THE CREDIT DEFAULT SWAP MARKET

Report

THE BOARD
OF THE
INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS

FR05/12	**JUNE 2012**

Copies of publications are available from:

The International Organization of Securities Commissions website www.iosco.org

Contents

Executive summary

The market for credit default swaps ("CDS") is going through rapid change. Over the last several years, CDS contracts have become more standardized, and electronic processing and central clearing of trades have increased. Large amounts of CDS data have become publicly available, and abundant research has been conducted to assess the role that CDSs play in global financial markets.

This report discusses those recent changes and current trends in the CDS markets, and provides information from recent literature about the trading, pricing and clearing of CDS. The report is meant to inform the ongoing regulatory debate and highlight some key policy issues. However, policy recommendations are left for other reports.

In summary, the amount of CDS trading has continued to increase even after the onset of the financial crisis while standardization and risk management practices have significantly expanded. Trade compression has reduced CDS contracts by tens of trillions dollars. A non-negligible amount of CDS trades are currently being cleared by several central counterparties (CCP) around the world and the number of cleared CDS contracts is expanding.

Because of its highly concentrated and interconnected nature, and given the evidence of possible under-collateralization of CDS positions, one of the main sources of risk in the CDS market is counterparty risk generated by the default of large protection sellers. The use of central counterparties has been seen as a way of mitigating counterparty risk and preventing default contagion.

Though the amount of public information on CDS has increased over the recent years, the CDS market is still quite opaque. Regulators would benefit from better access to information on trade and position data, which is necessary for financial stability supervision, for improving the assessment of counterparty risk by CCP and for the detection of market abuse. As for transparency towards market participants (disclosure of pre- and post-trade information), results from theoretical research and empirical work on the OTC bond market in the US for the time being suggest that greater transparency may reduce information asymmetries and transaction costs, but it may also discourage dealers from providing liquidity. IOSCO will continue to examine these issues in order to provide a sound basis for possible future policy proposals on how to best improve the functioning of the CDS markets.

Available research shows that CDS have an important role in the price discovery process on credit risk and that the inception of CDS trading has a negative impact on the cost of funding for entities of lower credit quality. To date, there is no conclusive evidence on whether taking short positions on credit risk through naked CDS is harmful for distressed firms or high-yield sovereign bonds. IOSCO will continue to monitor market developments on this issue, however, going forward.

1) Introduction

This report has been prepared by IOSCO to respond to a mandate given by the G20 to assess the functioning of the CDS market and the role of CDS in price formation of underlying assets. The report is organized as follows: Section 2 briefly describes the basic structure and payoff of CDS contracts and reports market statistics, discussing their informative role in terms of evaluating counterparty risk and credit risk reallocation performed by CDS. The size of the CDS market is compared to that of the underlying bond market, in order to evaluate whether the relative market activity in CDS has changed over the recent years.

Section 3 illustrates a series of operational features that characterize the functioning and regulation of the CDS market. The Section 3.1 describes the evolution of the self-regulatory framework, which over the last 3 years has led to strong contract standardization and to the emergence of centralized procedure to liquidate contracts in case of credit events.

Section 3.2 then illustrates the available evidence on the structure of the market, with specific reference to trade transparency and interaction between different types of market participants (dealers and end-users), presenting some statistics on trade frequency and trade size that indicate differences between the CDS market and other markets with strong retail participation.

Next, Section 3.3 discusses counterparty risk and collateralization practices in CDS market, highlighting some important differences from other OTC derivatives, and then illustrates the role of central counterparties in the CDS market.

Sections 3.4 and 3.5 are dedicated to the arbitrage between CDS and bonds and to the role of CDS under Basel III regulation. As for the first point, it is shown why arbitrage should make CDS spreads equal bond spreads, then highlighting frictions and market imperfections that explain why in practice such equivalence is often violated. As for the second point, the discussion focuses on the role of CDS under Basel III in order to measure capital charges related to counterparty risk.

Section 4 reviews the main academic literature related to the impact of CDS on bond and credit markets.

The first part of the Section discusses the issue of whether CDS can reduce credit spreads or enable firms to issue more debt and whether CDS can make bankruptcies more likely than restructurings.

The second part of the Section reviews the academic research on the impact of the CDS market on the liquidity and orderly functioning of the underlying bond market.

Finally, the last part of the Section analyzes the evidence and the academic debate on the role of CDS in the price discovery process.

Section 5 concludes and summarizes the main issues of more relevance from a policy perspective.

2) Basic functioning of Credit Default Swap (CDS) contracts and market size

2.1 Basic functioning of CDS contracts

Credit Default Swaps (CDS) are a bilateral OTC contracts that transfer a credit exposure on a specific ("reference") entity across market participants. In very general terms, the buyer of a CDS makes periodic payments in exchange for a positive payoff when a credit event is deemed to have occurred[1]. These contracts are linked to either a specific reference entity ("single name CDS") or a portfolio of reference entities ("index" or "basket" CDS).

Selling protection through a CDS contract replicates a leveraged long position in bonds of the underlying reference entity[2], exposing protection sellers to risks similar to those of a creditor. Buying protection through CDS replicates instead a short position on bonds of the underlying reference entity (with proceeds reinvested at the riskless rate)[3].

Buyers of protection through a CDS contract can hedge a credit exposure on the underlying reference entity or effectively take a short position on credit risk. This is the case when the CDS buyer has no credit exposure on the reference entity (so called "naked" CDS position) or has an exposure lower than the value of the CDS contract (so called "over-insured" position).

While it is possible for a protection buyer to replicate the economic payoff of a CDS contract by shorting bonds of the underlying reference entity and reinvesting the proceeds at the riskless rate, CDS may be an attractive alternative to short selling because of their ability to eliminate the risk associated with rolling over short positions.

When a credit event occurs, the contract is terminated. In this case, if "physical delivery" is the specified settlement method, the CDS seller must pay to the buyer the nominal contract value and the CDS buyer must deliver bonds of the reference entity (of a pre-specified type). Alternatively, if "cash settlement" is the agreed settlement method, the seller must pay to the buyer the difference between the notional contract value and the market value of the bonds.

---

[1] As it will be better explained further on, the International Swap and Derivatives Association (ISDA) has developed a standard legal documentation format for CDS contracts (see next §3.1) that includes a list of credit-event situations (which go from bankruptcy to debt restructuring). Though contract counterparties are free to amend the ISDA definitions, the vast majority of CDS trades are covered by the standard ISDA documentation.

[2] More specifically, selling protection through CDS is similar to a leveraged long position in a floating rate note (FRN) of the reference entity. The intuition for such equivalence is that, similar to FRN, CDS prices reflect changes in credit risk, while are insensitive to changes in the yield curve. Since, as it will be shown further on (§3.4), CDS prices should equal bond spreads (ignoring counterparty risk and other market frictions), the periodic payment received by a CDS seller should be equivalent to the spread over Libor (or Euribor) that the reference entity would pay if it were to issue a FRN (this spread is usually referred to as the "asset swap spread", i.e. the spread over Libor at which a fixed coupon of the reference entity is swapped for a floating coupon). On the other hand, a pay-off in which one receives the spread on a FRN can be replicated by buying the FRN using Libor/Euribor financing; hence, the CDS premium should equal the pay-off of a leveraged FRN long position, which is in turn equivalent to the asset swap spread (see Duffie 1999 for the initial formalization of these arguments, and De Wit 2006 for a simple illustration of the details of the CDS-FRN or CDS-asset swap spread equivalence).

[3] Following the same argument of note 2, paying the CDS price should be equivalent to paying the FRN spread, which in turn can be replicated by shorting the FRN and investing the proceeds at Libor/Euribor rate.

For index or basket CDS a credit event on one of the component reference entities will not cause the contract to be terminated and the buyer of protection will receive a compensation proportional to the weight of the reference entity on the index (see next §3.1 for more details).

There are a number of ways to "terminate" or change the economic exposure associated with a CDS contract other than those related to the occurrence of a credit event. The first is referred to as "novation", which entails the replacement of one of the two original counterparties to the contract with a new one. A novation is executed by identifying a market participant that is willing to assume the obligations of one of the original counterparties at prevailing market prices. There are however two quite different kinds of novation: the first is the one in which a new party replaces one of the parties of the original trade and the second in which both parties give up the trade to a central counterparty (so called "CCP novation" – see next §3.3), though in this latter case there is no change or termination in the economic exposure for the original counterparties. Other changes may be related to early termination clauses[4] or to contract terminations due to "compression" mechanisms designed to cancel redundant contracts due to offsetting positions. For example, if the same counterparties have entered into offsetting positions on contracts with the same economic terms, a compression trade cancels these contracts and creates a new contract with the same net exposure as the original contracts. It is also possible to terminate a position by entering into a transaction of opposite sign ("offsetting transaction") with other market participants. The difference between an offsetting transaction and a novation is that in the first case the original contract is not cancelled and remains a legal obligation[5]. Though offsetting transactions are the most common way to terminate the economic exposure related to the reference entity underlying the CDS contract, they create a network of exposures that results in increased counterparty risk.

2.2 Size of the CDS market

Quantifying the trading activity and the economic exposure of market participants in the CDS market is quite difficult. Data on new trades will underestimate actual transaction activity because, as noted above, novation and termination provide alternative ways to modify the exposure to the underlying reference entities and may contribute to price formation. Because of the mentioned importance of offsetting transactions, data on outstanding contracts (gross notional value) may largely overstate the economic exposure towards the underlying reference entities. The sum of the net positions of the net buyer of protection (net notional value) gives instead a better estimate of the net exposure because it represents the aggregate payments that would be made in the event of the default of a reference entity[6] (assuming the market value of defaulting bonds is equal to zero[7]).

---

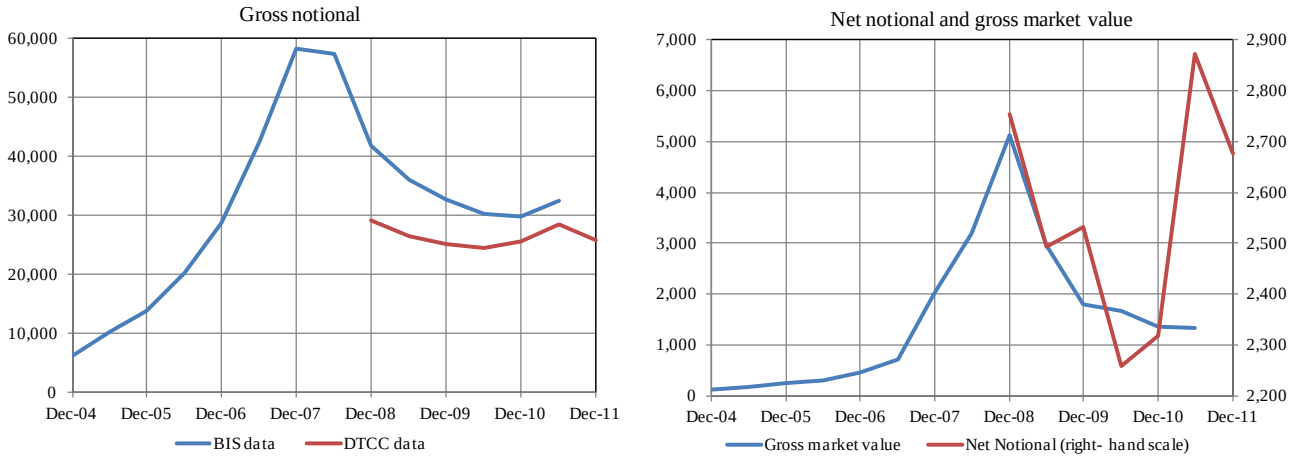
4 Early termination may occur in case one of the counterparties defaults (see §3.4 for a full discussion of the contractual arrangements in such situation).

5 This is not the case when a central counterparty (CCP) interposes itself between the original counterparties to each contract (through the mentioned novation process). In this case, traders' positions are offset multilaterally and each trader ends up with a bilateral balance against the CCP.

6 This is technically correct only if operators adhere to a contractual multilateral offsetting mechanism of the positions should a credit event occur. This type of service is supplied for example in the US by the Depository and Trust & Clearing Corporation (DTCC).

Hence, the gross notional value of outstanding contracts gives an indication of the size of the CDS market in terms of counterparty risk, while the net notional value is a measure of the size of the market in terms of credit risk reallocation.
At the end of 2011, the gross notional value of outstanding CDS contracts amounted to approximately 26,000 billion US dollars (Figure 1), which has a corresponding net notional value of approximately 2,700 billion US dollars (roughly 10% of the gross notional value). Single name CDS account for approximately 60% of the overall market in terms of gross notional, while the remaining share is represented by index and basket CDS and by so called "tranche" CDS that are structured to take exposures on specific segments of an index loss distribution (Figure 2) .

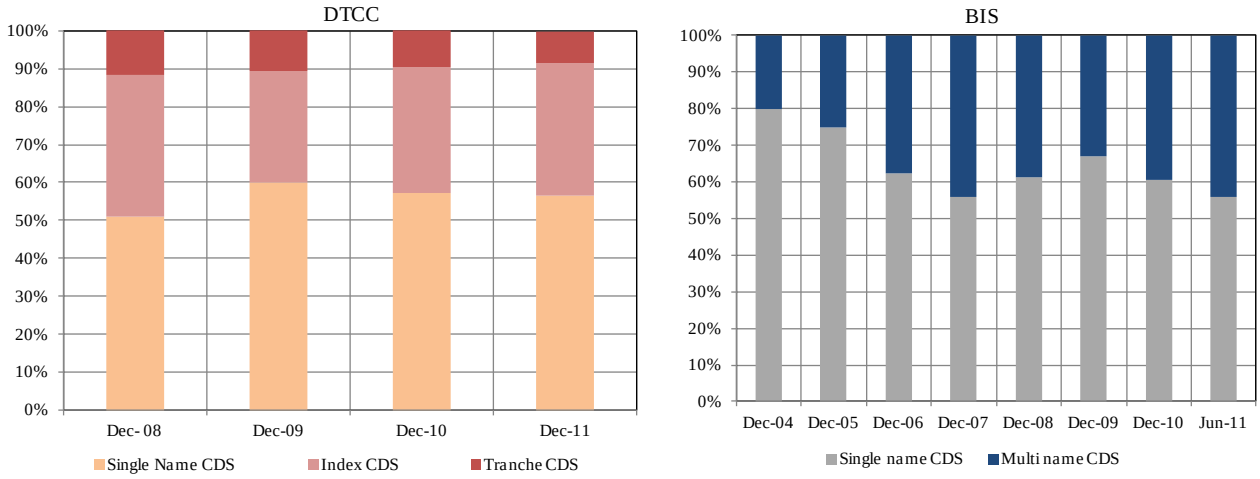
Figure 1 – Size of the CDS market
(semi-annual data in bln of US$ for outstanding contracts at the end of period)



Source: Calculation on Bank of International Settlements (BIS) and Depository Trust & Clearing Corporation (DTCC) data. BIS collects open positions of leading global dealers through central banks of 11 reporting countries (Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, Switzerland, United Kingdom and United States). All BIS published figures are adjusted for double-counting of positions between reporting institutions. DTCC provides information on CDS contracts registered in the DTCC's Trade Information Warehouse. "Net notional" with respect to any single reference entity is the sum of the net protection bought by net buyers (or equivalently net protection sold by net sellers). The "gross market value" is the sum of the absolute values of all open contracts with both positive and negative replacement values evaluated at market prices prevailing on the reporting date.

