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The uses and the valuation methods of Credit Default Swaps

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Contents

1. Introduction

This thesis studies Credit Derivatives and especially the nature of Credit Default Swaps (CDS) and their main characteristics. CDS attracted the attention of policy makers and market investors after the global financial crisis of 2007. In addition, during the European debt crisis, CDS became very popular, thus they offer trading for a wide range of instruments (fixed income and equity) with exposure to credit risk. The reason why it is so important that more is known about the accuracy of sovereign CDS spreads is that sovereign defaults can severely damage the global financial stability. The sovereign credit risk that is attached to a nation has a bigger impact on the financial system than macro-economic risks, market liquidity risks, and emerging market risks (IMF 2011)[1].

Furthermore, in the thesis, it is described how CDS markets work, the basic structure of CDS, the documentation, the strategies which are based on CDS contracts, like hedging, arbitrage and asset swap. We also review the literature which deals with CDS pricing, the basic determinants of CDS and factors affect the strategies and examine the relationship between CDS spread and key macroeconomic factors, especially in Portugal, Italy, Ireland, Greece and Spain (PIIGS).

[1] International Monetary Fund. (2011). Global financial stability report October 2011, p2

2. Credit Derivatives

Derivatives are either simple or complex financial instruments specifically designed to effectively hedge or transfer several risks between two or more counterparties. Because of this specific nature, derivatives are very popular in financial markets, especially during periods characterized by high uncertainty and volatility.

Definition I

"Credit derivatives are financial instruments that are designed to transfer the credit exposure of an underlying asset or assets between two parties." In general a credit derivative refers to one of any of "various instruments and techniques designed to separate and then transfer the credit risk" or the risk of an event of default of a corporate or sovereign borrower, transferring it to an entity other than the debt-holder.

Fabozzi et al. (2004), D. Satyajit (2005) & M. Simkovic (2009)

Formally, credit derivatives are bilateral financial contracts that isolate specific aspects of credit risk, concern an underlying instrument (bond, loan, stock etc). These instruments are used in order to transfer that risk between two parties. Credit derivatives are fundamentally changing the way banks price, manage, distribute, and account for credit risk, but also how institutional investors think in order to hedge credit risk. For example in the case of bank loans which are not traditionally appeale to be accounted as an asset class, hedging is needed via an other non-bank institutional investor for two main reasons: (i) the administrative burden of assigning and servicing loans; and (ii) because of the absence of a repo market to finance

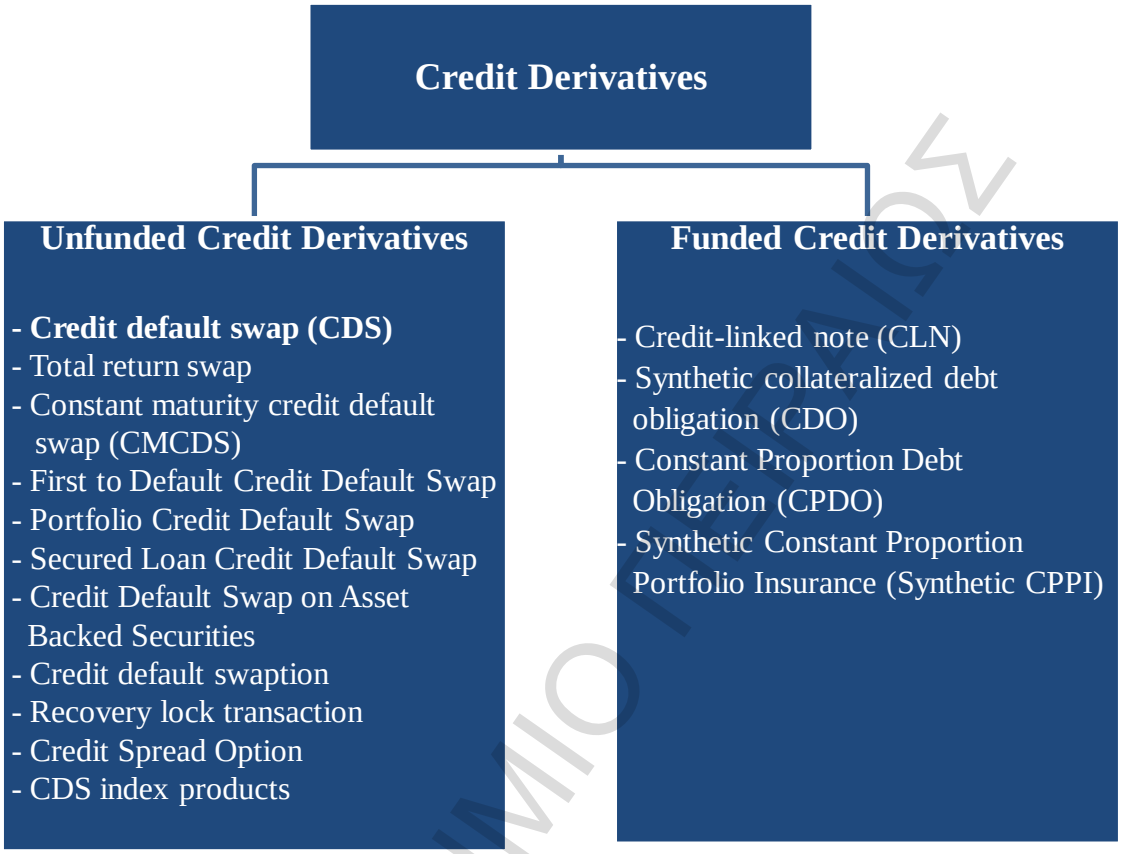
investments in bank loans, the return on capital offered by bank loans has been unattractive to institutions that do not enjoy access to unsecured financing.

