the issues that are of concern to market participants.

Clearing members of the CCP are required to post margins for every transaction. Margins consist of an initial margin and a variation margin. The initial margin accounts for specific risk characteristics of the CDS contract, such as jump-to-default risk and liquidity risk, and the variation margin is calculated on a daily basis based on the changing market value of the position held. The recent financial crisis has shown that an increase in margin and collateral requirements can provoke substantial liquidity problems to the individual counterparties, causing negative feedback effects throughout the financial system. In a bilateral market, collateral requirements are usually negotiated between the contracting parties and are adjusted on a discretionary basis. During the recent financial crisis, the evaporation of liquidity and simultaneous demand for additional collateral were a major factor that led to the collapse of financial institutions such as Lehman Brothers and AIG (Pirrong 2009). AIG

⁵⁴ A detailed analysis regarding the interoperability of CCPs is beyond the scope of this paper. For an in-depth discussion of interoperability see Mägerle and Nellen (2011) and EuroCCP (2010).

experienced a ‘margin run’ when, as a result of its downgrade, several counterparties demanded that it had to post more collateral. AIG would have failed had the Fed had not rescued it. Thus, bilateral derivative markets have the tendency to reinforce the downward spiral of liquidity, increasing procyclicality in the financial system. The existence of a CCP in the CDS market mitigates liquidity risk for market participants through the following two factors: First, a robust and well-managed CCP lowers the uncertainty about counterparty risk in periods of market stress. Second, a CCP requires posting margins for every transaction for all its clearing members regardless of the individual credit rating. This rule-driven management of margins ensures that rating downgrades create less pressure on counterparties and the markets for the securities used as collateral. However, the rule-driven approach through uniform margin calls could also aggravate the liquidity problem for counterparties that are in financial distress because it does not allow the flexibility to adjust margins based on the situation at hand (Cecchetti, Gyntelberg, Hollanders 2009).⁵⁵

The majority of CDS market participants, however, deals not directly with the CCP, but instead must find a clearing member to act for them. These clients are still required to post a margin on their transactions with the clearing member and are therefore exposed to a potential default of the clearing member. In the case where clients lose confidence in the creditworthiness of the clearing member, a ‘bank run’ could occur if clients try to close out or novate their positions with the respective clearing member.⁵⁶ In March 2008, Bear Stearns experienced such a scenario by its hedge fund clients and other counterparties that led to the evaporation of the bank’s liquidity and eventually brought the firm down (Brunnermeier 2009).

There are two key mechanisms that can reduce the probability of a ‘bank run’ on a clearing member in an extreme situation: the segregation of clients’ margin accounts and the account portability. The segregation of clients’ margin accounts helps to ensure that margins posted by clients are not exposed to the default of a clearing member.

⁵⁵ Moreover, CCPs have the right to increase initial margin requirements on short notice, which, on one hand, increases the safety of the CCP but, on the other hand, puts additional pressure on the liquidity of the counterparties. For instance, in November 2011, LCH.Clearnet SA raised initial margins for Italian bonds, which led to the disappearance of real money investors in the market and made financing for the Italian Government very difficult (Reuters 2011).

⁵⁶ Novation of a contract is defined as transferring the position from the old counterparty to a new, unrelated counterparty so that the CDS contract remains active but one of the old counterparties is replaced by the new counterparty.

Under EMIR, two major possibilities of segregation exist. The cost-effective alternative is the so-called omnibus account, where the margins of the clearing member are segregated from the client accounts but all client margins are co-mingled in an omnibus account. With omnibus accounts, however, the clients face the risk that if one client defaults and the clearing member is not able to cover the loss, the CCP can utilize the margins of other clients in the omnibus account to meet the defaulting client's obligations. This risk can be eliminated by segregating the margins of each client in fully separate accounts. This second alternative is however more costly for a client than an omnibus account because it requires higher operational effort (Pirrong 2011).

Account portability relates to the transfer of both a client's positions and margin accounts from a defaulting clearing member to another solvent clearing member. Therefore portability reduces the potential legal complications caused by a clearing member's default and further eliminates the need to close or replace positions with the defaulting clearing member, which helps to reduce transaction costs and large price movements under stressed market conditions. Under EMIR, portability is considered to be optional. If a clearing member defaults, only at the request of the client will the CCP transfer the client's positions and margin accounts to another back-up clearing member that has been preassigned by the client. The back-up clearing member is only obligated to accept the client's position and margin accounts if "it has previously entered into a contractual relationship for that purpose" (European Commission 2010). If no back-up clearing member is assigned, the CCP is allowed to close out the client's position held through the defaulted clearing member within a predefined period specified by the operating rules of the CCP (Herbert Smith 2012). In addition, the ease of portability is linked with the degree of segregation because separate margin accounts at the client level facilitate the transfer from one clearing member to another. However, it should be noted that certain client positions might be too large and complex to be accepted by one back-up clearing member should the original clearing member default. This is particularly true if multiple clearing members would be in trouble and a small number of remaining back-up clearing members is required to assume responsibility for the clients' positions. Thus, it is likely that back-up clearing members will negotiate contracts with clients that allow them to refuse portability above a certain threshold of exposure. Furthermore, back-up clearing members face higher capital charges for the possibility that porting might actually take place. It is likely that these additional costs will be passed on, to some extent, to the clients by

way of higher fees. If no back-up clearing member is appointed by the client, however, EMIR requires that clients face higher capital charges (Zebregs 2011). Therefore, it is important for the client to analyze his situation and whether the appointment of a back-up clearing member is advisable.

Taken together, segregation and portability of clients' positions and margin accounts mitigate the costs and risks that clients face should a clearing member default. These protection mechanisms therefore help to reduce the risk of a 'bank run' on the clearing members. Conversely, these protection mechanisms reduce the incentives for clients to monitor their clearing firms because they are no longer directly affected by the default of a clearing member. This may create a moral hazard problem and, furthermore, lead to greater losses for the clearing members because risks are correspondingly greater with lower monitoring (Pirrong 2011).

Central clearing and the segregation of clients' margin accounts will also negatively affect the liquidity management of clearing members. As opposed to collateral posted in a bilaterally cleared market, margins posted with a CCP or in segregated accounts are not allowed to be rehypothecated (i.e. re-used in other transactions) by clearing members. Thus, banks and other major dealers who act as clearing members in the CDS market have to post more collateral and margins, which increases their demand for liquid assets and heightens their costs for funding liquidity (Singh 2010). The increased costs of funding liquidity may in turn affect CDS spreads in times of market stress (as shown by Brunnermeier and Pedersen (2009)) because dealers are forced to sell CDS and other derivative positions to free up liquid assets posted as margins. Furthermore, the heightened costs of funding liquidity make derivatives trading in general more costly, which may result in a loss of market liquidity.

A run on clearing members, however, is only one source of systemic risk that threatens the stability of the CDS market. Another source of instability is the CCP itself that is prone to runs due to a loss of confidence in its liquidity and/or solvency. Based on the experience of the stock market crash in 1987, Bernanke (1990) already pointed out that the performance of the CCP must never be in doubt, to avoid panic among market participants. Thus, it is crucial that the risk management and financial resources of a CCP are robust and can manage plausible, but extreme market scenarios.⁵⁷

⁵⁷ In the last decade, several failures of CCPs exemplify the vulnerability of central clearing. In 1983, the Kuala

Several risk buffers exist to increase the robustness of a CCP. One important risk buffer aside from margins is the guarantee fund, which should absorb losses that exceed margins posted by defaulted clearing members. Initial margins are typically calculated so that there is only a small probability for a price move generating losses that exceed margins posted by the counterparty. Thus, only when a clearing member incurs losses in excess of its margins does the CCP become vulnerable to a loss by a defaulting member and the second defense line, the guarantee fund, comes into force. In determining the size of the initial margin, the CCP can at least in theory establish a tail probability for which a CCP suffers losses in excess of margins posted; however, the calculation of the tail probabilities is dependent on certain parameters such as market liquidity or the interdependencies with other asset classes, which are difficult to estimate. In addition, because margins are costly and tie up liquid assets, CCPs face a trade-off between choosing margins that, on one hand, foster financial stability but, on the other, are efficient and do not limit trading activity (Pirrong 2011). Therefore, the appropriate design of the guarantee fund becomes an important task that complements the margin policy and ensures the stability of the CCP.