7 The market value is usually greater than zero as it considers an estimate of the recovery rate. The payment value in the event of default would therefore amount to: net notional value x (1- recovery rate).

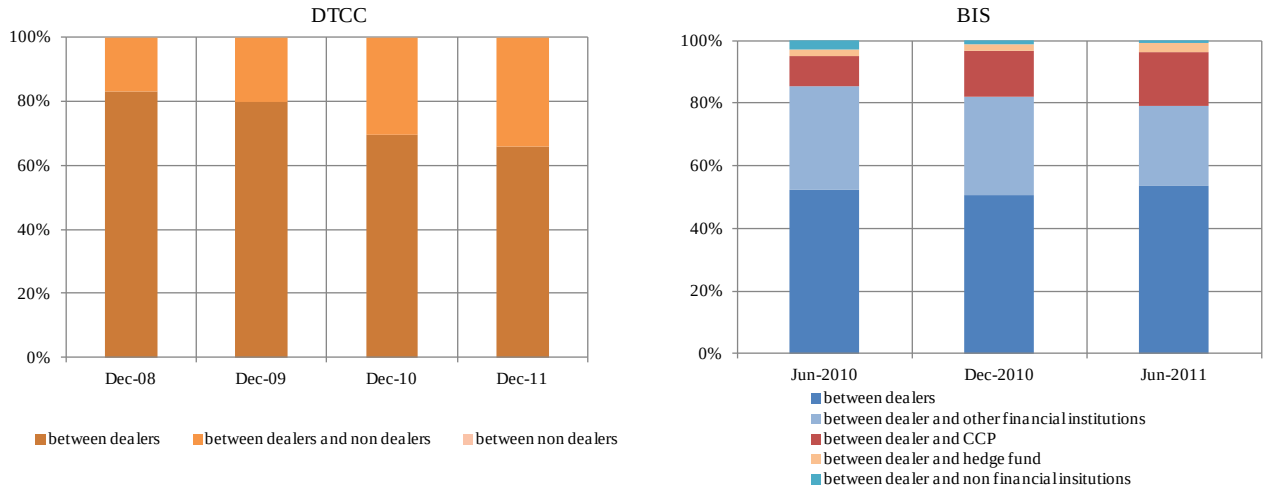
Figure 2 – CDS gross notional by instrument type



Source: Calculation on Bank of International Settlements (BIS) and Depository Trust & Clearing Corporation (DTCC) data.

According to different data sources, it can be estimated that roughly 60% of the outstanding contracts (in terms of gross notional) are concluded between dealers (i.e. financial institutions that post regularly indicative buy and sell quotes – see next §3.2), while the remaining share is represented by contracts between a dealer and a non-dealer – mostly financial - institutions (banks, institutional investors, central counterparties and hedge funds) (Figure 3).

Figure 3 – CDS gross notional amount outstanding by counterparty categories



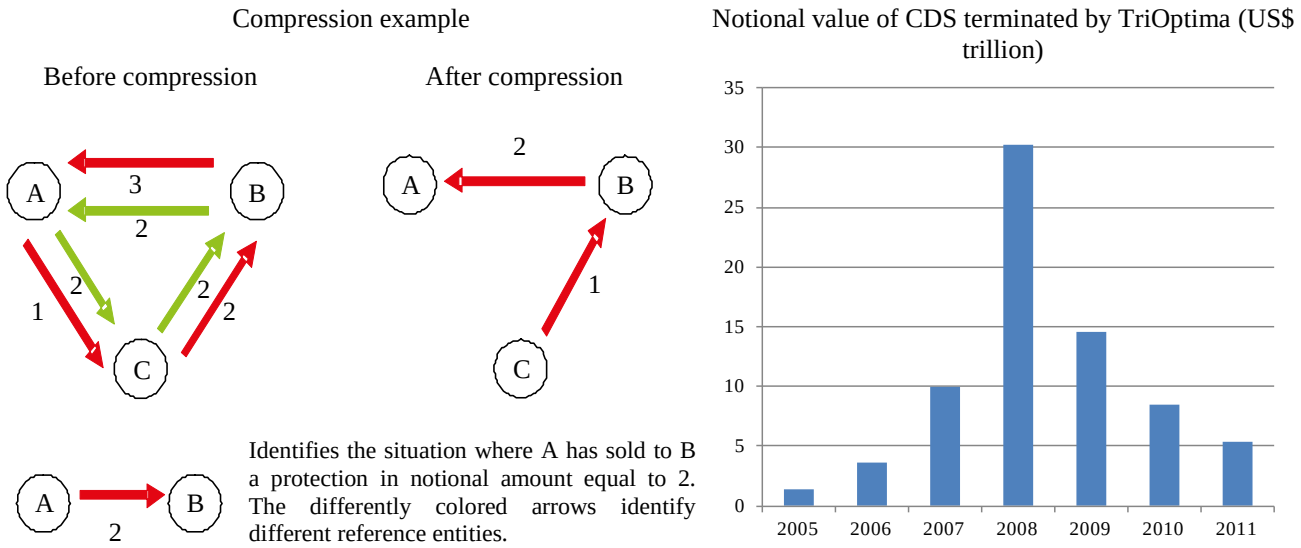
Source: Calculation on Bank of International Settlements (BIS) and Depository Trust & Clearing Corporation (DTCC) data.

Since offsetting transactions increase outstanding contracts without changing the overall economic exposure to the underlying reference entities, the industry has increasingly developed the recourse to the mentioned compression mechanism to eliminate legally redundant (or nearly redundant) contracts. The strong growth of compression practices has been made possible by parallel industry initiatives to standardize CDS contracts (in terms of maturity and coupon size; see next §3.1 for a full discussion) and has resulted in a great reduction in the gross notional value of outstanding CDS positions.

In fact, according to Vause (2010) the gross notional value of the CDS contracts has more than halved since the peak of 2007 (when it reached almost 60,000 billion US dollars) because of the great development of compression mechanisms, while CDS trading has continued to grow even after 2007. Data from TriOptima, one of the main providers of compression services, confirm the relevance of CDS compression, which peaked in 2008 (Figure 4).

Figure 5 shows the break-down of the total gross and net notional CDS exposure between sovereign and private (financial and non- financial) entities. The share of CDS on sovereign entities has grown steadily since 2008, from around 15% to almost 25% of total net notional value. At the end of 2011, slightly more than 50% of the net notional value of outstanding CDS had non-financial reference entities as underlying, while CDS on financial entities accounted for roughly 20%. Thus, the notional CDS exposure to private entities is approximately four times the notional CDS exposure to sovereign entities.[8]

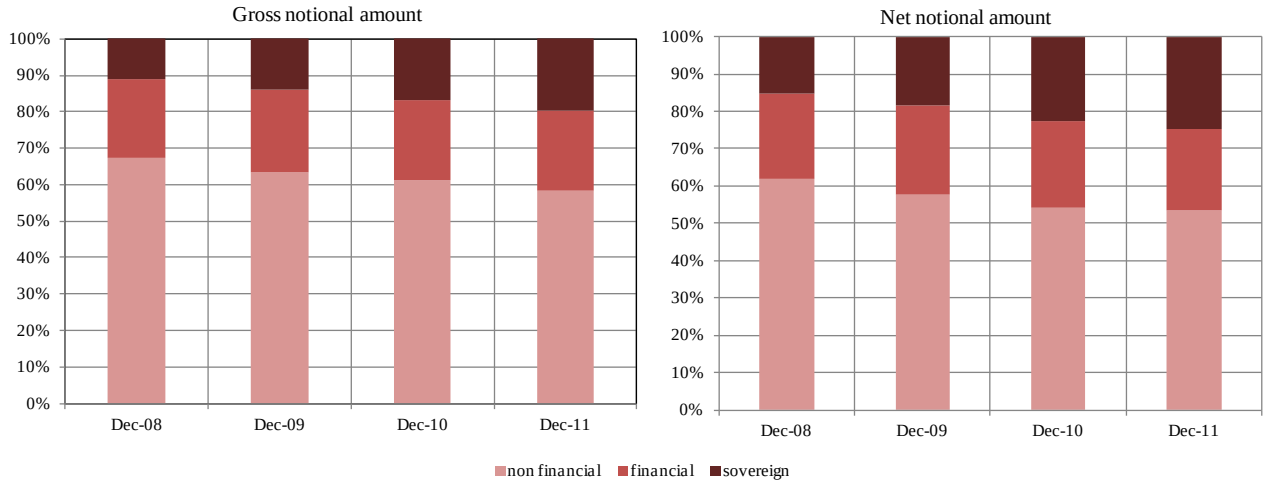
Figure 4 - Example of CDS compression and value of CDS terminated



Source: Bank for International Settlement and TriOptima.

8 The greater weight of CDS on private issuers as compared with that of the CDS on sovereign issuers partly reflects the different dimension of the market of government bonds as compared to that of corporate bonds. The data from the Bank of International Settlements for advanced countries and the main emerging countries show that in September 2010 the value of government bonds amounted to approximately 38,000 billion US dollars, as compared to approximately 10,000 billion US dollars for bonds of non-financial issuers and 41,000 billion dollars for bonds of financial issuers (including securitisations and structured securities, such as collateralized debt obligation, collateralized bond obligation, etc.). Bonds of private issuers therefore amounted to approximately 51,000 billion dollars, compared to the 38,000 billion dollars of government bonds. On the other hand, as mentioned in the text, the notional value of CDS on private issuers is four times that of the CDS on sovereign issuers. This difference may reflect the fact that the hedging needs through CDS are more relevant for corporate issuers than for sovereign issuers.

Figure 5 – CDS gross and net notional by sector of the reference entities



Source: Calculation on BIS and Depository Trust & Clearing Corporation (DTCC) data.

Figure 6 reports evidence on the size of the CDS market relative to the underlying debt for listed banks and for the top 100 reference entities by CDS gross notional value reported by the DTCC. Underlying debt is calculated as the sum of short- and long-term debt from end-of-year balance sheet data (as reported in the Worldscope database). Figure 6 also reports evidence on the size of the CDS market relative to public debt for sovereign issuers in the top 1,000 reference entities (approximately 50 issuers).

Figure 6 shows that, in terms of gross notional, bank CDS have remained quite stable relative to the underlying debt over the period 2008-2011 (the weighted mean of gross notional to underlying debt has remained close to around 9%[9]), while it has decreased in terms of net notional (the weighted mean of net notional to underlying debt has decreased from around 0.9% to 0.7%). Similar evidence emerges for corporates (the weighted mean of the ratio of gross notional to underlying debt has remained stable at values higher than 100%, while the weighted mean of the ratio of net notional to underlying debt has decreased from 10% to around 7%), but the ratio of gross/net notional to underlying debt is more than 10 times higher than for banks. At the end of 2011, for three quarters of the corporate firms in our sample the CDS gross notional largely exceed outstanding debt. Moreover, smaller corporate firms (in terms of issued debt) tend to have a higher CDS net notional relative to underlying debt (since the simple mean is much higher than the weighted mean) and it is more so than for banks.

Hence, for private issuers the size of the CDS markets relative to underlying debt has remained relatively stable in terms of gross notional over the last four years, while it has significantly reduced in terms of net notional. Moreover, the use of CDS is proportionally higher for smaller firms and is much more intense in the corporate sector than in the banking sector. This last evidence may be due to different factors. First, the average credit quality of the corporate firms in our sample may be lower than that of banks and this may explain a

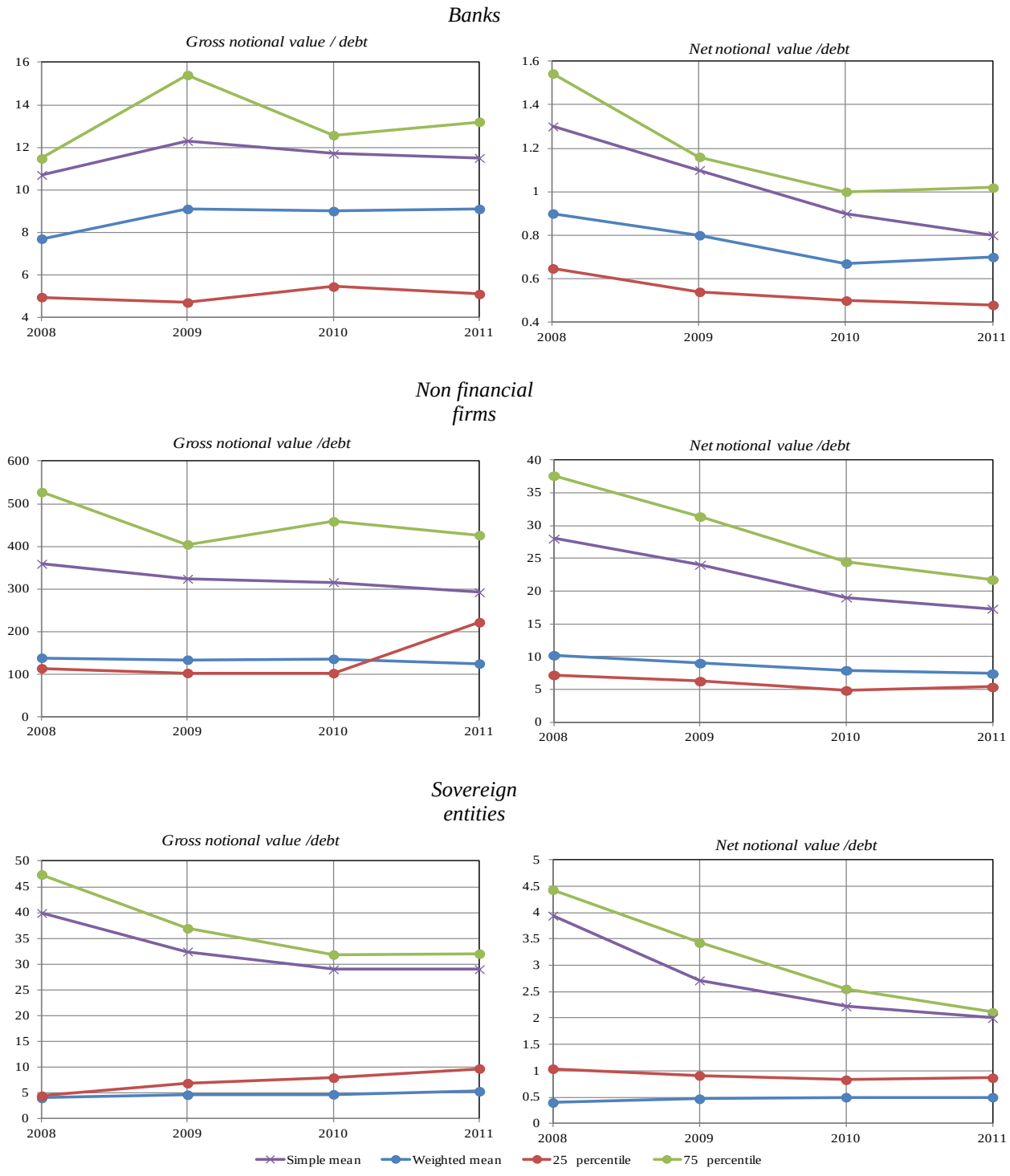
[9] The weighted mean of the ratio of gross/net notional to underlying debt is equal to the ratio of total gross/net notional to total underlying debt.

higher use of CDS for hedging purposes; second, irrespective of the credit quality, some banks may be perceived as too-big-to-fail and this reduces the incentive to use CDS.