Credit derivatives, despite when they are included in structured notes or other products, are off-balance- sheet instruments. In these cases, offer considerable flexibility to leverage and achieve arbitrage gains. In fact, the user can define the required degree of leverage, if any, in a credit investment.

The category of credit derivatives include credit default swaps, asset swaps, total return swaps, credit-linked notes, credit spread options, and credit spread forwards. Credit derivatives are fundamentally divided into two categories: (a) funded credit derivatives and (b) unfunded credit derivatives. Figure 1, represents the basic categorization of credit derivatives and the main types of credit derivatives.

Unfunded credit derivative is a bilateral contract between two counterparties, where each party is responsible for making its payments under the contract (i.e. payments of premiums and any cash or physical settlement amount) itself without recourse to other assets. A funded credit derivative involves the protection seller (the party that assumes the credit risk) making an initial payment that is used to settle any potential credit events. (The protection buyer, however, still may be exposed to the credit risk of the protection seller itself. This is known as counterparty risk.).

Figure 1 – The Categories and Types of Credit Derivatives



Source: Fabozzi et al. (2004) and Author elaboration

Credit derivatives have many potential benefits, in response to two long-standing problems in banking and risk management. First, lending operated under the restriction of hedging credit risk was impossible. The problem is that taking a short position in credit was not feasible. For instance, selling a sovereign bond short is only theoretically possible, many borrowers do not have liquid debt outstanding, so borrowing for a short sale is often impossible. A second problem was diversification of credit risk. Buying protection by means of credit derivatives provides solutions to both of the foregoing problems. By allowing banks to take a short credit position, credit derivatives enable banks to hedge their exposure to credit losses.

Another benefit of credit derivatives is that they add transparency to credit markets (Kroszner 2007). Prior to the existence of credit derivatives, determining a price for credit risk was difficult, and no accepted benchmark existed for credit risk. As credit derivatives become more liquid and cover a wider range of entities, however, lenders and investors will be able to compare pricing of cash instruments such as bonds and loans with credit derivatives. Further, investors will be able to engage in relative value trades between markets, which will lead to further improvements in efficiency and price discovery.

At a higher level, economic stability stands to benefit from the ability to transfer credit risk by buying and selling protection. As with other derivatives, the cost of risk transfer is reduced, so risk is dispersed more widely into deeper markets. The result is that economic shocks should have less effect than was the case prior to the existence of derivatives. Several objections can be made to such an argument, however, and these will be considered in the next section.

3. Credit Default Swaps

3.1. Definition and Structure

Credit Default Swaps are by far the most well-known and widely used type of credit derivatives for two main reasons (a) can be used as a standalone credit derivative in order to hedge or transfer credit risk and widely used by commercial and investment banks, hedge funds, institutional investors, pension funds, asset managers and traders, (b) can be extensively used in order to form structured and more complex credit derivative products, as synthetic CDOs and Credit notes for institutional and retail investors. Credit Default Swaps were invented by Blythe Sally Jess Masters Managing Director at JP Morgan, responsible for the structuring and distribution of credit derivative products.