The guarantee fund of ICE Europe, the leading CCP for CDS in Europe, stands currently at \$ 2,697 million and is dedicated exclusively to CDS clearing. For ICE Europe, the guarantee fund “is sized to mutualise losses resulting from the potential simultaneous default of the three largest single name exposures of clearing members” (ICE 2012), whereas the funded portion of the guarantee fund of LCH.Clearnet “shall be equal to the sum of the theoretical losses caused by an event of default occurring in respect of the clearing members that are responsible for the two highest uncovered risks” (LCH.Clearnet 2012).

Liu (2010) points out that there are two ways a CDS market can contribute to systemic risk. First, when a large clearing member defaults, its counterparties become more likely to default due to the domino effect. This risk can be largely mitigated by the introduction of a CCP. Second, when one or multiple reference entities to which clearing members have large exposures default, large payments are triggered. Because the CDS market is concentrated, clearing members are interconnected and there exists

Lumpur Commodities Clearing House failed when half a dozen large brokers defaulted following a crash in palm-oil futures, and, in 1987, the Hong Kong Futures Exchange clearing house failed as a result of the global stock market crash (Tucker 2011). Furthermore, the Singapore International Monetary Exchange could only prevent a failure by borrowing \$300 million to cover any shortfall in open futures contracts associated with the default of Barings Bank (New York Times 1995).

a high degree of “wrong-way risk”,⁵⁸ the default of one or multiple large reference entities increases the correlation among clearing members. Thus, when a large amount of risk is shared among a small number of clearing members, the probability of a joint failure of *all* clearing members increases and it is difficult for a CCP to manage this second type of risk. In their respective definitions of the guarantee fund, ICE Europe accounts for the second type of risk, whereas LCH.Clearnet only accounts for the failure of the two clearing members with the highest uncovered risks. Therefore, to ensure the functioning of the CDS market even in periods of extreme market stress, CCPs should regularly reassess the size of the guarantee fund and the stress test scenarios and adapt the fund size accordingly.

The predetermined maximum number of clearing member or reference entity defaults poses however a problem, which deserves closer attention. Pirrong (2011) explains that once a large default has occurred in times of extreme market turmoil and the maximum number of defaults is fixed in advance by the CCP, doubts about the adequacy of capitalization of the guarantee fund and the CCP in general may lead to a run on the CCP with market participants trying to close out their positions. This outcome in turn may cause serious liquidity problems for the CCP and lead to high price volatility in the CDS market.

To avoid these issues, a CCP has to ensure that a recapitalization mechanism is in place when a clearing member or large reference entity defaults. The objective of external funding can be achieved by either requiring non-defaulted clearing members to provide additional capital or having access to central bank money. Pre-committed conditional capital by clearing members, however, increases the contagion effect, especially in periods of market stress due to the high contingent capital demand, which is counterproductive to the idea of a CCP to limit the exposure of market participants to counterparty risk. Moreover, the uncertainty about the amount of conditional capital that clearing members are required to provide may increase the risk of a run by clients on clearing members once a large default happens, thereby reinforcing the contagion effect (Pirrong 2011).

The second alternative, having access to central bank liquidity in periods of market stress, provides an important and reliable source of funding when a CCP faces serious liquidity problems. Since CCPs are systemically important clearing institutions that are

⁵⁸ According to data by the DTCC, six of the major CDS dealers were among the top ten non-sovereign reference entities at the end of July 2009.

considered to be “too big and too interconnected to fail”, access to emergency central bank liquidity is a necessity to alleviate the systemic risk of clearinghouses. However, an undesired result of the central bank’s role as “lender of last resort” may be a change in a CCP’s incentives, which may lead to moral hazard. Because CCPs are privately held and profit-oriented organizations, they may compromise on risk management standards and collateral requirements in case a central bank stands ready to bail them out and provide liquidity. To mitigate these incentive problems, emergency liquidity by a central bank should be collateralized by high-quality liquid securities and central banks and other regulatory authorities should play an important role in monitoring and regulating CCPs (IMF 2010).

3.3 Ownership, Governance and Regulatory Oversight

Setting the right incentives is also central to the ownership and governance of CCPs to achieve the most efficient outcome for market participants. All three CCPs for clearing CDS in Europe are held privately (see Table 9). Each CCP is governed by a board of directors and various committees. Among them the risk committee plays a pivotal role because its decisions affect the CCP’s risk management, margin setting, collateral accepted and default management procedures. ICE Europe’s risk committee, for instance, comprises up to 15 members including up to ten clearing members (ICE Clear Europe 2012), whereas LCH.Clearnet’s risk committee consists of representatives of LCH.Clearnet, representatives of clearing members and representatives of independent third parties (LCH.Clearnet 2012).

Due to the different stakeholders of a CCP, conflicts of interest may cause an inefficient outcome that risks the primary goal of a CCP to provide financial stability to the CDS market. The main stakeholders of a CCP are shareholders, direct and indirect clearing members and regulatory authorities. As Zhu (2011) asserts, because CCPs are held by private shareholders and several CCPs compete with each other, concerns are that these factors might lead to a “race to the bottom” through intensified pressure on CCPs’ risk management methodologies, threatening the financial soundness and risk mitigation capacity of CCPs. In his study, Zhu (2011) analyzes the practices of the three CCPs in the European equity market – LCH.Clearnet, EMCF and EuroCCP – but finds no evidence that the soundness of the different CCPs’ risk management frameworks has been weakened. Interestingly, however, the study finds

evidence of tariff-cutting activities as a competitive response by CCPs, which helps to increase market efficiency. With regard to clearing members, concerns are that clearing members of a CCP who act as the major dealers in the CDS market have an incentive to keep margin and guarantee fund requirements low to increase their profitability (Miller 2011).⁵⁹ Thus, the shareholders' and clearing members' objective to maximize profitability at the micro level weakens the financial stability of the CDS market at the macro level. As opposed to shareholders and clearing members, the primary objective for regulatory authorities is to safeguard financial stability and the functioning of the CDS market.⁶⁰ This phenomenon is particularly the case for central banks because they may assume the role of a "lender of last resort" if the CCP's financial stability is in doubt.

To solve these conflicts of interest, it is necessary to align the control and decision rights with the interests of those who bear the risks of a CCP. A failure of alignment would otherwise lead to inefficient outcomes and moral hazard that may force some stakeholders to bear the costs borne by others (Duffie, Li, Lubke 2010). According to the "waterfall" process of a CCP, the first loss is usually taken by the other non-defaulting clearing members through the use of the guarantee fund if a defaulting clearing member's margins and contribution to the guarantee fund are insufficient to cover its losses. An additional protection layer is provided through the shareholders' capital held by the CCP, and, as mentioned above, a central bank might stand ready as a "lender of last resort" to provide emergency liquidity to the CCP. Thus, based on the default waterfall process of a CCP, its governance structure, particularly the composition of the risk committee, should reflect these risk-bearing accountabilities.

Under EMIR, the new regulations do not impose explicit ownership and governance rules for CCPs, but call for "robust governance arrangements". In addition, "at least one-third, and no less than two, members of its board should be independent" and "clearing members and clients need to be adequately represented as decisions taken by the CCP may have an impact on them" (European Union 2012).

The current structure of ICE Europe's risk committee places a strong emphasis on the importance of clearing members, which might lead to deteriorating risk

⁵⁹ Reaching agreements between clearing members is particularly easy in the CDS market due to the small number of major CDS dealers.

⁶⁰ It should be noted that shareholders and clearing members do have an incentive to ensure financial stability which, however, conflicts with their primary objective to maximize profitability.

management standards at the expense of central banks that may be forced to bail out CCPs due to the “too big and too interconnected to fail” problem. The risk committee of LCH.Clearnet includes independent third party representatives, which is in line with current requirements by EMIR but might come at the expense of other stakeholders that are underrepresented in the decision-making process of the risk committee.

Taken together, a CCP’s primary objective is to provide financial stability that might be in conflict with the interests of its shareholders and clearing members that are profit-oriented. Thus, regulatory authorities and central banks play an important role in setting rules and incentives that ensure the financial stability of CCPs. EMIR makes a first step in this direction by introducing not only robust governance rules, but also mandatory prudential requirements such as guarantee fund contributions as well as minimum capital and liquidity requirements for CCPs.