For sovereign entities the weighted mean of gross/net notional to underlying debt has remained rather stable (respectively, at approximately 5% and 0.5%) and close to values similar to those observed for banking sector. There is however more dispersion in the distribution of both ratios compared to banks. The weighted mean is constantly below the 25th percentile because countries such UK, US and Germany have a large public debt but a very small CDS gross/net notional, and below the simple mean because smaller countries tend to have a higher ratio of CDS gross/net notional to public debt.

Finally, Figure 7 confirms the evidence on the relative stability of the size of the CDS market for euro area sovereigns, contrary to the suggestions that the debt crisis may have increased the demand of CDS for hedging purposes. In fact, though for some peripheral euro area sovereigns the ratio of gross notional to public debt has actually increased since the inception the crisis, the ratio of net notional to public debt has remained stable or actually decreased for countries more exposed to the crisis such as Ireland, Portugal and Greece.

Figure 6 – Size of the CDS market relative to the underlying debt
(percentage values)

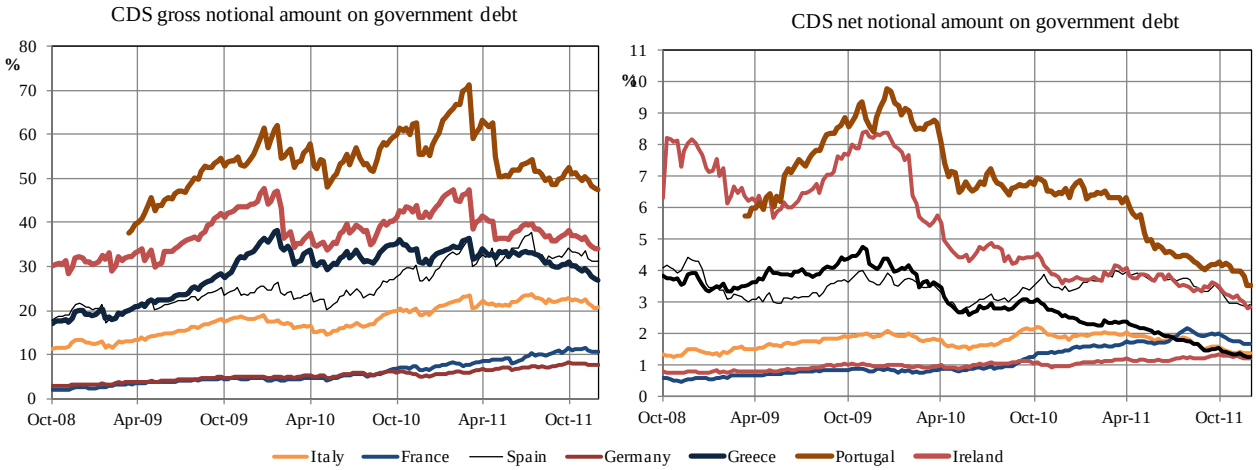


Source: Calculations on DTCC, Datastream-Worldscope and IMF data. Banks are all listed banks included in the top 1,000 reference entities by CDS gross notional at the end of each year (50 in 2011, 49 in 2010, 46 in 2009, 45 in 2008); non financial firms are the first 100 non financial listed firms in the top 1,000 reference entities by CDS gross notional; sovereign entities are all sovereigns included in the top 1,000 reference entities by CDS gross notional (55 in 2011, 53 in 2010, 52 in 2009, 47 in 2008). For banks and non financial firms debt

is the sum of short and long term debt from balance sheet data in the Datastream-Worldscope database (codes 03051 and 03251); for sovereigns debt is the government consolidated gross debt computed by the IMF.

Figure 7 – Size of the CDS market relative to public debt for selected euro area countries

(weekly data; from 31/10/2008 to 31/12/2011)



Source: Calculation on DTCC, Bloomberg and Thomson Reuters data.

3) Features of the CDS market

3.1 Contract standards

The growth of the CDS market has been fostered by the development of a solid self-regulatory environment, promoted by the initiatives of the International Swap and Derivative Association (ISDA)[10]such as contract standardisation, aimed at facilitating back office and contract management operations, and reducing legal disputes.

In 1992 ISDA developed a Master Agreement together with related documentation applying to any OTC derivatives trades, including CDS, to ensure the enforceability of netting and collateral provisions. The Master Agreement was then revised in 2002. With specific regards to CDS contracts, ISDA defined a format for trade confirmation (Master Confirmation Agreement on Credit Default Swaps) and a standardized legal documentation predefining various optional variables and information such as: *i)* reference entity (underlying in form of a legal entity, indices or sovereign), *ii)* nominal value, *iii)* maturity date (agreed tenor or by credit event), iv) agreed premium/coupon, v) credit event trigger (and related reference obligation) and vi) contract liquidation procedure in case of a credit event. In particular, the codification of credit events and the definition of the liquidation process have helped to reduce the risk of potential legal disputes (see further on for more details on this point).

Compliance with the Master Agreement allows counterparties to: *a)* define the net amount to be transferred following the aggregation of all credit and debt positions with regards to a

10 ISDA is a private international association founded in 1985 to improve the industry's operational infrastructure in derivative trading and its members are represented by more than 800 market participants, including dealers, institutional investors, non financial and law firms.

single counterparty; *b)* close all positions in case of default of one counterparty through a single payment ("close-out netting").

As a result of the growing importance of CDS and of the increasing demand for contract standardization to facilitate compression mechanisms and the development of central counterparties (CCP – see §3.3), in 2009 ISDA developed a new Master Confirmation Agreement (so called “Big Bang Protocol”), to which more than 2,000 market participants (including banks, hedge funds and institutional investors) voluntarily adhered. The Big Bang Protocol introduced two main changes. First, it established Determination Committees allowed to takes binding decisions on whether a credit event occurs, replacing the previous bilateral negotiation. Second, it made auction the default option to set the price of distressed bonds in order to liquidate CDS contracts in case of credit events (see the discussion further on), whereas previously it needed to be agreed to upon the occurrence of a credit event, and made the use of such auction mechanism binding for those parties that signed to the Protocol. The ISDA also introduced strong contract standardization, in terms of expiry dates and premiums, which has allowed the growth of CCP and compressions. CDS premiums were set at 100 or 500 basis points for US contracts and at 25, 100, 500 or 1000 basis points for European single name CDS. Hence, protection sellers or buyers may be required an upfront payment to compensate for the difference between the market price and the standardized premium set by the protocol.

In light of different regional practices and legal definitions, in 2009 ISDA also developed several “Standard CDS Contract Specifications” (for instance, a “Standard European CDS Contract Specification” and a “Standard North American CDS Contract Specification”).

In order to clarify open issues in the Big Bang protocol relative to the absence of a common definition of Chapter 11 for European firms and to the qualification of restructuring events, ISDA introduced in July 2009 the so called “Small Bang” protocol. This Supplement to the Master Agreement extends the auction hardwiring provisions of the Big Bang Protocol to restructuring credit events.

Specific contractual arrangements and market conventions apply to CDS contracts on a basket of reference entities or securities, so called index and tranche CDS.

The main provider of indices used as underlying in the CDS market is Markit, which developed two main index families using the most liquid single-name CDS. The “CDX” family of indices has North American and Emerging Markets reference entities as constituencies, while the “iTraxx” family has European and Asian reference entities. Both CDX and iTraxx index families provide several sub-indices for various industries or regions and for different maturities. The most heavily traded indices are the CDY.NA.IG on US investment grade firms and the CDY.NA.HY on US high-yield firms. CDY.NA.IG is composed of 125 investment grade entities domiciled in North America, each with an equal weighting of 0.8%.

Index CDS have different design and trading rules compared to single name CDS.

Every March and September the composition of the basket of a certain index CDS is redefined (rolled) according to certain rules (e.g. minimum amount of debt securities outstanding and liquidity of the CDS of the single reference entities). Each of these “roll” results in a new series of the relevant index. For instance “iTraxx Series 17” was launched on March 20, 2012, with a maturity of June 20, 2017 for the 5 year contract. Although the latest

roll is the most frequently traded, the older roll will be updated until final maturity of the series.

Definition of Credit Events

Though counterparties in a CDS trade are free to agree on whatever definition of credit events that trigger contract liquidation, the vast majority of CDS trades use the ISDA definitions of credit event. ISDA has in fact codified the following situations as credit events[11]: 1) bankruptcy; 2) obligation acceleration (i.e. a situation where the relevant obligation becomes due and payable as a result of a default by the reference entity before the time when such obligation would otherwise have been due and payable); 3) obligation default (i.e. a situation where the relevant obligation becomes capable of being declared due and payable as a result of a default by the reference entity before the time when such obligation would otherwise have been capable of being so declared); 4) failure to pay (i.e. a failure of the reference entity to make, when and where due, any payments under one or more obligations); 5) repudiation/moratorium (i.e. a situation where the reference entity or a governmental authority disaffirms, disclaims or otherwise challenges the validity of the relevant obligation); 6) restructurings binding for all creditors, i.e. excluding those agreed voluntarily by creditors (covers events as a result of which the terms, as agreed by the reference entity or governmental authority and the holders of the relevant obligation, governing the relevant obligation have become less favourable to the holders than they would otherwise have been). For instance, this could result from a reduction of the coupon or amount of principal (haircut), deferral of payments of interest or principal (maturity extension), subordination of the obligation and change of the currency. However, in order to avoid any doubts, counterparties have to agree on the applicable restructuring definition.

Restructuring clauses are not common in the North American CDS contract specification, since in North America corporate restructuring automatically triggers a "chapter 11" bankruptcy event. By contrast, European firms may restructure their debt without necessarily entering into a formal bankruptcy procedure (so called out-of-court restructuring). Consequently, the "Standard European CDS Contract Specification" refers to restructuring as a specific credit trigger event. However, different restructuring clauses exist. The original "unmodified" version of restructuring, allows the protection buyer to deliver bonds of any maturity in case of any forms of restructuring occurs. The "modified restructuring" (MR) clause limits deliverable obligations to bonds with maturity of less than 30 months after restructuring and was a common practise in North America until 2009. The "Modified Modified Restructuring" clause (MMR) is a modified version of the MR clause that resulted from the criticism that MR was too strict with respect to deliverable obligations. Under the MMR clause, which is more popular in Europe, deliverable obligations can be maturing in up to 60 months after a restructuring.

As noted above, voluntary restructurings are not considered credit events Hence, an important criterion in order to have a restructuring event is that the restructuring has to be binding for all holders of the restructured debt. For bonds with a "collective action clause" (CAC) or a loans with a qualified majority voting clause of 75%, changes in the terms of the bonds or loans become binding to all creditors if 75% of them agree on the restructuring. This means

[11] See, however, the original ISDA "Credit Derivatives Definitions" for a more comprehensive and legally accurate description of the following six definitions of credit events.

that the new terms are binding to all creditors, irrespective of whether they did not vote or voted against the restructuring.

Credit event decisions and contract liquidation

As previously mentioned, the Determinations Committee (DC), introduced in 2009 by the ISDA Big Bang Protocol and consisting of market participants and legal experts[12], decides on whether a certain situation can be qualified as a credit event. The decision process starts with a request by one or more market participants, based on publicly available information, to review a certain situation relative to a reference obligation or entity in order evaluate if it falls within the definition of credit events under the ISDA protocol. The DC decides first to start a determination process for the reference obligation and second whether a credit event is actually triggered or not. The decision of the DC is binding to all parties that have signed to the ISDA protocol, irrespective of the nature of the reference entity or obligation (corporate or sovereign). With supermajority voting (12/15 of the members) the DC can decide that a credit event has occurred without asking for an external legal review.

A "Successor Event" occurs in the case a reference entity enters in a merger, acquisition or a spin-off and hence a new obligor(s) of the previously existing debt has to be defined. In this situation the DC defines the successor entity as reference entity for the CDS contracts.

In case of a credit event, there can be different contract liquidation procedures. Until 2005, CDS contracts were mostly physically settled, in the sense that the protection seller bought the distressed loan or bond (the "deliverable obligation") from the protection buyer at par. In this case, the protection seller, as the new owner of the defaulted asset, realizes the recovery rate and can gain or lose from subsequent changes in the market price of distressed securities.

Physical settlement was acceptable as long as CDS were mainly used for hedging, so that the value of CDS did not normally exceed that of the underlying reference entity. With the growth of the CDS market, cases of CDS notional value exceeding the value of the underlying bond became more frequent and in such situations, in case of a credit event, the buyers of protection, who might not have the underlying bonds to deliver in order to comply to physical settlement, had to buy them on the secondary market creating the potential for an artificial price pressure (short squeeze). In order to avoid short squeezes, cash settlement became an option and the payment to protection buyers could be determined as the difference between the nominal and the market value of the reference obligation. In contrast to physical settlement, the protection buyer keeps the exposure to the distressed bond for price changes subsequent to the contract liquidation.

One main drawback of such cash settlement arrangement is that obtaining quotes for distressed securities is often quite difficult, since liquidity dries up rapidly in case of credit events. For these reasons and in order to increase the transparency of the settlement process, ISDA protocol has introduced the mentioned centralized auction as a default procedure to define the reference price for cash settlement. From mid-2009 auction settlement became the standard settlement mechanism for CDS contracts.

The auction is based on a two-stage procedure. The first step identifies an indicative price, the "initial market mid-point" (IMM), and the net open interest (NOI) for the defaulted

[12] Members of the several regional Determination Committees are published by ISDA: http://www.isda.org/dc/dc_info.asp

bonds. The IMM provides a first indication of final price, while the NOI indicates the size and direction of the open interest. The second step gives the definitive (final) price to be used for the settlement of CDS contracts. With majority voting, the DC sets the auction terms (auction date, initial and subsequent bidding periods, inside market quotation amount, maximum inside market bid-offer spread and minimum number of valid inside market submissions).

In the first stage of the auction dealers supply two-way market quotes on the basis of a pre-defined maximum spread and with a pre-defined quotation size associated with it. Additional inputs are the "Physical Settlement Requests". These are the requests to buy or sell bonds/loans (at the final price), which when combined with the cash settlement of their CDS trade adds up to be equivalent to physical settlement.

In the second stage, the NOI from the first stage of the auction process is cleared, in order to determine the definitive (final) price for cash settlement, through a standard uniform price auction in which dealers and investors can submit limit orders with the relative quantity.

In case of a credit event of a reference entity that is a constituent of an index CDS, contracts on such index CDS is settled via participation in the credit event auction and the result of the auction is reflected on a pro rata basis according to the weight of the reference entity on the index. The notional amount of the CDS index contracts will be reduced by the weight of the defaulted entity on the index itself so that there is no replacement or creation of a new index series, though in the following roll a new index series will be defined.

The Greek case

In general, the described procedure to ascertain a credit event and to liquidate CDS contracts applies to private as well to sovereign entities. However, the restructuring of sovereign debt may differ in some aspects from that of corporate debt.

In the case of the Greek sovereign debt crisis, for example, the initial hypothesis on a debt restructuring had raised questions on whether it could be considered a credit event because the Greek Government and the EU Commission were looking for a voluntary debt restructuring arrangement.

The Greek case highlighted that, in order to have a credit event under ISDA rules, it is crucial to determine whether the restructuring is voluntary or mandatory. As noted above, a voluntary debt restructuring agreement does not trigger a credit event, since it only binds those investors that agree to the restructuring.