Definition II

"A credit default swap (CDS) is a financial swap agreement that the seller of the CDS will compensate the buyer in the event of an underlying asset or assets default or other credit event. The buyer of the CDS makes a series of payments (the CDS "fee" or "spread") to the seller and, in exchange, receives a payoff if the underlying asset or assets defaults.

Fabozzi et al. (2004)

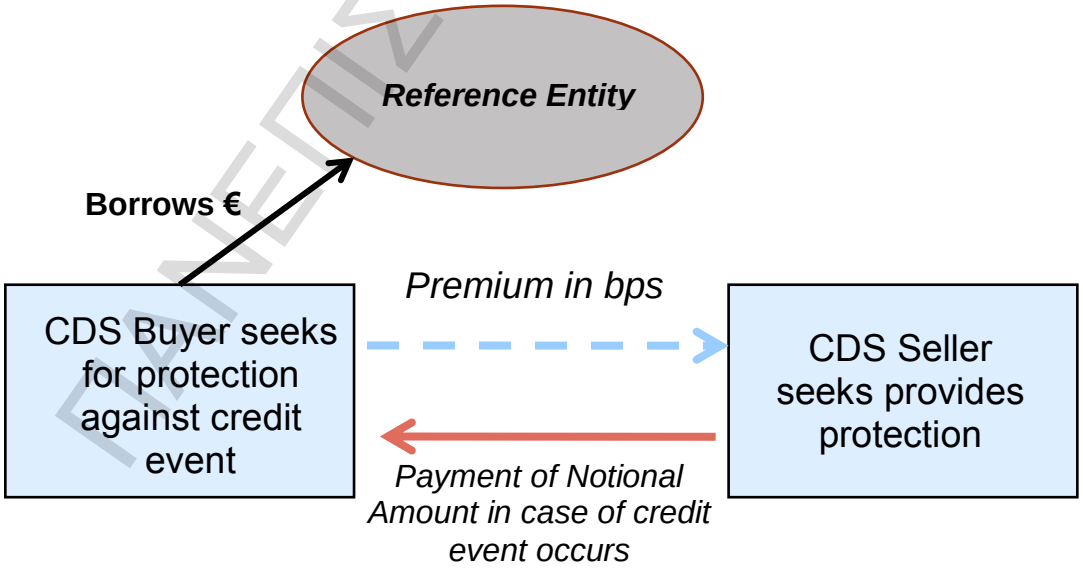
The most common type of credit derivatives is credit default swaps, counting more than 90% of credit derivatives market. A credit default swap or option is simply an exchange of a fee in exchange for a payment if a "credit default event" occurs. The Contingent Payment can be effected by a cash settlement mechanism designed to mirror the loss incurred by creditors of the Reference Entity following a Credit Event.

CDS structure is based on the idea of insurance policy, in order to transfer credit risk for reference entities. In case the protection buyer the investor than buys the protection in case of a credit event has also invested in the reference asset, CDS is used in order to hedge against credit risk. On the contrary, any investor has the ability to invest in CDS without owning the reference asset, in order to speculate or bet on the default of the reference entity (issuer of the asset, bond or loan).

In this section we are going to analyze the key investment features and characteristics of Credit Default Swaps and the main applications and strategies that assets managers use in financial markets.

A traditional or plain vanilla credit default swap is a payment/premium by one counterparty party in exchange for a credit default protection payment if a credit default event on a reference asset occurs. The amount of the payment is the difference between the original price of the reference asset and the recovery value of the reference asset. The following schematic (Figure 2) shows how the cash flow of this credit derivative transaction work:

Figure 2 – How Credit Default Swaps Work



CDS are similar to have an insurance contract against default or any credit event. The credit default premium is usually paid over time. For some very short dated structures, the credit default premium may be paid upfront. If the fee is paid this way, which may be the case for very short dated structures, the agreement is likely to be called a credit default option, by market professionals. This is because all cash flows paid over time is like an amortization of an option premium. Protection buyer pays so called default swap premium, usually expressed in bps. If specified event (mostly default) is triggered, protection seller covers losses in case of credit event occurs. In practice, buyer delivers specific predefined asset (bonds, loans) to seller and receives 100% of the notional specified in the CDS contract.