4 Conclusion

The expansion of central clearing is currently transforming OTC derivative markets, and new regulatory initiatives such as the European Market Infrastructure Regulation (EMIR) have been designed to further strengthening the role of central clearing with the intention to create major benefits such as mitigating contagion among market participants, facilitating multilateral netting and increasing transparency. These changes will alter the financial system and have a significant impact on market participants. With respect to the European CDS market, three central counterparties exist, with ICE Clear Europe as the dominant market leader in terms of gross notional volume cleared.

The CDS market infrastructure is organized according to the net-clearing model, where only clearing members clear their trades directly with a CCP and all non-clearing members must clear their trades with one of the clearing members. Due to the high entry barriers for clearing members set by the CCPs, the position of major CDS dealers will be strengthened, thereby increasing the already high concentration risk in the CDS market.

The optimal amount of CCPs in the CDS market with respect to netting efficiency is reached when the benefits of multilateral netting across market participants still dominate the loss in bilateral netting across asset classes. Where the introduction of a

separate CCP for CDSs is at least debatable from a netting efficiency point of view, it is unambiguous that the optimal solution in terms of netting efficiency is a single CCP clearing all classes of derivatives on a global scale. Thus, netting efficiency could be improved by linking CCPs across different geographical regions and asset classes. It should be noted, however, that netting efficiency is not the single criterion in determining the optimal number of CCPs, and the primary objective for the introduction of CCPs is the improvement of financial stability. Hence, diversification of operational and counterparty risk should also be considered when discussing the optimal number of CCPs.

To increase financial stability, CCPs and clearing members must be financially robust and immune to liquidity dry-ups, which will lower the uncertainty among CDS market participants in assessing counterparty risk exposures in times of financial stress. Segregation of clients' margin accounts and account portability are two key mechanisms that serve to reduce the probability of a run on clearing members in extreme situations; however, these mechanisms carry additional operational costs that are likely passed on to clients through higher clearing fees. Moreover, in comparison to bilaterally cleared markets, the segregation of clients' margin accounts negatively affects the liquidity management of clearing members because clients' margins are not allowed to be re-used by clearing members in other transactions. This will increase the dealers' costs for funding liquidity and, in turn, make CDS trading more costly.

With respect to the CCP itself, the guarantee fund serves as an important risk buffer that should absorb losses exceeding margins posted by a defaulting clearing member. However, it is difficult for a CCP to manage the simultaneous default of several clearing members. Therefore, a CCP should regularly reassess the size of the guarantee fund and the stress test scenarios and adapt the fund size accordingly. In addition, a recapitalization mechanism should be established once a clearing member has defaulted to avoid any doubts about the adequacy of the capitalization of the guarantee fund. However, recapitalization through the provision of pre-committed capital by clearing members might reinforce the contagion effect in the CDS market, which is counterproductive to the idea of a CCP to limit the exposure of market participants to counterparty risk. Access to emergency central bank liquidity is another alternative source of funding in order to alleviate the systemic risk of central counterparties, but the potential moral hazard problem inherent with the central bank's role as "lender of last resort" should be avoided at all costs.

Aligning control and decision rights with the interests of those who bear the risks of a CCP is central to ensuring the provision of financial stability. Robust ownership and governance rules are therefore crucial to avoiding conflicts of interest between the different stakeholders, which may otherwise lead to inefficient outcomes. Thus, the governance of CCPs, in particular the composition of the risk committee, should reflect the risk-bearing accountabilities of the different stakeholders based on the default waterfall process of a CCP. EMIR takes the first step in this direction by calling for robust governance arrangements and setting explicit governance rules.

To conclude, a CCP provides several major benefits to the CDS market but is by no means a panacea, because it poses a systemic risk to the financial system due to the concentration of counterparty risk. Thus, a CCP faces a delicate trade-off between promoting and ensuring financial stability on the one hand and optimizing efficiency of the use of financial resources such as margins on the other. These objectives are not mutually exclusive, but after the experience of the recent financial crisis and the failures of “assumed-to-be safe” financial institutions such as AIG, it remains to be seen whether the primary objective of a CCP to promote financial stability will not be sacrificed for increasing the efficient use of financial resources.

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IV HOW CAN NON-FINANCIAL CORPORATIONS MAKE USE OF CREDIT DEFAULT SWAPS?

1 Introduction

Derivatives have become commonly used instruments in the armory of corporate treasurers who manage the financial risks of corporations. The increased use of derivatives is assisted by several finance theories stating that under certain market imperfections the use of derivatives can increase the value of the firm. In their seminal paper “The cost of capital, corporate finance and the theory of investment” Modigliani and Miller (1958) demonstrate that under the assumption of perfect capital markets, corporate financial decisions only affect how the firm value is divided among its claimholders but are irrelevant for the value of the firm. Smith and Stulz (1985), Bessembinder (1991) and Froot, Scharfstein and Stein (1993) go one step further and identify four major imperfections in capital markets that give rise to hedging activities by corporations: (1) expected costs of financial distress, (2) a progressive corporate tax schedule, (3) an underinvestment problem due to conflicts of interest between equity- and debtholders and (4) contracting parties of the firm require additional compensation for bearing nondiversifiable risk inherent in their claims on the firm.

These theoretical considerations are supported by a series of empirical studies which find evidence of an increase in the value of the firm by the corporate use of derivatives as a risk management tool. Consequently, corporations have made extensive use of foreign exchange (fx) and interest rate derivatives in the past. In 2011 nonfinancial firms traded notional amounts outstanding of USD 9.5 trillion fx derivatives and USD 37.4 trillion interest rate derivatives, respectively. As can be seen from Figure 16, nonfinancial firms accounted for a market share of 15% in the global OTC foreign exchange derivatives market and of 8% in the global OTC interest rate derivatives market by the end of 2011.

In contrast to these established derivatives markets, the credit derivatives market is relatively young. Credit derivatives became popular during the last decade when the market grew from USD 6 trillion in 2004 to USD 29 trillion in 2011 and it is by now the third largest OTC derivatives market –after interest rate and foreign exchange

derivatives– in terms of notional amounts outstanding.

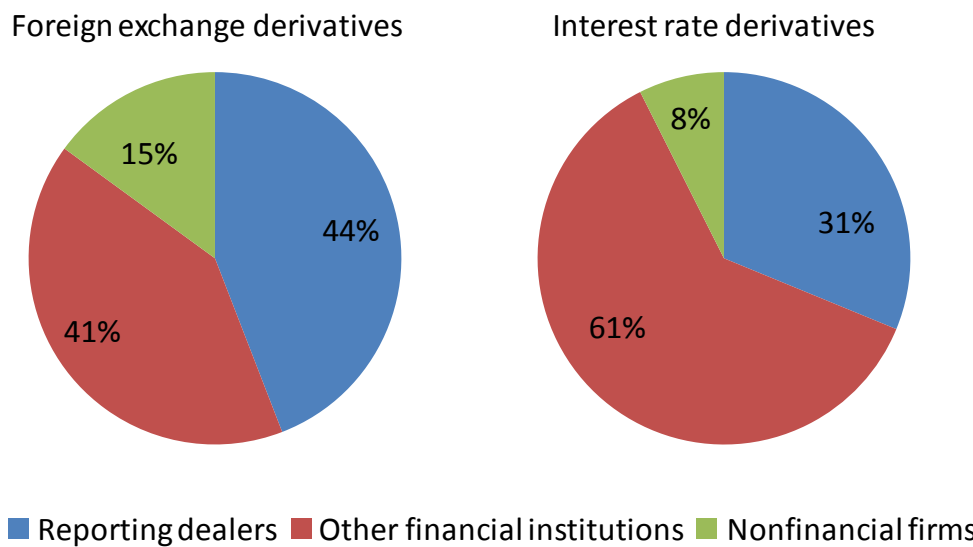


Figure 16: FX and Interest Rate Derivatives – Market Share by Counterparties⁶¹

Surprisingly, however, non-financial firms account only for a market share of 1% on a global basis or USD 200 billion of notional amounts outstanding by the end of 2011 (see Figure 17). Thus, the use of credit derivatives by nonfinancial corporations has been rather limited so far, suggesting that credit derivatives are not part of the armory of corporations to hedge their credit risk exposure.