Greece first tried to come to a voluntary debt restructuring agreement and on March 1, 2012, the ISDA Determination Committee for EMEA area stated that a voluntary haircut agreement could not be considered a credit event. However, since it turned out that the voluntary restructuring could not result in the expected debt reduction, the Greek authorities took the unilateral decision to retroactively introduce collective action clauses (CAC) for bonds issued under the domestic Greek law. Though the introduction of CAC is not *per se* a credit event, it has had the effect to bind all bondholders to a debt swap restructuring implying a significant haircut and for this reason, on 9 March 2012, the ISDA Determinations Committee decided that a "Restructuring Credit Event" occurred relative to the Greek debt. Consequently, on 19 March an auction was held according to the previously described procedures.

The voluntary exchange of the outstanding Greek debt for new debt (under the so called "Private Sector Involvement" program) that became binding for all bondholders implied losses for 53.5% of the nominal value. Investors received 31.5% of the original face value of their bonds in newly- issued bonds with 30 years maturity, 15% in bonds issued by the European Financial Stability Facility (EFSF) with 2 years maturity and a "GDP Warrant" that may increase coupons by 1% after 2015 depending on the GDP growth rate.

The deliverable bonds for CDS settlements were the newly-issued bonds with 30 years maturity and the price of these bonds in the auction held on 19 March was set at 21.5% (recovery rate). The settlement of the CDS contracts resulted in net payment by protection sellers of 2.89 billion US dollars, against a gross amount of outstanding CDS of around 80 billion US dollars. The large difference between gross and net exposures, also highlighted in Figure 7, was due to the high incidence of offsetting positions. However, since most of the exposures were collateralized the impact of the CDS settlement in terms of liquidity risk has been limited.

BOX 1: **The Greek debt restructuring**

On 27th of February 2012, ISDA received a query about whether the voluntary acceptance by some private banks of a haircut on their holdings of Greek debt could be defined as a credit event. On the 1st of March, ISDA issued a note clarifying that, according to the facts recorded until that date, this event could not be considered as a default event.[13] Following a similar query posed a few days later, ISDA announced on the 9th of March that the triggering of the collective action clauses in domestic-law bonds was a "Restructuring" credit event for the CDS contracts on Greek debt.

The agreement on the voluntary exchange of Greek debt for new debt, as reflected in the Private Sector Involvement (PSI) agreement, implied that the private investors in Greek bonds would accept losses of 53.5% of the notional value of their bonds. In exchange for this, the investors would receive 31.5% of the original face value of their bonds in 30-year Greek bonds, 15% in 2-year bonds issued by the European Financial Stability Facility (EFSF) and a "GDP Warrant" that could increase the payments of the bonds' coupons by 1% after 2015 depending on the GDP rate of growth.

In the execution of the CDS contracts, the restructuring payments were set using the newly-issued Greek bond with a 30-year maturity. The price of this last bond, and hence the recovery rate, was settled in an auction held on March 19th. As a result, the recovery rate was set at 21.5%, which was close to some market estimations made before the auction. According to DTCC, the settlement of the auction resulted in net cash flows of $2.89 billion, against a gross amount outstanding of Greek CDS of around 80 billions of dollars. The difference between the gross and the net exposures was due to the fact that investors closed

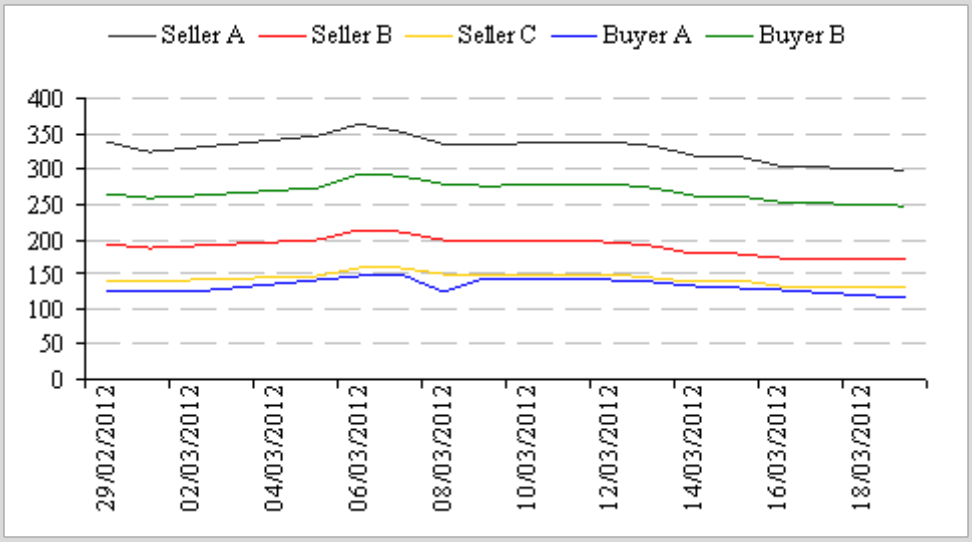
[13] In the case of Greece, the 15 institution which had the right to vote for the evaluation of the credit event included 10 dealers, who were selected according to their volume of transaction in the CDS market, and 5 non-dealer institutions, that were selected randomly from a pool of buyers of protection.

many of their positions by offsetting their contracts which increases the total gross notional amount outstanding. The above amount of net exposures is nevertheless consistent with some sellers of protection having an exposure larger than $2.89 bn.

Due to the fact that these exposures would be partially compensated by the recovery rate of the underlying and that many of these contracts were collateralized the total payment at the time of the credit event would have been much lower. Specifically, the recovery rate was set at 21.5% and, on average, 70% of the exposition of the derivatives was collateralized, with an average level of collateralization above 90% for the CDS transactions, according to ISDA. Thus, according to these figures, a high proportion of the total $2.89 bn could have been paid shortly after the declaration of the credit event.

A central question at that time was whether this credit event would lead to a large flow of payments to the buyers of protection and whether this could have any material effect on the financial system at large, due to the high degree of concentration in this market, and especially with regard to the European banks by virtue of their direct and indirect expositions. In spite of this, however, the impact of the credit event was remarkably low, with no visible effect on the indicators of financial soundness of those institutions more exposed to CDS on Greek debt. For instance, the next figure shows that the announcement of the credit event by ISDA did not have a significant effect on the CDS premium of five European banks, three of which were the main European bank-sellers of protection on Greek debt and two of them the European bank-buyers at that time according to the data made available by the European Banking Authority. As it can be directly inferred from that figure, the CDS premiums for these five financial institutions did not react significantly around the referred date.

CDS premiums for the main European-bank net protection sellers and buyers of CDS on the Greek debt (in basis points)



Source: EBA and CMA

It turned out that the initial fears of a systemic impact of the Greek credit event, related to a possibly high concentration of the exposures on few protection sellers, were overstated. The impact of the Greek credit event has been smaller than that of the Lehman Brothers default in September 2008. In fact, the exposure on Greece was lower (and probably more collateralized) than that on Lehman Brothers and the recovery rate was higher (21.5% compared with 9% for Lehman Brothers bonds).

In sum, the CDS market has worked in an orderly way after the credit event of Greece, although this episode also brought to the forefront several doubts on the future of this market, especially, in case there is a default of another sovereign with a larger volume of CDS contracts. In particular, the Greek event has reinforced the need for supervisors to have a thorough understanding and transparency of exposure across institutions. This aspect was partially overcame thanks to the EBA reporting of detailed disclosures on banks' exposures to sovereign CDS which could have helped avoid the emergence of weakly-founded concerns about the fragility of some key players in the CDS market. Still, after this credit event several technical issues remain related to the deliverable bonds, the definition of credit events and the setting recovery rate that deserve further attention, for their potentially implications in the well-functioning of CDS markets, as pointed out recently by Duffie and Thukral (2012).

3.2 Market structure

The CDS market, similarly to other OTC derivatives market, is characterised by two types of transactions.

The first type of transaction, which represents the majority of trades, originates by end-user and transaction agents who trade with dealers operating as market-makers. The typical transacting agent is a registered investment advisor that serves as a "buy-side" intermediary on behalf of end-users that transact infrequently but desire beneficial ownership. The dealer side is largely dominated by the so called G14 dealers[14], who are the largest derivatives dealers worldwide and hold roughly 90% of the CDS notional amount. Some studies tried to assess the degree of concentration in the CDS dealer market, finding that there is a low or moderate degree of concentration based on several measures.[15]

Buy-side market players are represented mainly by institutional investors and other non-dealer financial institutions (very few, if any, retail investors are involved in the CDS market). The interaction between end-users, possibly intermediated through transacting agents, and dealers, as in other OTC markets, takes place through bilateral contacts, based on indicative and unbinding quotes posted on major data providers.

The second type of transaction is represented by inter-dealer trades to manage or hedge transactions with buy-side clients or the dealers' inventories. These trades are usually intermediated by so called "inter-dealer brokers". These intermediaries do not take any

14 Goldman Sachs, HSBC, J.P. Morgan, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS and Wachovia Bank.. Nomura joined the group in August 2011 and Crédit Agricole is expected to join in 2012.

15 See for example ISDA (2010a).

proprietary positions, but only match dealer orders, guaranteeing counterparty anonymity until the transaction is concluded. Inter-dealer brokerage systems have gradually evolved from traditional voice brokerage mechanisms into electronic trading platforms. Such platforms provide automatic order execution and allow dealers to observe and transact anonymous quotes posted by other dealers[16].

The CDS market is characterized by a relatively low trade frequency and large average trade size compared to the bond market. Table 1 gives summary statistics for the average daily number of trades for CDS on the top 1,000 single-name reference entities and for index CDS from the DTCC database. Single-name CDS trade on average 5 times per day, with CDS on sovereigns trading more frequently than corporate CDS. Trade frequency increased for both corporate and sovereign entities in the past two years, but the sovereign sector showed a stronger increase. The index CDS are traded much more frequently than single-name CDS (each index series trades on average 20 times per day, compared to roughly 5 times per day for single-name CDS).

The most frequent notional trade size for single-name CDS is 5 million US dollars for corporate and 7.1 million for sovereign entities. For index CDS the modal trade size is 25 million US dollars but the frequency distribution of trade size is skewed to the right (Figure 8). The average notional trade size for index CDS is much larger than for single-name CDS (55.5 against 6.6 million US dollars – Table 2).This is driven by some large outliers, namely CDX.NA.IG and "iTRAXX Europe" indices, which increase the average notional trade size.

Similar statistics of low trade frequency and high average trade size in the CDS market are also reported by Chen et al. (2011) and Amadei et al. (2011) among others.

Table 1 - Trade frequency in the CDS market

		June - Sep 2011		June 2009 - March 2010	
		Number of reference entities	Average n. of trades per day per reference entity	Number of reference entities	Average n. of trades per day per reference entity
Top 1000 single-name		1000	4.9	996	4.3
	Corporate	934	4.3	934	4.1
	Sovereign	66	13.5	62	8.0
		June – Sep 2011		March – Sep 2010	
Index CDS		137	20.2	117	15.7

Source: Calculation on DTCC data.

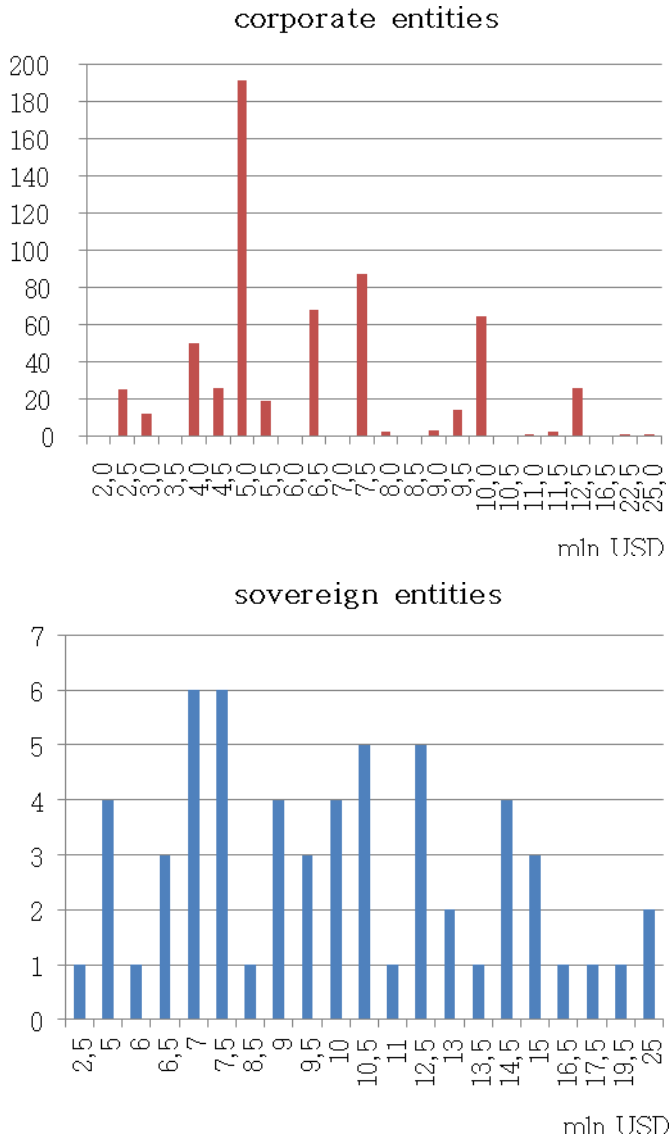
16 See Avellaneda and Cont (2010).

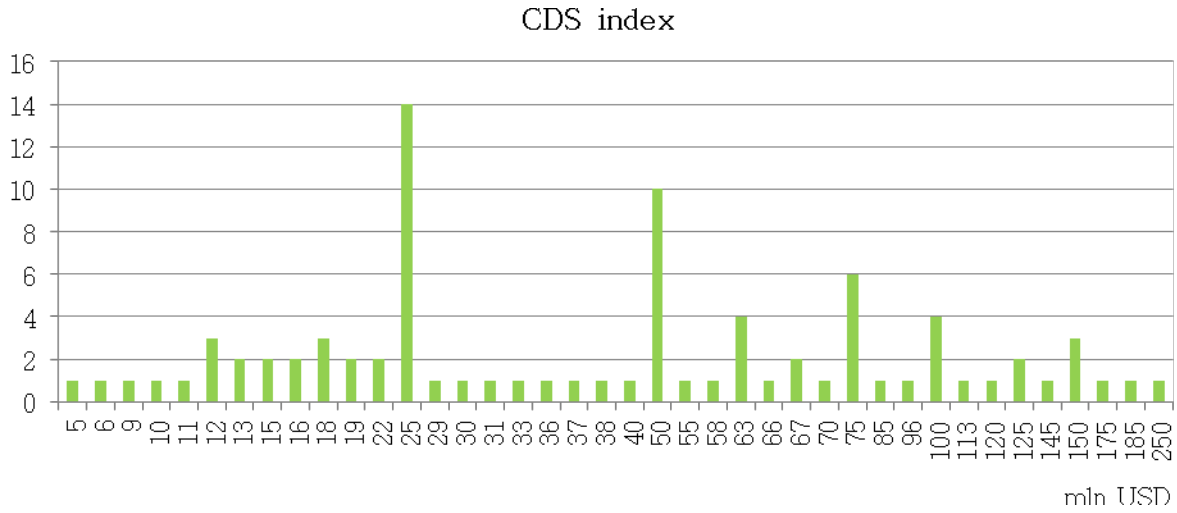
Table 2 - Trade size in the CDS market

		number of reference entities	mean trade size (mln. US $)	median trade size (mln. US $)	modal trade size (mln. US $)
Top 1000 single-name		898	6.6	6.3	5.0
	Corporate	839	6.4	5.8	5.0
	Sovereign	59	10.5	10.0	7.1
Index CDS		86	55.5	45.0	25.0

Source: Calculation on DTCC data. Data from June to September 2011. Average trade size is calculated dividing average daily traded notional amount by the average daily number of trades using the publicly available DTCC data, Entities with average numbers of daily trades equal to zero are excluded causing a divergence from the total number of reference entities in Table 1.