The premium paid by the protection buyer to the seller, often called " CDS spread". CDS spread is calculated in bps (bps) on a yearly basis and is estimated on the contract's notional value. Usually the payments are been arranged quarterly. CDS spreads represent the annual "price" of protection of the notional value, and not based on any risk - free rate or any interest rate benchmark. Periodic premium payments allow the protection buyer to deliver the defaulted bond at par or to receive the difference of par and the bond's recovery value. In other words, a CDS contract works like a plain vanilla put option written on a bond, thus the protection buyer is protected against losses due to a credit event (default, restructuring etc) that triggers the CDS.

Illiquidity is a main characteristic of credit positions, and can be appeal by a number of factors. In the case of bank loans and derivative transactions, relationship concerns often lock portfolio managers into credit exposure arising from key client transactions. Credit derivatives allow users to reduce credit exposure without physically removing assets from their balance sheet.

3.2. Credit Default Swap Market Today

The CDS market originally is a private market, concern bilateral agreements between investment and commercial banks, institutional investors, asset managers etc. This fact is because of its over-the-counter character.

The transactions that take part in this market are by end-protection buyers and transaction agents who trade with other dealers, as typical market-makers. The dealer side actually represents the G14 dealers[2], who are the largest derivatives dealers worldwide and hold more than the 90% of the CDS notional.

The buy-side is represented by institutional investors/banks and other institutions and very few private investors. As in all OTC markets the transactions have the form of bilateral contacts. Another type of transaction comes from inter-dealer trades, from institutions in order to hedge transactions with their buy-side clients or other dealers. These trades are coming from "inter-dealer brokers". These positions match dealer orders, guarantee counterparty anonymity until the transaction is concluded. The CDS market has relatively large average trade size compared to the bond market, but much lower frequency.

According to the International Swap and Derivatives Association (ISDA), derivative contracts remain concentrated in interest rate products, which comprise 80% of total derivative notional amounts. Credit derivatives, which represent 6% of total derivatives notionals, declined 6% to $13 trillion at the end of 2012[3] (ISDA, 2012). It is very important to mention that the notional amount of derivatives declined by $3.8 trillion, or 2%, to $223 trillion. Notionals have now declined in five of the past six quarters, due to the relative decrease of uncertainty especially in EU.

[2] Goldman Sachs, HSBC, J.P. Morgan, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS and Wachovia Bank, Nomura and Crédit Agricole.

[3] International Swap and Derivatives Association (ISDA) quarterly report and OCC's Quarterly Report on Bank Trading and Derivatives Activities 4th Quarter 2012.

Credit derivatives follow a decline trend the past quarters, during Q4 of 2012, credit derivatives fall $0.8 trillion (6%) to $13.2 trillion. The last 1,5 years have lost a total amount of $2.5 trillion (or 16%). Credit derivatives outstanding remain well below the peak of $16.4 trillion in the first quarter of 2008. From year-end 2003 to 2008, credit derivative contracts grew at a 100% compounded annual growth rate. Industry efforts to eliminate offsetting trades ("trade compression"), as well as reduced demand for structured products, has led to a decline in credit derivative notional amounts. Credit default swaps are the dominant product at 97,1% of all credit derivatives notional amounts.

Figure 3 - Credit Derivatives Composition By Product (Q4 2012)