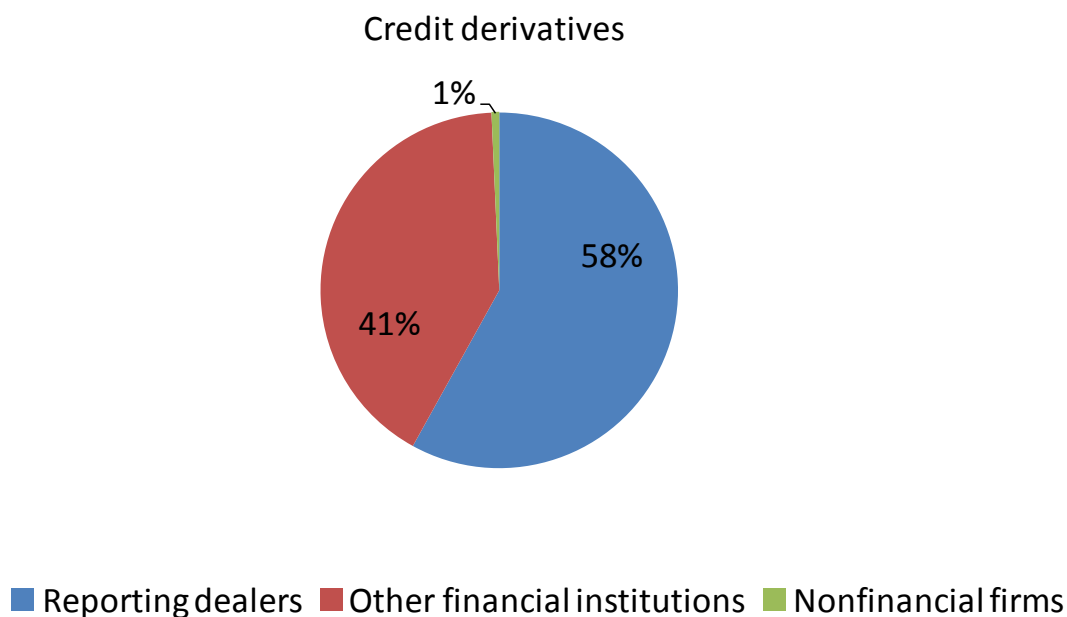


Figure 17: Credit Derivatives – Market Share by Counterparties⁶²

⁶¹ Source: BIS

This is surprising given the increased focus by corporate treasurers on credit and counterparty risk since the breakout of the recent financial crisis. For instance, the Global Treasury Survey 2010 by PricewaterhouseCoopers highlights a significant rise in the number of treasurers considering counterparty risk management as of high importance. Therefore, the questions arise why credit derivatives have not played a larger role in the risk management tool set to date and how credit derivatives could add value for non-financial firms in the future.

The existent literature on the use of credit derivatives by non-financial corporations is rather limited. To the knowledge of the author, there are in fact two studies which explicitly examine the use of credit derivatives: Freeman, Cox and Wright (2006) explore the possible uses of credit derivatives by corporate treasurers whereas Smithson and Mengle (2006) primarily discuss the reasons why the use of credit derivatives by non-financial corporations has failed.

Relative to the existent literature, the main purpose of this paper is to examine the promises and perils of credit default swaps (CDS) for non-financial corporations against the background of new regulatory requirements in the CDS market, which will be implemented from 2013 onwards. Thus, this paper offers important insights especially for decision makers of non-financial corporations such as treasurers or credit risk managers by providing them with an elaborated analysis of CDSs as a risk management tool as well as by considering the impact of a new regulatory framework on the use of these instruments.

2 The Promises and Perils of Credit Default Swaps for Non-financial Corporations

Single-name credit default swaps (CDS) and CDS indexes are the most commonly used credit derivative instruments. According to the most recent data from the Bank for International Settlements, single-name CDSs and CDS indexes accounted for 59% and 37% of total credit derivatives in terms of notional amounts outstanding by the end of 2011. CDS and CDS indexes are heavily traded by banks, securities firms and hedge funds who are the dominant players in the market. Non-financial corporations, however, make up the smallest slice in the credit derivatives market. They are primarily active in the single-name CDS segment where they account for USD 86

⁶² Source: BIS

billion of protection bought and for USD 49 billion of protection sold, thereby classifying as net protection buyers (BIS 2011).

A CDS makes it possible to transfer the credit risk of an underlying reference entity between two counterparties. Figure 18 exemplifies the mechanics of a CDS transaction: Alpha Corporation has purchased protection on Charlie Corporation (the reference entity). In turn, Beta Bank sold protection and is now long credit risk on Charlie Corporation. The protection buyer has to pay a fixed periodic premium to the seller until the end of the life of the CDS or until a predefined credit event occurs. In case Charlie Corporation suffers a credit event, the protection seller makes a payment to the protection buyer. If no credit event occurs until maturity of the CDS contract, the protection seller pays nothing.

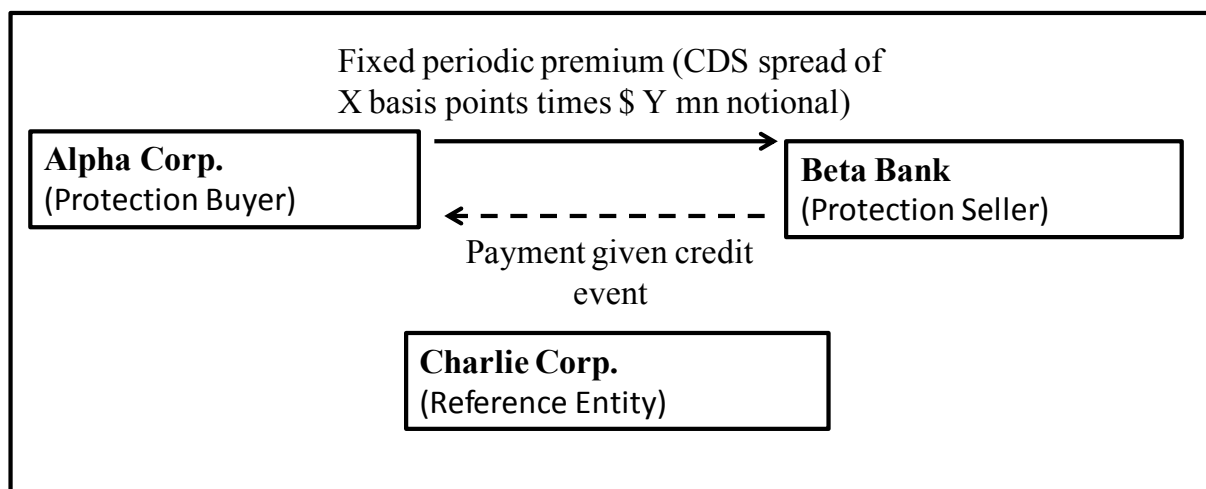


Figure 18: Mechanics of a Single-Name Credit Default Swap

Credit events are specified in the CDS contract and can include bankruptcy, failure to pay, obligation acceleration, repudiation or moratorium and restructuring. When a CDS contract is triggered by a credit event, the contract can either be physically or cash settled, which is determined upfront when the contract is entered by the counterparties. In a physically settled contract, the protection buyer has the right to sell a range of deliverable obligations to the protection seller who in turn has the obligation to pay the full face value of the obligation. In a cash settled contract, the protection seller pays the difference between face and market value of the reference obligation to the protection buyer.

The majority of CDS contracts are nowadays to a large extent standardized by the International Swap and Derivatives Association (ISDA), which has developed the

2003 ISDA Credit Derivatives Definitions. These definitions were amended in 2009 by the Big Bang Protocol and the Small Bang Protocol. The evolution of standard legal documentation has been a major development in the credit derivatives market and has helped to reduce legal risk which increased the acceptance of credit derivatives among investors.

2.1 Promises of Credit Default Swaps for Non-financial Corporations

In general, a corporation is exposed to external as well as internal credit risk. External credit risk relates to the default of a contracting party whereas internal credit risk refers to credit risk of the corporation itself which has direct implications for the company's financing and liquidity conditions.

The most obvious external credit exposures for non-financial corporations are customer accounts receivables. Receivables can be large in nature and are usually short-lived. For regular customers, the outstanding amount of accounts receivables may be relatively constant over time due to long-standing contractual relationships. Moreover, for companies that are dependent on only a handful of customers such as suppliers of customized auto parts to large car manufacturers, the credit exposure can be highly concentrated (Smithson and Mengle 2006).