Figure 8 - Frequency distribution of CDS trades





Source: Calculation on DTCC data. Data from June to September 2011.

After the global financial crisis, financial regulators and some experts called for greater transparency in the OTC derivatives markets, on concerns that the opaque nature of these markets had exacerbated the crisis.[17] Transparency in this context may refer to the information available on the issuers' terms of sale (pre-transparency), to prices and volumes of transactions carried out in the market (post-transparency) or to the available information on the positions held by each dealer, an issue which is of special relevance for the identification and assessment of potential aggregate risks. In all these cases, there is a rather general consensus around the fact that in all these dimensions, the level of transparency is still suboptimal.

There is a large amount of research on transparency in regulated stock, bond and exchange-traded derivatives markets with large retail involvement, but these markets are different from the CDS market, as previously illustrated, and direct research evidence from the CDS market is limited. A number of recent analyses have stressed some benefits that the establishment of transparency regimes in these markets might be expected to bring. Such benefits can be broken down into those accruing mainly to the supervisory authorities and those which would benefit market participants (see e.g. Stulz 2010). SLWGFR (2009) argues that increased transparency about the terms of market transactions would, in general, increase the quality of the market for these contracts, in terms of lower costs, including through greater competition between intermediaries, and higher liquidity. Litan (2010) expresses similar views, arguing that enhanced pre- and post-transparency would bring more efficiency to these markets, enriching the information content of the prices and reducing the bid-ask spreads.

Avellaneda and Cont (2010), leveraging on the literature more specific to the OTC markets (in particular on the introduction of the post-trade transparency on the OTC corporate bond market in the US through the so called TRACE system), argue that the cost of increased transparency may accrue to large dealers, while end-users may benefit from reduced

[17] See e.g. the G20 Leaders' declarations following the summits held in Pittsburgh (September, 2009) and Toronto (June, 2010) and the FSB report "Implementing OTC Derivatives Markets Reforms" (October, 2010). For an early academic contribution on this issue, see e.g. the Squam Lake Working Group on Financial Regulation, SLWGFR (2009).

execution costs. In fact, reviewing the empirical evidence on the introduction of the TRACE system, Bessembinder and Maxwell (2008) conclude that there is evidence that increased transparency is associated with a substantial decline in investors' trading costs and that this result is consistent with the theoretical argument that in an opaque market dealers may be able to extract rents from uninformed customers and profit from reduced competition (as, for example, in the models of Pagano and Roell 1996 and Madhavan 1995).

More generally, the evidence from the economic literature on whether increased transparency may reduce bid-ask spreads and execution costs is not conclusive. For example, Goldstein et al. (2007) and Bessembinder *et al.* (2006) find evidence of reduced execution costs after the introduction of TRACE post-trading transparency, while Madhavan (1996) and Madhavan *et al*. (2005) find evidence that transparency increases execution costs. The literature based on experimental studies points to contrasting results as well: for example, Flood *et al.* (1999) find that bid-ask spreads are higher in opaque markets but just at the openings of the trading day, while Bloomfield and O'Hara (1999) find opposite results that disclosure increase opening bid-ask spreads.

Moreover, Avellaneda and Cont (2010) argue that the TRACE experience is not directly applicable to the CDS market because the corporate bond market is composed of many more participants, including retail clients, and information was much more dispersed prior to the introduction of the TRACE system. By contrast, the CDS market is an institutional market, much more concentrated on a small network of dealers: search costs should be lower and dissemination of pre-trade information through bilateral exchanges may be quite effective. It may be also important to distinguish CDS indices from single name CDS.

Nevertheless, some have warned on the potential losses for some market participants steaming from more transparency. For instance, Avellaneda and Cont (2010) conclude that the main beneficiaries from higher transparency standards would be the less informed participants together with those who carry out small volume transactions (due to the reduction of transaction costs). However, they contend that increased transparency requirements could erode the benefits obtained by CDS dealers.[18]

The possibility that dealers' positions are known by other market participants may expose dealers to predatory trading, i.e. if the market knows that a dealer has a large position to hedge or unwind, other market participants will trade in the same direction to anticipate the expected price movement. In their theoretical model Brunnermeier and Pedersen (2005) show that predatory trading is more likely and intense the more the market is illiquid and the more dealers' activity is concentrated on few players. Given that the CDS market shares most of the mentioned characteristics, the downside of post-trade transparency in terms of discouraging dealers' activity may be significant, unless the disclosure is sufficiently delayed.

As regards the information available for supervisors, there seems to be a general consent on the idea that the notion regulatory transparency should extend to granular transaction and position data. For instance, Acharya et al. (2009) argue that transparency may help improve the correct assessment of counterparty risk, thus, leading to greater efficiency in the determination and use of the margins required in contracts. The implicit argument is that, by improving information about the positions and risks of each participant, the bilateral margins could be calculated in such a way as to be better aligned with each particular risk. Kiff et al.

[18] Litan (2010) analyses the potential conflicts of interest between the several market participants and identifies some possible elements of resistance to pro-transparency reforms on the part of some major CDS dealers.

(2009) emphasize the idea that the fears of systemic risk in CDS markets could abate if supervisors and participants had access to more detailed information about the reference entities of the different contracts and the counterparties. Stultz (2010) also notes that trade reporting could also help in identifying market manipulation in the form of insider trading.

Several initiatives were taken by regulators and the industry at national and international levels to mitigate the risks in the OTC markets, including requiring the central clearing of standardized OTC derivative products (see next §3.3) and dissemination of additional information on the markets.

The Depository Trust & Clearing Corporate (DTCC), for example, started to publish CDS data in November 2008 from its Trade Information Warehouse on a weekly basis. The greater use of electronic platforms in the inter-dealer segment of CDS market also enables to provide some degree of pre-trade transparency. Market participants also have access to real time non-binding quotes posted by dealers and information on intraday prices available from data providers like Markit.

The Committee of European Securities Regulators (CESR – which has since become the European Securities and Markets Authority) examined the possibility to extend MiFID transparency requirements to non-equity financial instruments in a consultation paper published in May 2010. CESR, based on the comments received, recommended certain post-trade transparency requirements for the OTC markets in accordance with the size (net value) of transactions (the smaller the size of transactions, the higher the level of transparency required). However, while recognizing a need for harmonization across jurisdictions, CESR did not propose at that stage to introduce mandatory pre-trade transparency requirements given that the market microstructure and the degree of liquidity varied widely across different OTC products.

Though the amount of public information on CDS has increased over the recent years, the CDS market still retains a high degree of opacity because post-trade transparency is scarce and pre-trade transparency is limited to part of the inter-dealer market (see e.g Litan 2010).

Summing up, available research on the impact of transparency on execution costs and on the incentives to provide liquidity does not provide conclusive results. However, some policy-oriented papers insist on the benefits of introducing more transparency both toward market participants (market disclosure) and towards supervisors (reporting).

As for market disclosure (basically pre- and post-trade transparency), SLWGFR (2009) concludes that more transparency about the terms of market transactions may increase market quality and bring lower costs, higher liquidity and greater competition between intermediaries, and Litan (2010) argues that enhanced pre- and post-trade transparency would bring more efficiency, enriching the information content of prices and reducing bid-ask spreads.

As for reporting, there seems to be a general consensus that regulators should have access to granular information on trade and position data. Benefits from reporting are highlighted by, for example, Acharya et al. (2009), who note that reporting may help improve the assessment of counterparty risk by CCP, and Stultz (2010), who argues that trade reporting helps in the detection of market manipulation and insider trading.

3.3 Counterparty risk and collateralization

While CDS buyers reduce credit exposure to a reference entity, they also take on counterparty risk because of the exposure to the protection seller. One of the main concerns regarding the functioning of the CDS market is related to the counterparty risk generated by the default of large protection sellers. This may happen by a failure to meet payments obligations following a credit event or inability to post collateral following a downgrade of the credit rating of dealer itself. If the protection seller defaults, the CDS positions would be replaced at unfavorable market prices. Because of the highly concentrated and interconnected nature of the CDS market, this may create systemic risk. The bailout of AIG, a major CDS dealer, and the bankruptcy of another important CDS dealer like Lehman Brothers in 2008 illustrate the importance of counterparty risk in the risk management of CDS.

One distinctive feature of CDS compared to other OTC derivatives is the price discontinuity before default that is often referred to as the "jump to default". The market value of a CDS position (i.e. its replacement cost) prior to a credit event occurs can be a small fraction of the notional, but the actual exposure upon default may represent a large fraction of the notional. This implies that the protection seller could suddenly owe large amounts that it may not pay. This jump-to-default risk complicates the risk management of CDS and may result in under-collateralization or underestimation of variation margins because of the complex modeling required (Pirrong 2011).

Indeed, in order to mitigate counterparty risk in OTC contracts, market participants may post collateral, which is intended to absorb first losses in case of default of the counterparty. Initial margins may be required on initiation of the contract. In practice, due to the jump-to-default risk, initial margins in bilateral CDS contracts can reach 10–30 percent of the notional amount, while they are normally much lower for other OTC derivatives. Furthermore, margin levels are regularly adjusted through margin calls, which can reach large amounts in case of a sudden deterioration of the creditworthiness of the reference entity or of the financial situation of one of the counterparties.

Although collateral is not systematically required in CDS transactions, collateralization agreements have been increasing in recent years. The ISDA (2010b) margin survey reports that 93 percent of the flow of all new credit derivatives trades executed in 2009 became subject to collateral arrangements. ISDA stock data indicate that about 70 percent of OTC derivatives net credit exposure was collateralized, though for the European market the ECB/Banking Supervisory Committee survey[19] estimates that only 44 percent of net exposures are collateralized.

Different studies estimate that the magnitude of under-collateralisation for the overall OTC derivatives markets can be substantial. Cecchetti *et al*. (2009) estimate the under-collateralization at end-2008 at about 1 trillion of US dollars, taking the difference between the gross credit exposure (estimated at 5 trillion US dollars on the basis of BIS statistics) and the amount of collateral used (estimated at 4 trillion US dollars on the basis of the ISDA margin survey). With specific reference to the CDS market, Singh (2010) infers the degree of

[19] See ECB (2009).

under-collateralization from an estimate of the collateral cost of moving CDS to central clearing, arriving at figures ranging from 40 to 80 billion US dollars.

Under-collateralization in OTC derivative markets may be due to the fact that collateral arrangements depend not only on the creditworthiness, but also on the type of the counterparty. For example, sovereigns, central banks, AAA insurers, Fannie Mae and Freddie Mac and other similar clients sometimes do not post collateral. Dealers only post collateral with each other for their net exposures. Furthermore, collateral received may be *rehypothecated*, *i.e.* re-used by the recipient as collateral for a different transaction. According to the ISDA (2010b) margin survey, 44 percent of all respondents and 93 percent of large dealers on derivative markets report rehypothecating collateral. Survey respondents as a whole report rehypothecating 33 percent of collateral received while the large dealers report rehypothecating 82 percent of collateral received.

The default of a protection seller may create default contagion. In this respect, network models provide a useful tool to analyse the impact of credit derivatives on systemic risk. In particular, Cont (2009) shows that the magnitude of financial contagion depends on some properties of the network structure other than on the exposure of its largest participants.

Central clearing

As a result of the financial crisis, and particularly after the AIG bailout, the use of central counterparties (CCP) has been seen as a way of mitigating counterparty risk in CDS contracts and preventing default contagion.

In fact, CCP, acting as a buyer to every seller and a seller to every buyer of protection, isolate counterparties from the default of each other and the consequent reduction of bilateral interconnectedness between financial institutions mitigates contagion risk in the financial system. In the event of default by a clearing member, CCP may use different pool of resources to absorb losses, such as margin calls, guaranty funds (to which clearing members may contribute according to the riskiness of their positions) and its own capital. These different layers of protection are designed to limit the risk of contagion by immunizing each member from the default of others. Moreover, centralized clearing makes it possible to establish harmonized requirements for monitoring and managing counterparty risk and may improve risk management practices by market participants, thereby increasing the confidence in the market. Finally, multilateral netting may encourages contract standardization in order to maximize the share of trades eligible for central clearing.

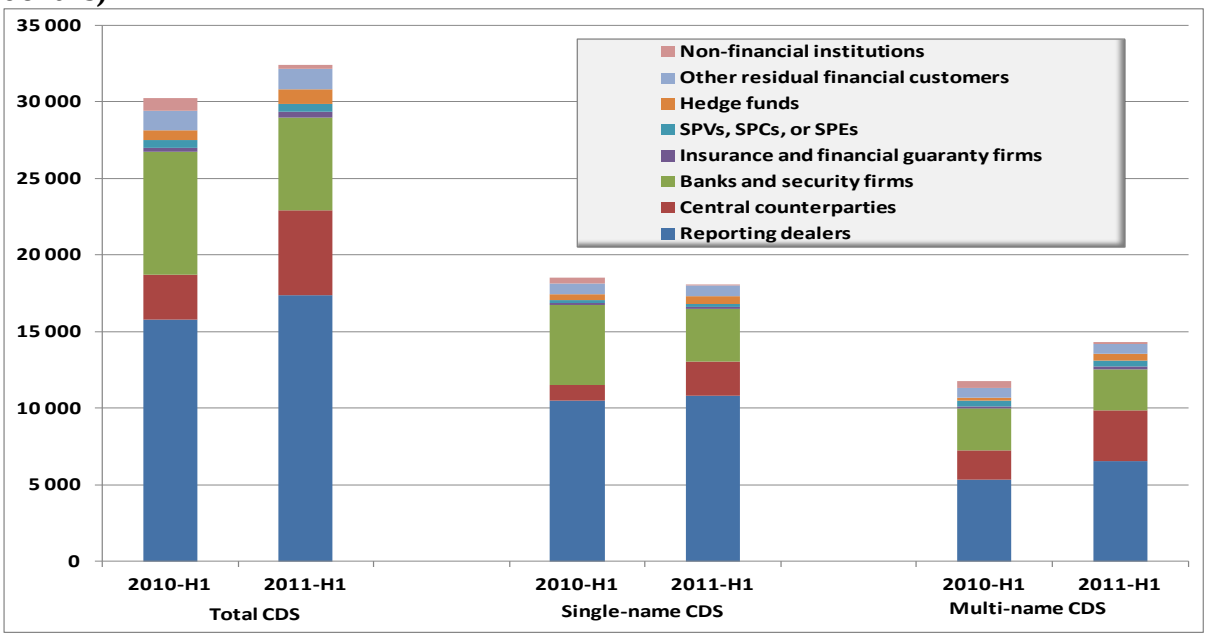
Although CCP reduce counterparty risk for market participants, their own failure may potentially lead to a systemic event. This may be particularly an issue when there is only a small number of CCP, as this may lead to a large concentration of risk and CCP become too connected to fail.