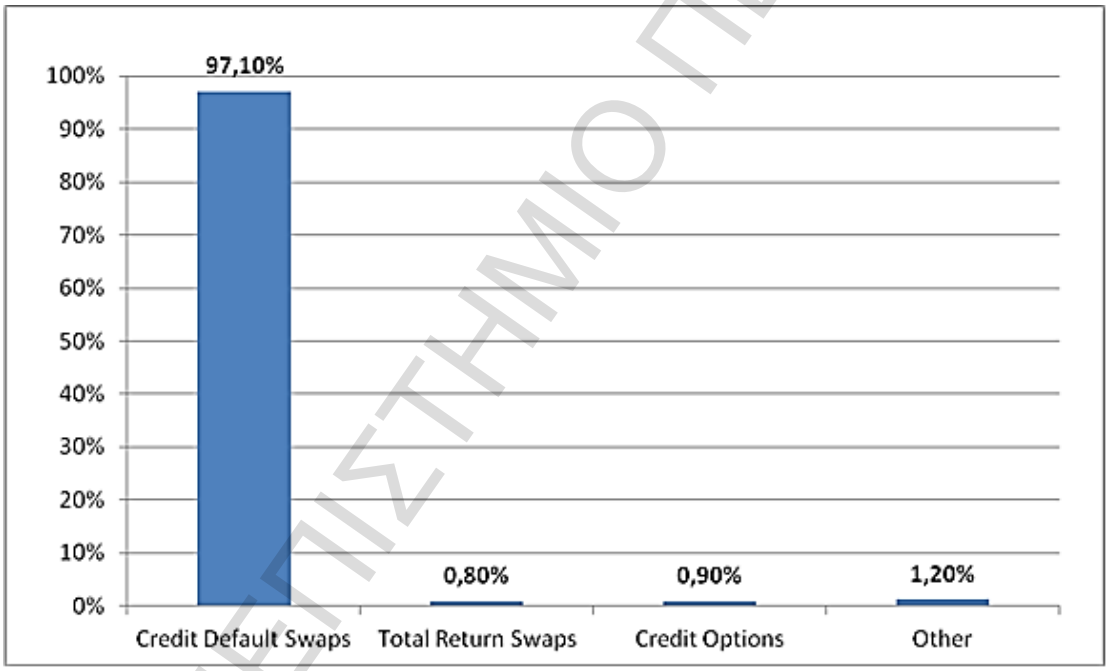
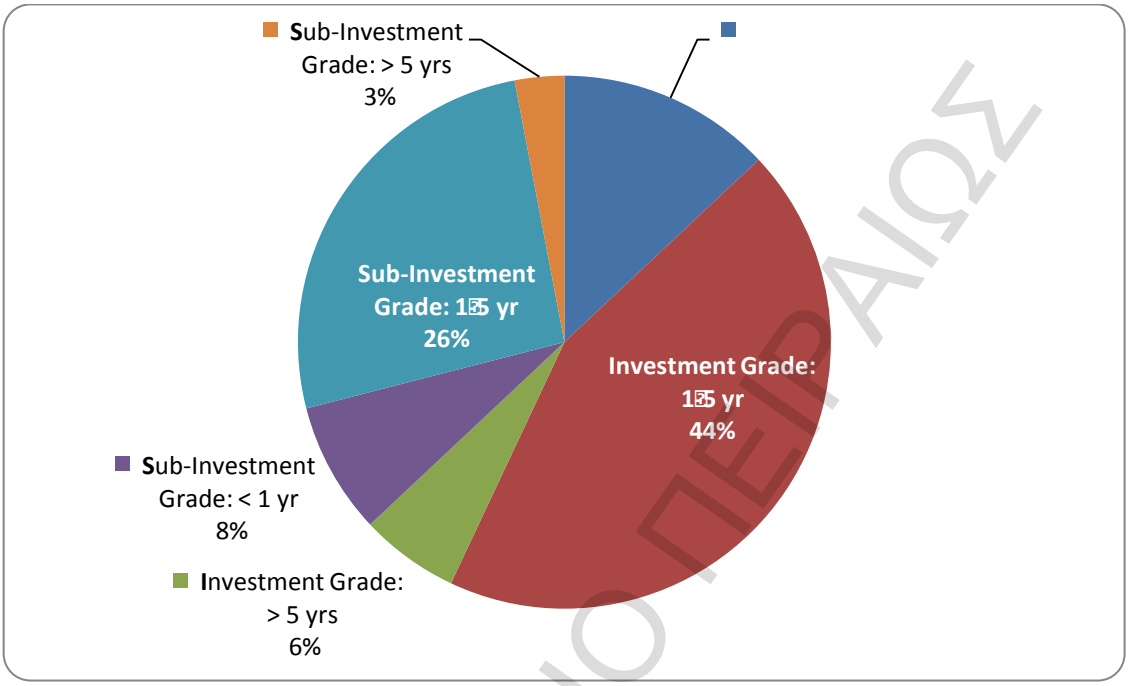