The following example illustrates how a CDS can add value when a company faces high amounts of accounts receivables. Imagine firm A is exposed to credit risk of one of its major regular customers, firm B. Monthly sales of firm A to firm B account for EUR 2 million allowing for 3 months trade credit. Thus, firm A is on average exposed to EUR 6 million credit risk of firm B. In order to hedge the credit risk, firm A buys a single-name CDS on company B. Since standard CDS contracts are not directly linked to receivables but instead to a reference obligation such as a bond, the most difficult part in this transaction is then to determine the notional amount of the CDS contract in order to hedge the loss in case firm B defaults on its receivables. Assuming the recovery value of the reference obligation is equal to the recovery value of the accounts receivables, a CDS on company B with a notional amount of EUR 6mn is purchased. Thus, the CDS contract provides a hedge offsetting the loss in case firm B defaults on its account receivables (Freeman, Cox and Wright 2006). It should be noted that the exemplified transaction does not provide a perfect hedge since it involves basis risk which I will explain in detail below.

The outlined hedging transaction may also be of value when a firm is highly dependent on a major supplier which plays an essential role in the firm's business operations. This so-called performance risk may be hedged by buying a CDS contract. In this case, the determination of the notional amount of the CDS contract is, however, even more difficult to estimate than in the previous example and depends on good business acumen.

One of the few corporations that actively uses CDSs to hedge some of the credit risk in its trade finance book is Siemens Financial Services, which manages Siemens' accounts receivables portfolio. By taking advantage of predominantly single-name CDSs, the Munich-based electrical engineering and electronics company can reduce its exposure to some of its key industry segments, thereby eliminating credit risk in a focused way (Tett 2006).

Another risk where CDSs can be of value is project finance risk. For instance, companies that invest in emerging markets, which offer significant growth opportunities, face substantial project finance risk due to unstable political situations. Thus, the reduction of political risks is of high concern. Another example is the currently uncertain political and financial situation in several European countries that poses a serious threat to companies that have large operations in these countries. Although it is difficult to find a direct hedge against political risks in these countries, the purchase of a CDS referenced to the sovereign debt may provide a good hedging instrument due to the high correlation between political risks and the risk of the country's sovereign debt (Senior 1999).

Furthermore, CDSs can be employed against credit risk stemming from OTC derivatives transactions. As the recent financial crisis has shown it is not only important for financial institutions to manage counterparty risk but also for non-financial corporations to have the ability to lay off excess counterparty credit risk resulting from bilaterally traded OTC contracts such as foreign exchange derivatives. For example, imagine corporation X deals regularly with its two relationship banks that act as counterparties to its OTC derivative transactions. During the pre-crisis period, bank Y and bank Z were assigned an investment-grade status and were considered safe and financially sound institutions. However, after the breakout of the subprime-crisis, bank Z was hit by a series of rating downgrades due to its large investments in the US mortgage market. As a result, corporation A is now exposed to substantial credit risk of bank Z, which might lead to significant losses in case bank Z defaults. Hence, the purchase of a CDS referenced to bank Z provides corporation A with a good protection against the counterparty risk of bank Z.

Diversifying credit risk provides corporations with an additional means to reduce credit risk concentration. Since many corporations are focused on customers in a specific industry segment, debtor concentration within a specific industry can be extreme. Significant industry concentration poses a major credit risk to a company since the default of a key industry participant can cause a chain reaction leading to a series of defaults within the industry. Hence, an easy-to-implement and cost-efficient method to diversify credit exposure is the purchase of credit risk by selling CDSs referenced to companies in other industries.

With regard to internal credit risk, CDSs provide an opportunity to manage the firm's borrowing costs and funding liquidity. Since a CDS allows a company to trade in its own credit risk, the company can buy credit protection to hedge a widening of its own credit spreads in order to secure favorable borrowing rates in the future. This is of particular interest for companies that are reliant on financing their business activities through the issuance of bonds. Recently, this has become of interest for the 'Mittelstand' in Germany and medium-sized companies in general due to tighter credit supply by banks and new regulatory requirements such as Basel III.⁶³ As an example, corporation B faces currently favorable costs of borrowing and would like to lock into those borrowing rates in anticipation of future debt issuances. Through the purchase of credit protection the company can go short in its own credit risk, which provides a good hedge against the widening of its own credit spreads in the future.⁶⁴ The flipside for the corporation, however, is that the hedge does not allow benefiting from narrowing credit spreads in the future.

CDSs can also help to improve funding liquidity especially for corporations that have limited access to capital markets such as small and medium-sized corporations. As an example, Figure 19 illustrates how this type of funding works. Corporation ABC needs additional funding and issues a private bond that is bought in total by its relationship bank, bank XYZ. In turn, the bank buys credit protection in the CDS market against this bond because the additional amount of debt would violate the bank's credit risk concentration limits. The credit risk is then passed on to the CDS seller -an AA-rated insurance company- that is looking for an additional yield pick-up

⁶³ See for instance Leker, Corporate Finance BIZ 05/2012 p. 1; Preysing, Finanzierung im Mittelstand 03/2012 pp. 12 (15).

⁶⁴ Another possibility for a company to secure favorable borrowing rates is the use of a Total Return Swap (TRS). In addition to hedging against a widening of credit spreads, the TRS allows to hedge against movements in the market funding rate such as LIBOR. However, TRS tend to be relatively illiquid with wide bid-offer spreads as compared to CDS, making it difficult for corporations to exit those trades in a cost-efficient and timely manner.

and diversification of its credit portfolio.⁶⁵ Corporation ABC pays indirectly for the cost of CDS protection as reflected in the yield of the private bond. It should be noted, however, that the use of CDSs in the previous example does not show up in the statistics as a use by non-financial corporations.

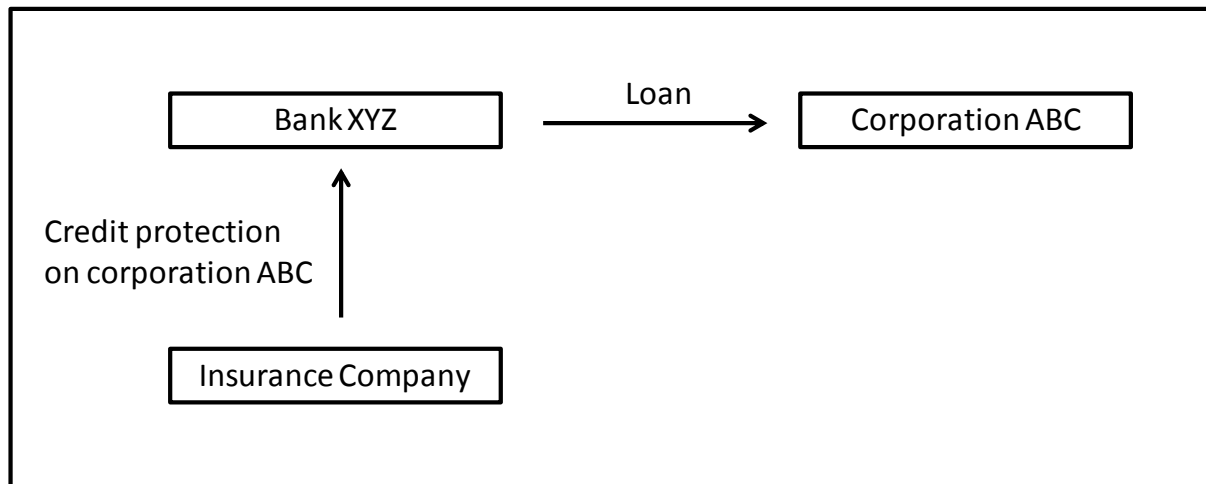


Figure 19: Funding Liquidity and Credit Protection

2.2 Perils of Credit Default Swaps for Non-financial Corporations

To date, the limited use of CDSs by corporations is mainly due to the existence of basis risk, accounting issues, the companies' organizational structure and other established financial instruments that serve as substitutes.

Perhaps the biggest obstacle to the use of CDSs by corporations is basis risk defined as an imperfect correlation between credit exposure and hedging instrument. This is in particular the case when hedging the credit risk of accounts receivables due to a mismatch between the reference asset defined in the CDS contract and the hedged accounts receivables. Since a CDS contract provides protection against the credit risk of the reference asset such as a bond, it is possible that receivables will default long before the CDS contract is triggered by a credit event. Furthermore, when a firm hedges its account receivables with a standard CDS contract, it faces a recovery basis risk since the recovery value of the reference asset and the recovery value of the account receivables do not necessarily match. Thus, the difference between the

⁶⁵ In a similar vein, a CDS can help to free up existing credit lines, where the bank buys credit protection on the company's debt passing on some of its credit risk to an external investor. For a detailed example see Smithson/Mengle, *Journal of Applied Corporate Finance* 18/2006 pp. 54 (60).

recovery value of the reference asset and the recovery value of the account receivables can be large, leaving the firm with a potentially un-hedged position (Smithson and Mengle 2006).