In September 2009, the G20 Leaders stated that all standardized OTC derivatives should be cleared through CCP by the end of 2012. The Dodd-Frank Act of the United States and European Market Infrastructure Regulation (EMIR) introduce a clearing obligation for suitable OTC derivatives.

Currently, there are multiple CCP services around the world. The main CCP for CDS trades are “Eurex Credit Clear”, “ICE Clear Europe” and “LCH.Clearnet SA” in Europe, “CME CMDX” and “ICE Trust US” in North America and “Japan Securities Clearing Corporations” in Japan. CDS cleared by CCP are mostly index CDS because CCP tend to clear more liquid contracts and index CDS are more liquid than single-name CDS, as previously noted.

The BIS data show that the share of outstanding CDS gross notional cleared by CCP increased from 10% at the end of June 2010 to 17% at the end of June 2011 (Figure 9 and Figure 3 in §2.1). Recent flow data indicate, however, that the percentage of CDS transactions cleared by CCP is increasing. In fact, the Financial Stability Board (2011) reports that the flow of new trades cleared through CCP in the first half of 2011 represented 32% of the overall gross notional amount of all new trades in CDS. It is likely that this trend will continue in the near future because of the new regulations in Europe and in the US mentioned earlier.

Figure 9 - CDS gross notional by counterparty and contract type (millions of US dollars)



Source: BIS.

Though the importance of CCP is increasing, the empirical evidence on the effects of CCP is scarce. Two recent theoretical papers have analysed the implication of different CCP industry structures. However, these two papers have to be carefully evaluated in the light of the simplifying assumptions underlying the models used and of the specific perspectives under which the problems are analysed.

The first paper is the one by Duffie and Zhu (2011), who present a basic model that shows how the increased efficiency in multilateral netting across a single instrument may be offset by the reduction in the efficiency of bilateral netting across different types of financial instruments. More specifically, the authors show that introducing a CCP for a particular set of derivatives, such as CDS, reduces average counterparty exposures only if the number of clearing participants is sufficiently large relative to the exposure on derivatives (including

OTC derivatives for equities, interest rates, commodities, and foreign exchange) that continue to be bilaterally netted[20].

The second paper by Cont and Minca (2010) takes a different perspective from Duffie and Zhu (2011) and argues that even a single CCP specialized in CDS clearing may be a preferable solution compared to bilateral netting in terms of reducing systemic risk (rather than in terms of reducing total counterparty exposure and collateral requirements) as long as all large CDS dealers are members of the CCP.

3.4 CDS prices and bond spreads

CDS prices and bond spreads (i.e. the difference between the yield of a defaultable bond and a risk-free rate) are measures of credit risk, and as it will be shown they should be equal in a perfect and frictionless market. A large literature has tried to model credit spreads (i.e. CDS prices and bond spreads) and identify their determinants. Such literature can be divided into two different streams.

The first is based on so called "structural models", which try to explicitly link credit risk to firms' characteristics. This approach has originated from the seminal work of Merton (1974) in which credit risk is basically a function of the difference between the market value of assets (modelled using option theory) and the value of the debt. Hence credit risk is essentially modelled as a function of firm's leverage and asset volatility.

The second stream of literature is based on so called "reduced form" models, which make a priori assumptions on the functional form that relates credit spreads to measures of credit risk (defaults and recovery rates) and to other variables (see Duffie 1999 for an example of this approach). These models are calibrated on historical market prices and then used for pricing or explaining the relative importance of the determinants of observed CDS and bond spreads.

Both of these approaches have been extensively used to explain the dynamics of CDS prices and bond spreads and to assess the relative importance of credit risk compared to other variables such as liquidity risk and risk premium in the pricing of credit spreads. For example, empirical researches by Chen et al. (2007), Longstaff et al. (2005) and Elton et al. (2001) find that credit spreads include risk premium and liquidity premium components, in addition to compensation for credit risk. Moreover, the empirical application of structural models has usually failed to prove strong correlations between firms characteristics and observed credit spreads (this is usually referred to as the "credit premium puzzle"; see Amato and Remolona 2003), meaning that proxies of credit risk based on fundamental variables have normally a small relevance in explaining credit spreads.

Hence, CDS spreads seem to be influenced not only by idiosyncratic factors related to the credit risk of the underlying reference entity, but also by market-wide factors related to liquidity and risk aversion of market participants.

[20] Their model and numerical estimates suggest that clearing CDS through a dedicated CCP improves netting efficiency if and only if the fraction of a typical dealer's total expected exposure attributable to cleared CDS is at least 66% of the total expected exposure of remaining bilaterally netted classes of derivatives.

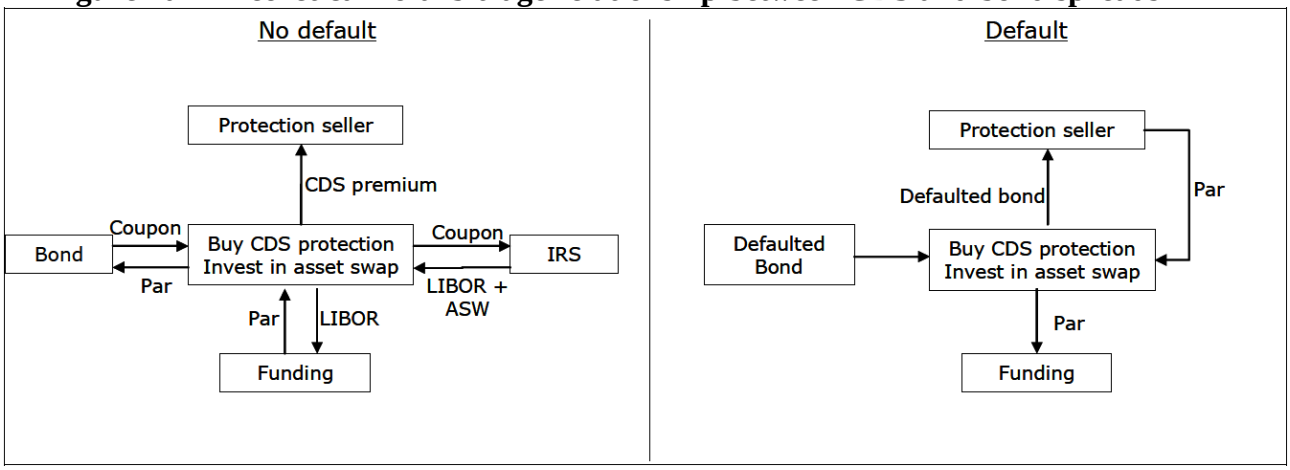
Definition and determinants of the "basis"

The difference between CDS and bond spreads is usually defined as the "basis". In a perfect market without frictions, the basis should be zero since otherwise there would be unexploited arbitrage opportunities.

More precisely, Figure 10 shows that an investor can achieve a fully hedged position by buying protection through CDS and entering into a leveraged long position in the underlying bond (using it as collateral to get a close-to-LIBOR rate through the repo market) and into an asset swap whereby the fixed coupon of the bond is exchanged for a floating rate (LIBOR+ spread).

If the CDS spread were lower than the asset swap spread (ASW) (i. e. negative basis), the investment strategy in Figure 10 would represent a profitable arbitrage opportunity to earn a risk-free return through a fully leveraged positions (because the investor would receive the ASW spread and pay the CDS spread). If the CDS spread were instead higher than the ASW, then the same result would achieved by selling CDS and short selling the underlying bond via a reverse repo (i.e. a repo in which bonds are borrowed and the proceeds of the short sale invested at LIBOR – in this case all the arrows in Figures 10 would be inverted, so that the investor would pay the ASW spread and receive the CDS spread).

Figure 10 – Theoretical no-arbitrage relationship between CDS and bond spreads



Source: De Witt (2006) based on the original argument by (Duffie 1999). ASW stands for "asset swap spread".

The reasons that explain why in real life the basis is not zero can be related essentially to technical factors, to frictions in the repo and interbank lending market and to counterparty risk.

As for the technical factors, there are at least two complications that imply that the cash flows in Figure 10 do not match exactly. First, buying protection requires an upfront payment after the introduction of the new ISDA protocol in 2009 and the standardization of CDS premium (see §3.1). Second, in order to create a leveraged long position on the bond a haircut is usually requested, so that the nominal amount of the funding through repo is higher than the nominal amount of the bond/CDS position.

Frictions in the repo market can cause the basis to be either positive or negative. A typical case of positive basis may be due to the fact that ASW spreads for top rated entities (e.g. AAA/Aaa names) are usually negative (because in the interbank lending market LIBOR rates are generally applicable to AA-/Aa3 institutions) while CDS prices cannot be negative

(because no protection seller would accept a negative premium). In order to profit from such positive basis situation, market participants should short the bonds and sell CDS, as previously described. However, it may be difficult or costly to borrow the underlying bonds because the demand to borrow highly-rated and liquid bonds may exceed the supply by those who owe such bonds that may be inhibited from legal or institutional requirements from supplying collateral[21]. These kinds of frictions will cause the repo rate to go below LIBOR (so called "special" repo rate) and the arbitrage may not generate a positive return even if the basis is positive.

Other kinds of frictions may instead explain negative basis situations. In such situations the arbitrage in Figure 10 would require to get LIBOR-funding using the long position in the bond as collateral. However, there might be situations of turbulence in the interbank lending market in which market participants are unwilling to provide liquidity or require a rate higher than LIBOR (even for high-quality collateral). A similar situation may also arise if the bonds are perceived as very low-quality collateral. Hence, in such situations the arbitrage is not attractive since the extra cost of the repo financing may exceed the profit form the negative basis.

Another important determinant of the basis is related to counterparty risk, because it makes arbitrage not totally riskless.

In principle, the protection seller's counterparty risk may be quite limited, because if the buyer defaults or misses a premium payment the obligation is extinguished (so called "default termination" or "close-out"), though he may lose a positive market value if the credit quality of the reference entity has improved[22]. Following a credit event, the buyer of protection is instead exposed to the difference between the nominal and the recovery value of the defaulted bonds, should the protection seller default following the reference entity's credit event. Thus, the protection buyer may ask for adequate collateral (see, however, the discussion in §3.3 highlighting that the share of uncollateralized CDS trades may be high).

If we assume that protection buyers remain exposed to significant counterparty risk, the return from the negative basis the arbitrage may not be sufficient to compensate for the counterparty risk in the CDS transaction. Hence, other things being equal, counterparty risk may explain a negative basis situation. Moreover, since risk premia may vary over time with general market conditions, counterparty risk may have a differential impact on the basis depending on market situations.

Most of the recent research confirms the arguments previously discussed that the basis is affected by counterparty risk, imperfections that make funding or short selling impossible or very costly (funding risk). For example, Fontana and Scheicher (2010) show that the basis for sovereign entities is affected by the cost of shorting bonds and by other country specific and

---

21 See Duffie (1996) for a thorough discussion of this point and for an illustration of why this is more likely for liquid and on-the-run US Treasuries bonds or liquid highly-rated bonds.

22 To be more precise, the ISDA Master Agreements require the parties to elect between the "First Method" of calculating termination payments and the "Second Method". Under the First Method, in the case of default of one of the two parties, if the market value is positive for the non-defaulting party, then it is paid by the defaulting party to the non-defaulting party, but, if it is negative, then no payment is due (i.e. the non-defaulting party is not required to make a termination payment to the defaulting party after an event of default). Under the Second Method (which is the market standard), if the market value is a positive for the non-defaulting party, then the defaulting party will pay it to the non-defaulting party, but if it is a negative, then the non-defaulting party will make a payment to the defaulting party.

global risk factors, while Arce et al. (2012) find that the basis is affected by counterparty risk, financing costs and differential liquidity between bonds and CDS. Similarly, for private entities, Bai and Collin-Dufresne (2009) and Fontana (2009) find that the basis is driven by funding risk, counterparty risk and collateral quality.

3.5 CDS role under Basel III

Under the Financial Accounting Standards Board (FASB) 157 and the International Accounting Standards (IAS) 39, banks are required to recognise in their income mark-to-market unrealised losses due to counterparty risk. Concerning derivatives, the market value of credit risk is measured by the so called "credit valuation adjustment" (CVA), which is the difference between the value of a derivative transaction assuming a risk-free counterparty and the value of the same transaction taking into account the possibility of changes in creditworthiness of the counterparty, including its default (Alavian *et al.* 2010 and Stein and Lee 2010). In other words, CVA is intended to absorb potential losses due to the default of its counterparties. It should be noted that this provision may avoid in some way large changes in accounting profits (i.e. it may mitigate the jump-to-default risk - see §3.3).

This value adjustment, which can be calculated in different ways, is largely applied by some banks using implicit default probabilities derived from CDS spreads. This accounting practice is consistent for banks that use CDS to hedge their positions, thereby justifying their use in the calculation of the CVA.

During the subprime crisis, CDS spreads increased sharply for all issuers and the CVA were an important factor in the losses recorded by the financial institutions. The Basel Committee on Banking Supervision (2010) estimates that roughly two-thirds of losses attributed to counterparty credit risk during the financial crisis were due to CVA losses (i.e. mark-to-market losses on non-defaulted counterparties) and only about one-third were due to actual defaults, which were already covered by the Basel II framework.

Consequently, the Basel Committee on Banking Supervision decided to introduce an explicit capital requirement for the CVA risk in Basel III, scheduled to become effective as of 1st January 2013[23] . This capital charge may be computed in one of the following two ways[24]. Banks with internal market model (IMM) approval and "Specific Interest Rate Risk" VaR model approval must use the advanced method, which determines the capital absorption for CVA risks by modelling the impact of changes in the counterparties' credit spreads, if available, for all OTC derivative counterparties, using the bank's VaR model. All other banks must use the standardized method, which is based on the counterparties' external rating.

The additional CVA capital charge may have several consequences (Basel Committee on Banking Supervision 2011; Standard and Poor's 2010). In particular, it may encourage banks to buy CDS protection in order to allow CVA capital reliefs creating pro-cyclical effects, since the demand of CDS protection may increase when credit spreads widen and the these two trends may reinforce each other.

---

[23] The Basel III proposals will be implemented into EU law through changes to the existing CRD – referred to as CRD IV.

[24] See Basel Committee on Banking Supervision (2011). It should be noted that transactions with a central counterparty are exempted from CVA capital charges.

4. The impact of CDS on the bond market

4.1 CDS impact on credit spreads and creditor incentives

In perfect capital markets without frictions, derivatives are considered to be redundant securities as their payoffs can be replicated by combinations of underlying assets. However, in practice, there are market imperfections such as transaction costs and short-sales constraints and derivatives, including CDS, are not necessarily redundant securities.

Duffie (2008) argues that CDS help to complete the markets because they offer investors a broader menu of asset and hedging opportunities; Duffie also argues that, by increasing the liquidity in the credit market, CDS can lower credit risk premia and reduce the cost of debt. Ashcraft and Santos (2009) further elaborate this point, highlighting two channels through which CDS can reduce the cost of debt. The first is basically a diversification effect, whereby investors are allowed to better hedge and diversify their exposure so that they are prepared to require a lower credit spread. The second effect is related to the possibility that the CDS market may generate signals that reduce information asymmetries and improve the price discovery process.