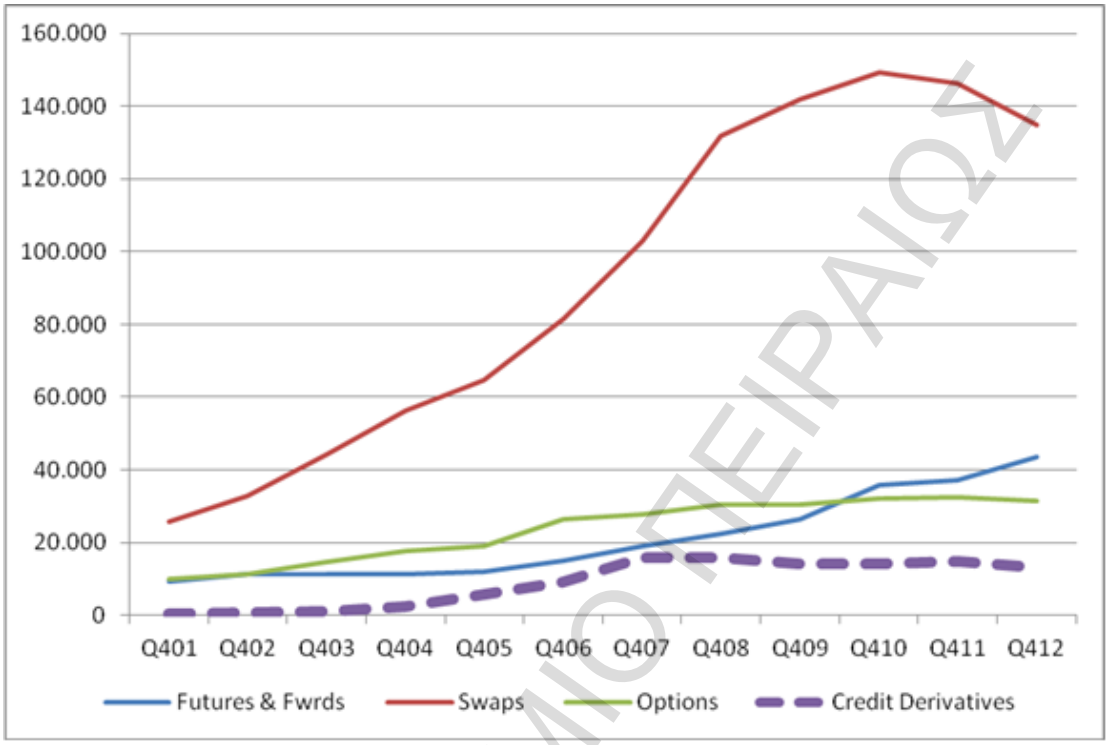
Figure 4 - Credit Derivatives Composition By Maturity & Quality of Underlying Reference Entity (Q4 2012)



Source: Call Reports, International Swap and Derivatives Association (ISDA)

As represented in Figure 4, contracts referencing investment grade entities with maturities from 1-5 years represent the largest segment of the market at 44% of all credit derivatives notional amount. Contracts of all tenors that reference investment grade entities are 63% of the market.

Figure 5 - Notional amount of Derivative Contracts by Product, 2001-2012 ($ bln)



Source: International Swap and Derivatives Association (ISDA)

3.3. Credit Default Swap Documentation

The rapid 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)[4] such as contract standardization, aimed at facilitating back office and contract management operations, and reducing legal disputes.

[4] SDA is a private international association founded in 1985 with main purpose to improve the market's microstructure and handle thw industry's operational issues in derivative trading.

The documentation of Credit Default Swaps is simple and includes specific information. Firstly, in the documentation is identified the reference entity and obligation. The reference entity is the issuer of a debt instrument or equity. In general, concern sovereigns, corporations, loans issued by banks etc. This documentation is standardized. Credit derivatives, and as an extension Credit Default Swaps are privately negotiated agreements traded over the counter (OTC). Given this fact there is very little regulation and these agreements are bilateral and are regulated through the content of the individually negotiated contracts. The International Swaps and Derivatives Association (ISDA) recognized the need to provide a common format/standardization for credit derivative documentation. The standardization of credit derivatives contract was established by ISDA in 1998. The Master Agreement was then revised in 2002.

This compiled standard documentation governing the legal treatment of credit derivative contracts. The form of documentation was primarily designed for Credit Derivatives but instead was flexible so that could be extended for other forms of transactions and derivatives contracts.

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) notional value,

iii) maturity date (agreed tenor or by credit event),

iv) agreed premium,

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).