Another obstacle for corporations using CDSs is the accounting requirement that credit derivatives have to be marked-to-market.⁶⁶ Since the hedged credit exposure (as for example accounts receivables or project finance risk) is unlikely to be marked-to-market and basis risk exists between the hedged item and the CDS, the use of a standard CDS contract as a hedging instrument may create unwanted earnings volatility. Thus, management may be reluctant to the introduction of CDSs as a hedging tool.

Furthermore, the companies' organizational structure has also contributed to the limited use of CDSs by corporations since credit risk management is usually not assigned to the treasury department but rather stays with the credit managers of the respective business units. However, the business units either do not have the authority to deal with derivatives such as CDSs or are not familiar with their application since the treasury department is primarily responsible for managing risks via derivatives (Seyfried 2001).

Finally, there are a number of other credit risk management instruments available that may serve as substitutes to a CDS. Credit dealers whom I interviewed pointed out that credit insurances and letters of credit are commonly used by corporations to hedge their credit risk exposure. Credit insurances help corporations to protect their accounts receivables from loss due to credit risk. However, in contrast to CDSs, credit insurances require proof of loss prior to any reimbursement, which can be tedious and costly and may even involve litigations. Furthermore, insurers may revoke coverage if the insured company is downgraded by a rating agency, thereby eliminating insurance when it is most needed. Another alternative to manage accounts receivables may be factoring, where receivables are sold to a factoring company. However, the price paid by the factoring company contains a significant discount from the receivables' present value due to liquidity constraints and adverse selection problems and can, therefore, be an expensive method for managing credit risk (Smithson and Mengle 2006).

In contrast to these risk management tools, CDSs avoid those drawbacks and offer some further advantages for corporations such as enhanced liquidity, improved market

⁶⁶ FAS 133 under US GAAP and IAS 39 under IFRS require that derivatives are marked to market. If the derivative's intended use is classified as a 'fair value hedge', the gain or loss of the derivative is recognized in the company's earnings together with the gain or loss resulting from the hedged item.

depth and tightening bid-offer spreads. Furthermore, CDSs allow transferring credit risk without the consent of the customer. In addition, the above mentioned issues of basis risk and earnings volatility may also be reduced in the future. With regard to basis risk, corporations have been able to negotiate special CDS contracts that are referenced to receivables instead of corporate bonds, thereby eliminating basis risk. It should be further noted that basis risk is likely to be positive when hedging receivables with a standard CDS contract since distressed companies will continue to make payments to suppliers as long as possible in order to ensure continuing business activities. Moreover, even if receivables default first, it is likely that this will trigger a CDS credit event such as bankruptcy since suppliers will stop delivering their products, thereby cutting off the company's supply chain. With respect to the issue of earnings volatility, hybrid credit products have been developed that behave like financial guarantees, which are not required to be marked-to-market. In addition, the impact of standard CDSs on earnings volatility may be less than expected when applying contracts with a shorter maturity (Triana 2005). It should be noted, however, that even though these new product innovations are better customized to the needs of non-financial corporations, they might come at the expense of less liquidity and wider bid-offer spreads. Hence, standard CDS contracts might still be a valuable option to consider due to their low execution costs and the ease to unwind trades.⁶⁷

For a summary of the main points stated above, Table 10 provides in a nutshell the benefits and risks for non-financial corporations when using CDSs.

⁶⁷ Even during the current financial crisis and the failures of important financial institutions, the CDS market remained fairly liquid and large defaults were handled efficiently as pointed out by Stulz, *Journal of Economic Perspectives* 2010, pp. 73 (92).

Table 10: Promises and Perils of CDSs for Non-financial Corporations (NFC)

Benefits of CDSs for NFC	Risks of CDSs for NFC
<p><i>External risks:</i></p> <ul style="list-style-type: none"> ▪ hedge credit risks from account receivables ▪ hedge performance risk (e.g. in case of dependency on suppliers) ▪ hedge project risk/political risks (e.g. in emerging markets) ▪ hedge counterparty credit risk (e.g. OTC derivatives) ▪ diversification of credit risk (e.g. in case of industry concentration) <p><i>Internal risks:</i></p> <ul style="list-style-type: none"> ▪ locking into favorable borrowing rates by purchasing credit protection ▪ improving funding liquidity ▪ better alternative than credit insurances and letters of credit (in terms of enhanced liquidity, improved market depth and tight bid-offer spreads) 	<ul style="list-style-type: none"> ▪ basis risk (receivables can default before the CDS contract is triggered by a credit event) ▪ recovery basis risk (difference between recovery value of the reference asset and the recovery value of account receivables) ▪ increased earnings volatility (due to marked-to-market accounting requirements)

3 The Impact of New Regulations on Non-financial Corporations

The introduction of new regulations for the derivative markets entails significant changes and it is, therefore, important to assess the impact these new regulations will have on non-financial corporations when trading CDSs. Before discussing the consequences in detail, one has to distinguish between standard CDS contracts that generally clear under the new regulatory requirements through a central counterparty (CCP) and customized or so-called bespoke CDS contracts that are still cleared bilaterally. According to a survey by Adsatis in 2010, market participants estimate that the vast majority of CDSs will be required to clear through a CCP, whereas bespoke CDS contracts might, however, still be of interest for non-financial corporations due to

their specific hedging needs. In the following, I will examine the regulation most relevant for the European CDS market: The European Market Infrastructure Regulation (EMIR).

EMIR, which is expected to be implemented from beginning of 2013 onwards, aims to increase transparency and to reduce counterparty- as well as operational risk. In particular, it reinforces the role played by CCPs in the OTC derivatives market by making clearing through CCPs mandatory for *eligible* OTC derivatives. Whether a CDS is classified as eligible for centralized clearing is determined by the European Securities and Markets Authority (ESMA), which applies the following criteria: (1) the degree of standardization, (2) liquidity and volume of contracts, and (3) availability of fair, reliable and generally accepted price information (European Commission 2012).⁶⁸

Under EMIR mandatory centralized clearing of *eligible* CDS contracts applies to all non-financial corporations, if the firm's derivative position exceeds a certain threshold that is yet to be specified by ESMA.⁶⁹ As an important side note, corporations should be aware that once the clearing threshold for a specific derivatives class -such as credit derivatives- has been exceeded, the clearing obligation applies to *all* future OTC derivatives traded by the specific firm and not only to the derivatives class where the threshold has been exceeded.

When calculating the firm's derivative position, it is important to note that non-financial firms can exclude true hedging transactions that "are objectively measurable as reducing risks directly linked to commercial activity or treasury financing activity" (ESMA 2012). More precisely, a CDS contract is considered a hedging transaction if either (1) "its objective is to reduce the potential change in the value of assets, services (...) that it owns, produces, manufactures" or (2) the CDS contract qualifies as a hedging transaction under the International Accounting Standards (IAS) 39 (ESMA 2012). In addition, the ESMA explicitly includes proxy hedges in its definition of activities that are considered hedging transactions. Thus, hedging receivables or project finance risk with a standard CDS contract as outlined above is considered a true hedging transaction and will not add to the firm's derivative position under EMIR.

When a CDS is cleared through a CCP, EMIR classifies non-financial corporations as "clients", which have no direct relationship with the CCP. Therefore, non-financial

⁶⁸ No final decision is made yet by the ESMA which OTC derivatives qualify as eligible for centralized clearing. A final draft of the technical standards is expected to be available by end of September 2012.

⁶⁹ In the ESMA consultation paper from June 2012, the clearing threshold for credit derivatives is set to EUR 1 billion notional value.

corporations have to clear their trades through a clearing member of the CCP, such as a major CDS dealer in the market.⁷⁰ Since clients are required to post margins for their derivatives positions, they have to hold a margin account either with their clearing member or with the CCP. Under EMIR, two possibilities of margin accounts exist: omnibus accounts and separate accounts. The main purpose of both options is to ensure that margins posted by clients are not exposed to the default of a clearing member. An omnibus account segregates the margins of the clearing member from the clients' margins but all client margins are consolidated in one account. With omnibus accounts clients face the risk that if a client defaults and the clearing member is not able to cover the loss, the CCP can utilize the other clients' margins in the omnibus account to meet any remaining obligations of the defaulted client. In contrast, when client margins are held in separate and individualized accounts, margins can only be used to cover losses of the defaulting client (IMF 2010). Separate accounts are, however, more costly than omnibus accounts since they require a higher operational effort.