Ashcraft and Santos (2009) empirically evaluate the impact of the inception of CDS trading on bond issuance and loan origination for a sample of US firms and find that in the period following the inception of CDS trading, more transparent and highly rated companies experience a slight reduction in the cost of debt, whilst for the other companies the costs of debt actually increase. Hence, in contrast to the theoretical predictions of Duffie (2008), CDS do not help reduce credit spreads for the typical firm. Ismailescu and Phillips (2011) find similar results for sovereign entities, showing that the inception of CDS trading reduces risk premia for investment-grade sovereigns while it increases borrowing costs for sub-investment-grade countries.

Shim and Zhu (2010) find, however, different results for the Asian markets and show how CDS lowered the cost of issuing bonds, particularly for smaller non-financial firms.

The negative impact of CDS trading on credit spreads may result from reduced the monitoring incentive by lending banks that can adjust their exposure using CDS, which in turn may adversely affect pricing by bondholders. Hakenes and Schnabel (2009) stress the fact that CDS can reduce bank incentives to exercise their monitoring role[25] and increase the incentives to finance riskier projects. Morrison (2005) argues that CDS destroy the informative role of bank debt as a certification device when issuing bonds, and induce firms to inefficiently issue bonds at higher spreads and run riskier projects.

Bolton and Oehmke (2011) argue that creditors insured through CDS may force a distressed firm into Chapter 11 bankruptcy even though a debt restructuring would have been preferable or less costly. In fact, it may be optimal for creditors to over-insure their exposure and force bankruptcy, because the gains from CDS compensation outweigh the credit loss. However, by raising the creditor's bargaining power, CDS act as a disciplining device for borrowers

25 Stulz (2010) however observes that the shares of American bank assets covered by CDS is surprising low (approx. 2%), probably because CDS are available or liquid for big companies only.

against incentives to strategically renegotiate down their debt repayments to their own advantage and ex-ante this may help increase the borrower's debt capacity.

Bolton and Oehmke (2011) model would help explain the evidence that CDS may actually increase credit spreads because, other things being equal, the same existence of CDS may increase the probability of defaults making bankruptcy more likely than out-of-court restructuring. Unfortunately, there is no empirical research on whether the inception of the CDS market has made bankruptcy more frequent than out-of-court restructuring for distressed firms, though ISDA (2009) argues that this has not been the case at least in the US. There is however some anecdotal evidence those creditors in the US may have forced distressed firms into defaults in order to gain from CDS. For example, Soros (2008) linked the AbitibiBowater and General Motors bankruptcies to the fact that some bondholders owned CDS and stood to gain more by bankruptcy than by reorganization. Hu (2009) argues that that Goldman Sachs, which had bought CDS on AIG, was willing to demand full collateral from AIG even though by doing so could cause liquidity problems for AIG and Goldman presumably might have hesitated to demand collateral had it not already hedged its credit exposure.

While the issue of whether CDS make bankruptcy more likely than out-of-court renegotiation remains empirically unsettled, there is some evidence in line with the other implication of the Bolton and Oehmke (2011) model whereby the *ex-ante* disciplining role of CDS allow firms to issue more debt. In fact, Hirtle (2008) finds evidence that greater use of credit derivatives by US banks is associated with greater supply of bank credit for large term loans (newly negotiated loan extensions to large corporate borrowers) though not for (previously negotiated) commitment lending. Moreover, the impact is primarily on the terms of lending - longer loan maturity and lower spreads - rather than on loan volume. This finding suggests that the benefits of the growth of credit derivatives accrue mainly to large firms with a liquid CDS market.

In their theoretical paper Che and Rajiv (2010) take an opposite view and argue that CDS can have negative externalities on credit supply. In particular, they state that those who are optimistic about the prospects of a firm may sell protection through CDS rather than supplying credit. Since CDS activity absorbs collateral (see previous §3.3), credit supply shrinks causing firms to select riskier projects. Hence, the presence of CDS may reduce the ability of firms to issue new bonds and cause credit spreads to widen.

Summing up, current economic research does not indicate that CDS can reduce credit spreads, nor that they enable firms to issue more debt (except for some large and well know firms). In theory, CDS can make bankruptcies more frequent than restructurings, but this has not been empirically proven so far.

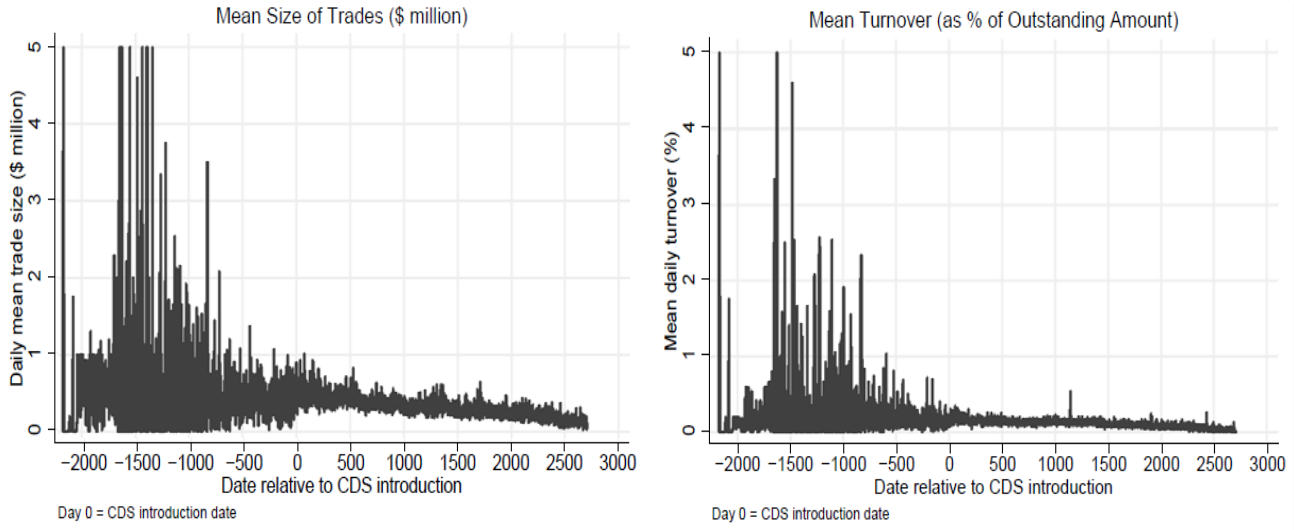
4.2 CDS impact on the secondary market of underlying bonds

One of the issues that has gained growing attention, especially since the outbreak of the sovereign debt crises, is the possibility that the use of CDS may have disruptive effects on the orderly functioning of the secondary market of the underlying bonds, amplifying downward trends and exacerbating volatility.

A recent study by Das *et al*. (2011) shows how the inception of the CDS market in the US has had negative effects on the secondary markets of underlying bonds in terms of lower liquidity and higher pricing errors. Figure 11 reports their descriptive evidence on how the advent of

the CDS market has impacted trading volume of underlying bonds for a sample of roughly 1,500 bonds issued by 350 US private firms over the period 2002-2008. Bond trading volume declines significantly after CDS inception and this might be due to the fact that some of the trading is diverted from the bond market to the CDS market and, for technical reasons discussed in §3.4, CDS may end up being more liquid than the underlying bonds. Hence, this trade diversion may cause the liquidity in the bond market to dry up and be absorbed by the CDS market, because professional market participants prefer the CDS market for their trading and hedging strategies.

Figure 11 – Trading volume for a sample US bonds around CDS inception



Source: Das et al. (2011). Data relative to 1,545 bond issued by 350 firms with CDS over the period 2002-2008.

If this were the case, CDS probably would not add any liquidity to the underlying bond market and CDS themselves would end up being more liquid than bonds. This could be the case especially for corporate firms, since Figure 6 in previous §2.2 shows that for most non-financial firms the CDS gross notional largely exceed outstanding bonds.

Focusing on the sovereign bonds markets, Ismailescu and Phillips (2011) provide an event-study framework to analyze the impact of CDS trading initiation on sovereign bonds issued by 54 countries, including both developed and emerging markets, using daily CDS spreads on over 3,000 reference entities. They report the following three main conclusions concerning the effects of CDS trading on the market for the underlying bonds: i) they reject the hypothesis that CDSs are redundant assets for the majority of the countries in the sample, in the sense that CDS initiation enhances the information set that influences sovereign debt prices, thus making the market for sovereign credit-risk more complete; ii) credit-risk price informativeness increases for the majority of the countries in the sample following the introduction of a CDS market and; iii) with few exceptions, CDS initiation reduces risk premiums for investment-grade sovereigns although it increases borrowing costs for sub-investment-grade countries.

In sum, the available evidence suggests that the existence of a CDS market may exert some effects on the functioning of the market for the underlying references, potentially, with

different signs of influence, depending on the particular market-dimension and the specific market at hand. Given this, a question that has received some attention recently is to what extent CDS can be used to manipulate the price of the underlying bonds in the secondary market and if taking short positions on credit risk through naked CDS can be harmful for market stability and integrity.

Unfortunately, there is no specific empirical research on these questions, though some insights can be drawn from recent qualitative papers.

Stulz (2010) argues, for example, that CDS trading did not, by itself, lead to an acceleration of the turbulence culminating in AIG and Lehman Brothers defaults (indeed, liquidation of Lehman CDS went on without particular problems).

Similarly, Duffie (2010) argues that it is unlikely that speculation through CDS has driven up Eurozone sovereign borrowing costs. He lays out one possible strategy to put under pressure bond spreads of sovereigns with strong public finance imbalances (or distressed firms as well) based on buying naked CDS at increasingly higher prices (i.e. at a prices higher than the theoretical or fair price expressed by an efficient market) in order to amplify herding behaviour by other market participants and create an excess demand for protection. However, he argues that such a strategy is intrinsically unstable and highly risky. It is unstable because it requires a coordinated action by a group of parties willing to purchase CDS at increasingly higher prices and since each "conspirator" has in interest in leaving the others to pay a higher price, there are strong incentives to free ride. It is risky, because it may be complex and difficult to induce herding behaviour in other investors.

However, since the CDS market for distressed firms or high-yield sovereigns can be highly illiquid, it may be possible to cause CDS prices to rise significantly through limited purchases and the lack of post-trade transparency may make market participants unable to assess to what extent the rise in CDS prices reflects a liquidity premium or rather an update of default probability expectations. The opacity of the CDS market may, therefore, make herding behaviour more likely and increase the probability of success of manipulative strategies based on naked CDS buying. This is powerful argument in favour of post-trade transparency in this market.

Unfortunately, there are no empirical studies that have tested these kinds of conjectures and the issues of whether CDS opacity can have negative externalities on distressed reference entities and be destabilizing for the underlying bond market remains an untested possibility.

4.3 The role of CDS in the price discovery process

In perfect markets, CDS spreads should equal bond spreads based on the no-arbitrage arguments discussed in previous §3.4. However, evidence on the role of CDS in the price discovery process is somewhat mixed. In general, most of the papers find that in the long run there exists a no-arbitrage equilibrium that ties CDS and bond spreads, though in the short run there may be significant deviations of CDS from bond spreads related to the different speed at which CDS and bond spreads adjust to arrival of new information.

Many papers, especially those on the corporate sector, find that CDS prices tend to adjust more rapidly to the release of new information and such adjustment, in turn, generates an informative signal for the bond market, which react with a time lag. Hence, the CDS market is often found to play a leading role in the price discovery process. For example, Blanco *et al*.

(2005) find short-term deviations between CDS and bond spreads, which tend to be corrected in the long-term through a price adjustment mechanism in which CDS play a leading role[26]. The authors justify the evidence whereby CDS are more sensitive to changes in credit risk with the greater liquidity and the different type of players that operate on the CDS market. As discussed in §3.4, there are many factors that may cause the CDS market to be more liquid than the bond market, especially for the corporate sector. Because of its higher liquidity, the CDS market may be more suitable for aggressive or speculative trading strategies. Additionally, as explained in §2.1 and §3.4, CDS may be preferred to short sales in order to take short positions on credit risk. For all these reasons, it is possible that traders with more aggressive and dynamic strategies will prefer to operate on the CDS markets, while the bond market will tend to be populated mainly by unsophisticated buy-and-hold investors.

As for sovereign credit market, Coudert and Gex (2010), Fontana and Sheicher (2010) and O'Kane (2012) show that in European countries with lower credit ratings, CDS play a leading role, particularly during periods of turbulence, whilst for countries with higher ratings and with larger and more liquid bond markets, the leading role is played mainly by the bond market itself. Palladini and Portes (2011) reports results more similar to those on the corporate sector, whereby for most euro-area sovereigns CDS has leading role in the price discovery process. Arce *et al*. (2012) provide a dynamic measure of price discovery and find evidence suggesting that the CDS markets lead price discovery in most Euro area countries in normal times while at times of heightened uncertainty (for example, after the collapse of Bear Stearns and Lehman Brothers or after the announcement of the private sector involvement program on the Greek sovereign debt), the CDS market becomes less efficient in terms of its contribution to price discovery.

The fact that the CDS do not always play a leading role in the price discovery for sovereign debt markets seems to contradict the argument of Blanco *et al*. (2005). According to these authors, the CDS market plays a leading role because it is populated by more sophisticated investors and it allows opening short positions more easily. These considerations do also apply to the sovereign CDS market, yet CDS do not always play a leading role. The fact that some sovereign issuers have very large and liquid bond markets seems to imply that it is liquidity *per se* that has a key role for the pricing process, rather than the ability to attract more sophisticated and aggressive investors as argued Blanco *et al*. (2005).

Another strand of literature confirms the evidences that CDS have a leading role in price discovery for private issuers, showing that CDS actually adjust more rapidly to new information and contribute to more information revelation compared to the bond market. In particular, Acharya and Johnson (2007) report evidence of significant incremental information revelation in the corporate CDS market under circumstances consistent with the use of non-public information by informed banks. The information revelation seems to occur only for negative credit news and for entities that subsequently experience adverse shocks. Similar results are found by Ismailescu and Phillips (2011) for the sovereign bond market, who show that CDS initiation enhances the information set that influences sovereign debt prices.

Related papers show how CDS prices tend to adjust more rapidly to negative information than rating changes. For example, Norden (2011) finds that CDS of firms with high media coverage start changing earlier and more strongly before rating events than those of firms

26 Similar results are documented by the European Central Bank (2004), Norden and Weber (2009) and Zhu (2006).

with low media coverage and that there is a significant clustering of days with no news but large abnormal CDS spread changes before negative events, but not before positive rating events.

Overall, the evidence that can be drawn from the existing research for corporate issuers is that the CDS market leads both other credit markets and credit ratings in the price discovery process.

There may be two (not necessarily alternative) explanations for this evidence. The first relies on the assumption that CDS increase the ability to take short positions (for reasons explained in §2.1). In this the case, CDS may actually contribute to more pricing efficiency because they allow prices to incorporate more quickly and accurately negative information. This explanation is supported by the theoretical model by Diamond and Verrecchia (1987) and empirically supported by the previously discussed researches by Acharya and Johnson (2007) and by Norden (2011). The second explanation may be due to the fact that CDS take-up liquidity from the bond market and end up being more liquid for technical factors described in Section 3 (most of the trading inevitably concentrates on just one CDS contract, contract terms are highly standardized, G14 dealers provide strong liquidity support, etc.). This explanation is supported by the evidence that CDS are not price leader for sovereign issuers with large and liquid debt markets, indicating that liquidity *per se* is a key factor in the price discovery process.