For those corporations that have to adhere to the clearing obligations, the margin requirement will have a significant effect on their liquidity. This will require a professional management of collateral and liquidity since non-financial corporations have typically traded CDSs and other OTC derivatives in the past without depositing collateral. The collateral accepted by CCPs consists of cash collateral and liquid non-cash collateral such as government bonds that are subject to different haircuts according to the credit standing of the specific country. Since margins are adjusted on a daily basis depending on the market values of the derivatives, the clearing obligation further adds cash-flow volatility for some firms (Duffie, Lu and Lubke 2010). Thus, it is crucial for non-financial corporations not only to ensure a sound liquidity management but also to improve their risk management (e.g. sensitivity analysis and stress testing on collateral requirements) and to efficiently manage the collateral received.

With respect to market transparency, EMIR requires that all derivatives contracts – irrespective of the clearing threshold – are reported to an authorized trade repository before the end of the next working day. Moreover, an extensive set of information is required to be submitted for each contract by the counterparties. In order to foster flexibility and to increase efficiency, EMIR allows a counterparty to delegate the

⁷⁰ In addition to client accounts, indirect client accounts have been proposed which are clients of a client. The development of indirect client accounts is still in its early stage and is not yet covered in detail by the consultation paper of the ESMA.

reporting of the contract to the other counterparty (e.g. a major dealer in the market) or to a third party such as a CCP (ESMA 2012). Consequently, corporations face additional costs due to these reporting requirements since they either have to make significant IT investments in order to comply with the reporting standards or they have to pay a third party for outsourcing these tasks.

In addition to the negative direct implications that EMIR has on non-financial firms, there are also several positive indirect effects such as increased liquidity and transparency in the CDS market that will lead to more reliable price information and lower transaction costs. Regulators currently undertake great efforts to incentivize dealers and end-users to move their activities in the OTC derivatives markets to CCPs in order to achieve a critical mass of contracts cleared. This will in particular improve the liquidity in the CDS market since dealers and investors have long transacted contracts that were non-standardized and non-fungible as opposed to standardized CDS contracts cleared via a CCP. Moreover, the standardization and enhanced liquidity will make it easier for investors to receive reliable price information as opposed to customized CDS contracts that are highly dependent on mark-to-model price information (IMF 2010). On top, improved liquidity and transparency and the high degree of product standardization will better enable dealers to promote CDS trading through fully electronic platforms that will enhance execution efficiency and will lead to considerably lower bid-offer spreads for end-users.

As opposed to standardized CDSs that are cleared via CCPs, non-financial firms may continue to prefer customized OTC derivatives, such as bespoke CDSs, in order to meet their specific hedging needs. Since bespoke CDSs are not suitable for clearing via a CCP due to their lack of standardization, they will continue trading as bilateral OTC derivatives. In addition to bespoke CDSs, non-financial firms have the choice under EMIR to continue trading standard CDS contracts bilaterally if they do not breach the clearing threshold and are, therefore, not subject to the clearing obligation.

As mentioned above, all derivative contracts –including bilaterally traded derivatives– have to be reported to a trade repository before the end of the next working day. In addition, when trading CDS contracts bilaterally, all counterparties –irrespective of the clearing obligation– are required to apply robust risk management techniques. This includes timely confirmation of the terms of the CDS contract, marking-to-market or –if not feasible– marking-to-model outstanding contracts on a daily basis and establish a formalized risk management process in order to monitor and mitigate counterparty risk. Moreover, non-financial firms exceeding the clearing threshold are required to exchange collateral for OTC derivatives not cleared by a

CCP. In a joint discussion paper the ESMA, the European Banking Authority (EBA) and the European Insurance and Occupational Pensions Authority (EIOPA) have published their view and proposal on collateral requirements. According to these European Supervisory Authorities, collateral should consist at least of a variation margin and in addition they consider requiring initial margins in order to reduce counterparty risk effectively. Thus, it is likely that collateral requirements for bilaterally traded contracts will be similar to margin requirements via CCPs because regulators want (1) to internalize the risk of any derivative contract by requiring the right amount of collateral and (2) incentivize the use of standardized contracts and to move derivatives trading to CCPs. In addition, the introduction of Basel III provides further incentives for non-financial corporations to move derivatives trading to CCPs due to the higher capital requirements for bilaterally traded OTC derivatives as compared to derivatives cleared via CCPs.

In sum, the introduction of new regulations for the CDS market and the derivative markets in general will have a significant effect on non-financial corporations. For those corporations breaching the clearing threshold, the new regulations will increase the costs for CDSs cleared via CCPs as well as for non-cleared CDS contracts due to higher margin or collateral requirements as well as higher capital requirements. For all corporations –irrespective of breaching the clearing threshold– the reporting costs for CDS contracts will increase. The new regulations will, however, also improve market liquidity and transparency for standardized CDS contracts, which will lead to more reliable price information and lower transaction costs, thereby facilitating the use of CDS by non-financial firms. A cost and benefit analysis will help corporations to adapt to the changing environment and to identify the appropriate contracts that are best suitable to their needs of hedging credit- and counterparty risk.

Table 11: Impact of EMIR on the Use of CDSs by NFC

Potential Improvements through EMIR	Potential Restrictions through EMIR
<ul style="list-style-type: none"> ▪ reliable price information through increased liquidity and transparency in the CDS market ▪ enhancement of execution efficiency ▪ lower bid-offer spreads for end-users 	<ul style="list-style-type: none"> ▪ costs of CDSs cleared via CCPs as well as costs for bespoke CDS contracts will increase due to higher margins, collateral, and capital requirements (with consequences on a NFC's liquidity and cash-flow volatility) ▪ additional costs originating from new reporting requirements

4 Conclusion

This paper has given an account of the promises and perils of CDSs and recommendations for a beneficial prospective use of CDSs by non-financial corporations. I have shown that CDSs provide a number of promising uses for non-financial corporations that have the potential to add value to the firm. In particular, CDSs provide protection against credit risk of customer accounts receivables and against counterparty risk stemming from bilateral OTC derivative contracts. Moreover, CDSs provide innovative approaches for managing the company's funding liquidity and borrowing costs.

There are, however, still several obstacles that need to be dealt with in order to increase the use of CDSs by non-financial corporations. Presumably the most important is basis risk leaving the firm with a potentially un-hedged position and giving rise to earnings volatility. In addition, the unflattering media exposure of CDSs during the recent financial crisis did not help these instruments to position themselves as the instrument of choice in the armory of a corporate treasurer.

These obstacles may, however, be overcome in the future by negotiating special CDS contracts that are referenced to accounts receivables instead of corporate bonds. Furthermore, standard CDS contracts might still be an interesting option to use as a substitute for credit insurances and letters of credit since standard CDS contracts provide enhanced liquidity and relatively narrow bid-offer spreads, thereby facilitating trading and reducing transaction costs.

Furthermore, this study has investigated the impact of new regulations on the use of CDSs by non-financial corporations. The results of this research suggest that the introduction of new regulatory requirements such as EMIR will further increase liquidity of CDS contracts cleared via CCPs and will incentivize the use of standardized CDS contracts, leading to more reliable price information and further reduced transaction costs. For those corporations that are required under EMIR to adhere to the clearing obligation, the collateral- and margin-requirements will have a significant effect on their liquidity and will further increase cash-flow volatility. As a consequence, those corporations should give high priority to a sound liquidity and risk management. In addition, all corporations –irrespective of the clearing obligation- will face higher costs due to increased reporting requirements and risk management standards. Thus, the future acceptance of CDSs by non-financial corporations will depend to a large extent on the cost-benefit analysis of the individual company and it remains to be seen if the benefits of the new regulations outweigh the costs for non-financial corporations.

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Summary and Outlook

The main objectives of this dissertation are to analyze the theoretical and empirical implications connected with the use of credit default swaps (CDSs) and to examine the potential impact of new regulatory requirements on the CDS market and its participants. With respect to the research questions outlined in the introduction, the following summary gives an overview of the main findings.

In Chapter I, I examine the two main approaches for modeling credit risk, the structural approach and the reduced-form approach. The focus is on the appropriate application of credit risk models when pricing financial products with payoffs tied to credit-related events such as CDSs.

Structural models usually trace their roots back to the seminal papers of Black and Scholes (1973) as well as Merton (1974) whereas reduced-form models refer to the seminal work of Jarrow and Turnbull (1995). The structural approach models the firm's fundamentals and, thus, relies on company specific information. Taking structural models to the data is, however, not an easy task for company outsiders since the estimation of company specific input parameters is problematic, which makes it difficult to calibrate the model for external users such as investors. In contrast, the reduced-form approach bypasses these model-calibration problems by dealing directly with observable market data. Thus, the key distinction between the two different approaches is in terms of the assumed information set known by the modeler. Hence, structural models should be applied if the modeler has the same information set as the firm's manager whereas reduced-form models assume that the modeler has the same information set as the market. This leads to the conclusion that when investors price credit derivatives, the information set observed by the market is the relevant one and preference should be given to the reduced-form approach.

In Chapter II, I analyze the costs and benefits found in the CDS market and subsequently discuss and derive appropriate policy recommendations.

The analysis shows that the main benefits of CDSs include the facilitation of risk-sharing among investors as well as the improvement of the price discovery process for credit risk. These benefits come, however, at a cost that became especially apparent during the recent financial crisis. Whereas the identified costs are numerous –including the empty creditor problem, counterparty- and concentration risk, jump-to-default risk, liquidity dry-ups, moral hazard and insider trading as well as price distortion and

manipulation— the main factors causing them are relatively limited. These factors can be classified into contract specific factors –such as highly leveraged contracts and the binary nature of CDS contracts– and market specific factors –such as a high degree of concentration among CDS dealers and a lack of transparency in the CDS market. A major consequence is an increase in systemic risk, as these factors have the potential to deteriorate liquidity, and the CDS market can quickly become gridlocked, causing contagion and instability within the financial system. Thus, the protection provided to the buyer of a CDS contract may diminish exactly in times of distress - when it is most needed.

These findings have important policy implications for the CDS market. First, an adequate market infrastructure is required that mitigates counterparty risk. A first step in this direction is the introduction of central clearing through central counterparties (CCPs). Second, the use of standardized CDS contracts should be promoted over bespoke CDS contracts as the latter cannot be moved to CCPs due to their customization and lack of liquidity. An appropriate measure to incentivize the use of standardized CDSs and to internalize the risks associated with bespoke CDSs could be the introduction of higher capital requirements and mandatory collateralization standards for bespoke CDSs. Third, market transparency should be increased to mitigate uncertainty among market participants about counterparty risk and to detect market manipulation and insider trading. Fourth, the alignment of incentives between the protection seller and the protection buyer could be improved through loss piece retention by the loan originator, which requires the originating bank to retain a minimum percentage of a loan unhedged on its books, thereby mitigating morally hazardous behavior.

In Chapter III, I assess the impact of the introduction of CCPs on participants in the CDS market. In doing so, I focus on three essential design elements: (1) market infrastructure, (2) risk management and financial resources and (3) ownership, governance and regulatory oversight.

Among the three CCPs in the European CDS market, ICE Clear Europe is the market leader in terms of market share by having cleared a gross notional volume of more than € 8 trillion index-products and € 1.2 trillion single-names since its launch in July 2009. In addition, ICE Clear Europe gained the strongest support by market makers since it comprises all major dealers in the European CDS market. In terms of cleared products, all CCPs focus primarily on standardized and liquid products such as itraxx indices and major European single-name reference entities.

The findings show that the introduction of a separate CCP for the CDS market is at least debatable from a netting efficiency point of view and that furthermore the optimal solution in terms of netting efficiency would be a single CCP clearing all classes of derivatives on a global scale. Thus, netting efficiency could be improved by linking CCPs across different geographical regions and asset classes. As the primary objective for the introduction of CCPs is, however, the improvement of financial stability, the diversification of operational and counterparty risk should also be taken into account when discussing the optimal number of CCPs.

With respect to CCPs' risk management and financial resources, the segregation of clients' margin accounts and account portability are two key mechanisms that serve to mitigate the risk of a severe liquidity dry-up. These mechanisms come, however, at additional operational and liquidity costs that are likely passed on to clients in terms of higher clearing fees. Moreover, in order to ensure financial robustness, CCPs should regularly reassess the size of the guarantee fund taking into account the simultaneous failures of several clearing members and adapt the fund size accordingly. In this context, a recapitalization mechanism for the guarantee fund should be in place once a clearing member has defaulted to ensure adequate capitalization of the fund at any time.

Finally, the alignment of control and decision rights with the interests of those who bear the risks of a CCP is central to ensure financial stability for all market participants because conflicts of interests may otherwise lead to inefficient outcomes that force some stakeholders to bear the costs borne by others. The European Market Infrastructure Regulation (EMIR) makes a first step in this direction by calling for robust governance arrangements and setting explicit governance rules. To conclude, a CCP provides several major benefits to participants in the CDS market but poses at the same time a systemic risk to the financial system due to the high concentration of counterparty risk. As a result it faces a delicate trade-off between its primary objective –promoting financial stability– on the one hand and optimizing the efficient use of financial resources in order to keep the transaction costs at a reasonable level for market participants on the other hand.

In Chapter IV, I examine the promises and perils of CDSs for non-financial corporations against the background of a new regulatory framework. I have shown that CDSs provide a number of promising uses for non-financial corporations such as protection against credit risk of customer accounts receivables and against counterparty risk of bilaterally cleared OTC derivative contracts. In addition, CDSs provide innovative approaches for managing the company's funding liquidity and

borrowing costs. However, several obstacles exist that prevent non-financial corporations from using CDSs. Presumably the most important is basis risk leaving the firm with a potentially un-hedged position and giving rise to earnings volatility.

In addition, the results of this research suggest that the introduction of new regulatory requirements such as EMIR will further increase the liquidity of CDS contracts cleared via CCPs and will incentivize the use of standardized CDS contracts, leading to more reliable price information and further reduced transaction costs. At the same time, however, all corporations will face higher costs due to increased reporting requirements and risk management standards. In addition, for those corporations that are required under EMIR to adhere to the clearing obligation, the collateral- and margin-requirements will have a significant effect on their liquidity and will increase cash-flow volatility. Thus, corporations should give high priority to a sound liquidity and risk management.

With regard to future research, a relevant question to address is whether the CDS market caused some of the recent market turmoil or whether the CDS market was merely an efficient information transmitter that rapidly incorporated information. Therefore, further empirical research is needed to determine whether the CDS market has contributed to price distortions, increased volatility and negative spillover effects in the underlying cash bond market. Furthermore, it will be highly relevant to analyze empirically the impact of the new regulatory framework on the CDS market after it is fully implemented in 2013.

Curriculum Vitae

Education

University of St. Gallen, Switzerland 2009 – 2013
Ph.D. in Finance

University of Trier, Germany 2002 – 2008
Master's Degree in Business Economics (Diplomkaufmann)
 Concentration in Finance
 Thesis topic: What is the Value of the Tax Shield of Debt? (published in 'Beiträge zur BWL und VWL')

Harvard University, Department of Economics, USA 2005 – 2006
 Visiting Student for the academic year 2005/2006

Boston University, School of Management, USA 2004 – 2004
 Visiting Student for the fall term 2004

Experience

University of St. Gallen 2009 – 2012
 Research Associate at the Swiss Institute of Banking and Finance, including two semesters abroad in Singapore at Singapore Management University and St. Gallen Institute of Management in Asia

Goldman Sachs International 2011 – 2011
 Intern in the Securities Division

PricewaterhouseCoopers 2008 – 2009
 Consultant in Corporate Finance and Transaction Services

Monitor Group 2007 – 2007
 Intern on strategy consulting projects

Lehman Brothers 2006 – 2006
 Summer Analyst in Corporate Finance / M&A

Sparkasse Trier 2000 – 2002
 Trained as a qualified junior banking executive (Bankkaufmann)

Personal

- Passionate Tennis-Player
- Dedicated reader of investment literature
- Jury member of the St. Gallen Wings of Excellence Award of the 42nd and 43rd St. Gallen Symposium