In summary, current research clearly shows that CDS tend to lead the price discovery process on credit risk for private issuers. However, it is not clear to what extent this depends on the fact that CDS are more liquid than bonds or rather on the fact that short positions are easier to take in CDS markets.

5. Conclusions

1. The market for credit default swaps ("CDS") is going through rapid change. Over the last several years, CDS contracts have become more standardized, and electronic processing and central clearing of trades have increased. Large amounts of CDS data have become publicly available, and abundant research has been conducted to assess the role that CDSs play in global financial markets.
2. At the end of 2011, the gross notional value of outstanding CDS contracts amounted to approximately 26,000 billion US dollars, which has a corresponding net notional value of approximately 2,700 billion US dollars (roughly 10% of the gross notional value). The notional CDS exposure to private entities is approximately four times the notional CDS exposure to sovereign entities. For private entities the size of the CDS markets relative to underlying debt has remained relatively stable in terms of gross notional over the last four years, while it has significantly reduced in terms of net notional. The use of CDS is proportionally higher for smaller firms and is much more intense in the corporate sector than in the banking sector. For sovereign entities the size of CDS relative to public debt has remained relatively stable since 2008 and smaller countries tend to have a higher ratio of CDS gross/net notional to public debt.
3. Over the years the growth of the CDS market has been fostered by the development of a self-regulatory environment, promoted by the initiatives of the ISDA, which resulted in contract standardization, aimed at facilitating back office and contract management operations, and in a reduction of legal disputes. However, after the global financial crisis,

several initiatives were taken by regulators at national and international levels to mitigate the risks in the OTC markets, including requiring the central clearing of standardized OTC derivative products and dissemination of more information on the markets.

4. Though the amount of public information on CDS has increased over the recent years, the CDS market is still quite opaque. Regulators would benefit from better access to information on trade and position data, which is necessary for financial stability supervision, for improving the assessment of counterparty risk by CCP and for the detection of market abuse. As for transparency towards market participants (disclosure of pre- and post-trade information), results from theoretical research and empirical work on the OTC bond market in the US for the time being suggest that greater transparency may reduce information asymmetries and transaction costs, but it may also discourage dealers from providing liquidity. IOSCO will continue to examine these issues in order to provide a sound basis for possible future policy proposals on how to best improve the functioning of the CDS markets.

5. Given its highly concentrated and interconnected nature, one of the important sources of risk in the CDS market is counterparty risk generated by the default of large protection sellers. The default of a protection seller may lead other participants to default. In this respect, some theoretical network models provide a meaningful analysis of the impact of credit derivatives on systemic risk. They show that the magnitude of financial contagion depends on some properties of the network structure, other than on the exposure of its largest participants.

6. There is evidence of under-collateralization of CDS positions, due to collateral re-hypothecation and to collateral arrangements that are not strictly related to the creditworthiness of the counterparty. Under-collateralization may also result from the price discontinuity before default ("jump to default") that complicates the risk management of CDS positions because of the complex modeling required.

7. The use of central counterparties (CCPs) has been seen as a way of mitigating counterparty risk in CDS contracts and preventing default contagion. An increasing number of transactions are being cleared by CCPs.

8. In perfect capital markets without frictions, derivatives are considered as redundant securities as their payoffs can be replicated by combinations of underlying assets. However, in practice, there are market imperfections such as transaction costs and short-sales constraints and derivatives, including CDS, that are not necessarily redundant securities. It is therefore important to look at the available evidence on the impact of CDS on the cost and supply of debt, on creditors' incentives, on the price discovery process and on the orderly functioning of the underlying bond market.

9. The CDS market broadens investors' menu of asset and hedging opportunities and, by increasing liquidity in the credit market, can lower credit risk premia and reduce the cost of debt. However, current economic research provides mixed evidence on whether CDS reduces the cost of issuing new debt. Some empirical studies find that in the period following the inception of CDS trading, more transparent and highly rated companies experience a slight reduction in the cost of debt, whilst for other companies the costs of debt actually increase. Moreover, CDS can reduce the monitoring incentive by lending banks, which in turn may adversely affect risk premia required by bondholders.

10. The empirical evidence broadly supports the existence of a close correlation between CDS prices and bond spreads, especially when their behavior is evaluated in the long run and in non-stress periods, though in the short run there may be significant deviations of CDS

prices from bond spreads related to the different speed at which CDS and bond spreads adjust to the arrival of new information and to the presence of inertia and frictions in the functioning of capital markets.

11. Current research clearly shows that CDS lead the price discovery process on credit risk for private issuers. However, it is not clear to what extent this depends on the fact that CDS are more liquid than bonds or rather on the fact that short positions are easier to take on the CDS market. As regards sovereign issuers, some research show that in European countries with lower credit ratings CDS play a leading role in the price discovery process, particularly during periods of turbulence, while for countries with higher ratings and with larger and more liquid bond markets, the leading role is played mainly by the bond market itself.

12. To date, there is no conclusive evidence on whether taking short positions on credit risk through naked CDS is harmful for distressed firms or high-yield sovereign bonds. IOSCO will continue to monitor market developments on this issue, however, going forward.

13. In summary, existing empirical evidence on many aspects of the CDS market tend to be mixed. There is mixed evidence on the impact of CDS on the orderly functioning of the primary and secondary markets of the underlying bonds and on creditor incentives, although the CDS market is found to have an important role in the price discovery process.

Appendix A -References

Acharya, V. and Johnson T. (2007), *Insider Trading in Credit Derivatives*, Journal of Financial Economics.

Alavian S., J. Ding, P. Whitehead and L. Laudicina (2010), *Credit Valuation Adjustment (CVA)*, unpublished manuscript.

Acharya, V., Engle, R., Figlewski, R., Lynch, A. and Subrahmanyam, M. (2009), *Centralizing Clearing of Credit Derivatives*, in Restoring Financial Stability: How to Repair a Failed System (eds. V. Acharya and M. Richardson), John Wiley & Sons, New York.

Amadei L., S. Di Rocco, M. Gentile, R. Grasso and G. Siciliano, *Credit Default Swaps. Contract Characteristics and Interrelations with the Bond Market*, CONSOB Discussion Paper, February 2011.

Amato, J. and Remolona, E. (2003), The Credit Premium Puzzle, BIS Quarterly Review.

Arce, O., Mayordomo, S. and Peña, J. I. (2012), *Do Sovereign CDS and Bond Markets Share the Same Information to Price Credit Risk? An Empirical Application to the European Monetary Union Case*, CNMV Working paper .

Ashcraft A. and Santos J. (2009), *Has the CDS Market Lowered the Cost of Corporate Debt?*, Journal of Monetary Economics.

Avellaneda M. and R. Cont (2010), *Transparency in Credit Default Swap Market*, unpublished manuscript.

Bai, J. and Collin-Dufresne, P. (2011), *The CDS-Bond Basis During the Financial Crisis of 2007-2009*, unpublished manuscript.

Basel Committee on Banking Supervision (2010), *Results of the Comprehensive Quantitative Impact Study*, December.

Basel Committee on Banking Supervision (2011), *Basel III: A Global Regulatory Framework for more Resilient Banks and Banking Systems*.

Bessembinder H, Maxwell W. and Venkataraman K. (2006), *Market Transparency, Liquidity Externalities and Institutional Trading Costs in Corporate Bonds*, Journal of Financial Economics.

Bessembinder H and Maxwell W. (2008), *Transparency and the Corporate Bond Market*, Journal of Economic Perspectives.

Blanco R., S. Brennan and I. Marsh (2005), *An Empirical Analysis of the Dynamic Relation between Investment Grade Bonds and Credit Default Swaps*, Journal of Finance.

Bloomfield R. and O' Hara M. (1999), *Market Transparency: Who Wins and Who Loses?*, Review of Financial Studies.

Bolton P. and Oehmke M.(2011), *Credit Default Swap and the Empty Creditor Problem*, Review of Financial Studies.

Brunnermeier M. K. and Pedersen L. H. (2005), Predatory Trading, Journal of Finance.

Cecchetti S. G., Gyntelberg J. and Hollanders M. (2009), *Central Counterparties for Over-the-Counter Derivatives*, BIS Quarterly Review.

CEPR (2006), *European Government Bond Markets: Transparency, Liquidity, Efficiency.*

Che, Y. and Rajiv S. (2010), *Economic Consequences of Speculative Side Bets: The Case of Naked Credit Default Swaps*, Columbia University Working Paper.

Chen, L., Lesmond, D.A. and Wei, J. (2007), *Corporate Yield Spreads and Bond Liquidity*, Journal of Finance.

Chen K., Fleming M., Jackson J., Li A. and Sarkar A. (2011), *An Analysis of CDS Transactions: Implications for Public Reporting*, Federal Reserve Bank of New York Staff Reports.

Cont R. (2009), *Measuring Systemic Risk*, Columbia University Working Paper.

Cont R. and A. Minca (2010), *Credit Default Swaps and Systemic Risk*, unpublished manuscript.

Coudert, V. and Gex M. (2010), C*redit Default Swap and Bond Markets: Which Leads The Other?*, Banque de France working paper.

Das, S., M. Kalimipalli and S. Nayak (2011), *Did CDS Trading Improve the Market for Corporate Bonds?*, unpublished manuscript.

De Wit, J. (2006), *Exploring the CDS-Bond Basis*, National Bank of Belgium Working Paper.

Diamond D. and Verrecchia R. (1987), *Constraints to Short-Selling and Asset Price Adjustment to Private Information*, Journal of Financial Economics.

Duffie, D. (1996), *Special Repo Rates*, Journal of Finance.

Duffie, D. (1999), *Credit Swap Valuation*, Financial Analyst Journal.

Duffie, D. (2008), *Innovations in Credit Risk Transfer: Implications for Financial Stability*, BIS Working Papers.

Duffie, D. (2010), *Is There A Case For Banning Short Speculation In Sovereign Bond Markets?*, unpublished manuscript.

Duffie D. and H. Zhu (2011), *Does a Central Clearing Counterparty Reduce Counterparty Risk?*, Review of Asset Pricing Studies.

Elton, E. J., Gruber, M. J., and Agrawal, D. (2001), *Explaining the Rate Spread on Corporate Bonds,* Journal of Finance.

European Central Bank (2009), *Credit Default Swaps and Counterparty Risk.*

Financial Stability Board (2011), *OTC Derivatives Market Reforms. Progress Report on Implementation*, October.

Flood M., Huisman R., Koedijk K. and R. Mahieu (1999), *Quote Disclosure and Price Discovery in Multiple Dealer Financial Markets*, Review of Financial Studies.

Fontana A. (2010), *The Persistent Negative CDS-Bond Basis During the 2007/2008 Financial Crisis*, unpublished manuscript.

Fontana A. and M. Scheicher (2010), *An Analysis of the Euro Area Sovereign CDS and their Relation with Government Bonds,* European Central Bank working paper.

Goldstein M.A., Hotchkiss E.S. and E Sirri (2007), *Transparency and Liquidity: A Controlled Experiment on Corporate Bonds*, Review of Financial Studies.

Hakenes H. and Schnabel I. (2009), *Credit Risk Transfer and Bank Competition*, unpublished manuscript.

Hirtle, B. (2008), *Credit Derivatives and Bank Credit Supply*, Federal Reserve Bank of New York Working Paper.

Hu, H. (2009), *Empty Creditors' and the Crisis*, Wall Street Journal, April 10.

ISDA (2009), *The Empty Creditor Hypothesis*, ISDA Research Notes.

ISDA (2010a), *Concentration of OTC Derivatives among Major Dealers,* ISDA Research Notes.

ISDA (2010b), *ISDA Margin Survey 2010*.

Ismailescu, I. and Phillips, B. (2011), *Savior or Sinner? Credit Default Swaps and the Market for Sovereign Debt*, unpublished manuscript.

Litan, R.E. (2010), *The Derivatives Dealers' Club and Derivatives Markets Reform: A Guide for Policy Makers, Citizens and Other Interested Parties*, The Brookings Institution, Initiative on Business and Public Policy at Brookings (April).

Longstaff, F.A., Mithal, S. and Neis, E. (2005), *Corporate Yield Spreads: Default Risk or Liquidity? New Evidence from the Credit Default Swap Market*, Journal of Finance.

Madhavan A, Porter D. and Weaver D. (2005), *Should Securities Markets Be Transparent?*, Journal of Financial Markets.

Madhavan A. (1996), *Security Prices and Market Transparency*, Journal of Financial Intermediation.

Madhavan A. (1995), *Consolidation, Fragmentation, and the Disclosure of Trading Information*, Review of Financial Studies.

Merton R. (1974), *On the Pricing of Corporate Debt: The Risk Structure of Interest Rates*, Journal of Finance.

Morrison, A. C. (2005), *Credit Derivatives, Disintermediation, and Investment Decisions*, Journal of Business.

Norden, L. and Weber M. (2009). *The Co-Movement of Credit Default Swap, Bond and Stock Markets: An Empirical Analysis*, European Financial Management.

Norden, L., *Why Do CDS Spreads Change before Rating Announcements?*, unpublished manuscript.

O' Kane, D., *The Link between Eurozone Sovereign Debt and CDS Prices*, EDHEC working paper.

Pagano M. and Roel A. (1996), *Transparency and Liquidity: A Comparison of Auction and Dealer Markets with Informed Trading*, Journal of Finance.

Palladini G. and Portes R. (2011), *Sovereign CDS and Bond Pricing Dynamics in the Euro-area*, NBER working paper.

Pirrong C. (2011), *The Economics of Central Clearing: Theory and Practice*, ISDA Discussion Papers.

Shim, I. and Zhu, H. (2010), *The Impact of CDS Trading on the Bond Market: Evidence from Asia*, BIS Working Paper.

Singh M. (2010), *Under-Collateralisation and Rehypothecation in the OTC Derivatives Markets*, Banque de France Financial Stability Review.

SLWGFR (Squam Lake Working Group on Financial Regulation) (2009), *Credit Default Swaps, Clearinghouses, and Exchanges*, Working paper (July).

Soros, G. (2008), *Three Steps to Financial Reform*, Wall Street Journal, June 16.

Stein H. and K.P. Lee (2010), Counterparty Valuation Adjustments, unpublished manuscript.

Standard&Poor's (2010), *Basel III Proposal to Increase Capital Requirements for Counterparty Credit Risk May Significantly Affect Derivatives Trading*".

Stulz R. M. (2010), *Credit Default Swaps and the Credit Crisis*, Journal of Economic Perspectives.

Vause N. (2010), *Counterparty Risk and Contract Volumes in Credit Default Swap Market*, BIS Quarterly Review.

Zhu, H. (2006), *An Empirical Comparison Of Credit Spreads Between The Bond Market And The Credit Default Swap Market*, Journal of Financial Services Research

Appendix B – Composition of the Committee on Risk and Research Sub-group

Work on the report was carried out by a sub-group of IOSCO's Committee on Risk and Research, which has the following composition**:**

Giovanni Siciliano (coordinator) – CONSOB, Italy

Peter Andrews – FSA, UK

Oscar Arce – CNMV, Spain

Anne Demartini – AMF, France

Siegbert Goebel – FINMA, Switzerland

Craig Lewis – SEC, US

Saiko Nakagawa – FSA, Japan