As a result of the growing importance of CDS, given the dramatic rise of CDS spreads, during both the corporate CDS spreads during the global financial crisis and the sovereign CDS spreads during EU debt crisis, and the increasing demand for contract standardization to facilitate compression mechanisms and the development of central counterparties, in 2009 ISDA developed a new Master Confirmation Agreement (so called "Big Bang Protocol"). The Big Bang Protocol introduced two main changes.

- Established Determination Committees allowed to takes binding decisions on whether a credit event occurs, replacing the previous bilateral negotiation.
- Made auction the default option to set the price of distressed bonds in order to liquidate CDS contracts in case of credit events, 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 bps for US contracts and at 25, 100, 500 or 1000 bps 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.

Any characteristics can be specified in the CDS contract (Confirmation). Obligation Characteristics according to 2003 ISDA Credit Derivatives Definitions are the following:

1) Not Subordinated: means any obligation that is not Subordinated to (i)the most senior Reference Obligation in priority of payment or (ii) if no Reference Obligation is specified in the related Confirmation, any unsubordinated Borrowed Money obligation of the Reference Entity.

2) Specified Currency: means an obligation that is payable in the currency or currencies specified as such in the related Confirmation (or, if Specified Currency is specified in a Confirmation and no currency is so specified, any of the lawful currencies of Canada, Japan, Switzerland, the United Kingdom and the United States of America and the euro and any successor currency to any of the aforementioned currencies, which currencies shall be referred to collectively in a Confirmation as the "Standard Specified Currencies".

3) Not Sovereign Lender: means any obligation that is not primarily owed to a Sovereign or Supranational Organization, including, without limitation, obligations generally referred to as "Paris Club debt".

4) Not Domestic Currency: means any obligation that is payable in any currency other than the Domestic Currency.

5) Not Domestic Law: means any obligation that is not governed by the laws of (A) the relevant Reference Entity, if such Reference Entity is a Sovereign, or (B) the jurisdiction of organization of the relevant Reference Entity, if such Reference Entity is not a Sovereign.

6) Listed: means an obligation that is quoted, listed or ordinarily purchased and sold on an exchange.

7) Not Domestic Issuance: means any obligation other than an obligation that was, at the time the relevant obligation was issued (or reissued, as the case may be) or incurred, intended to be offered for sale primarily in the domestic market of the relevant Reference Entity. Any obligation that is registered or qualified for sale outside the domestic market of the relevant Reference Entity (regardless of whether such obligation is also registered or qualified for sale within the domestic market of

the relevant Reference Entity) shall be deemed not to be intended for sale primarily in the domestic market of the Reference Entity.

Definition of Credit Events and CDS Triggering

Although counterparties in a CDS trade are free to agree on whatever definition of credit events that trigger contract liquidation, thus CDS contract is a bilateral agreement; the vast majority of CDS contracts are guided by the ISDA definitions of credit event. According to ISDA guidance for credit events occurrence, the situations are coded as follow:

1. **Bankruptcy,** when the reference entity defaults and does not pay any obligation
2. **Obligation acceleration**, means one or more Obligations in an aggregate amount of not less than the Default Requirement have become due and payable before they would otherwise have been due and payable as a result of, or on the basis of, the occurrence of a default, event of default or other similar condition or event (however described), other than a failure to make any required payment, in respect of a Reference Entity under one or more Obligations for example when the relevant obligation becomes due and payable as a result of a default by the reference entity before the time when this specific obligation would otherwise have been due and payable.
3. **Obligation default**, means one or more Obligations in an aggregate amount of not less than the Default Requirement have become capable of being declared due and payable before they would otherwise have been due and payable as a result of, or on the basis of, the occurrence of a default, event of default or other similar condition or event (however described), other than a failure to make any required payment, in respect of a Reference Entity under

one or more Obligations. When such a case occurs when 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**, refers to any case of failure of the reference entity to make any payments under one or more obligations
5. **Repudiation/moratorium**, in this case the reference entity disaffirms, disclaims or challenges the validity of the relevant obligation
    i. an authorized officer of a Reference Entity or a Governmental Authority (x) disaffirms, disclaims, repudiates or rejects, in whole or in part, or challenges the validity of, one or more Obligations in an aggregate amount of not less than the Default Requirement and
    ii. a Failure to Pay, determined without regard to the Payment Requirement, or a Restructuring, determined without regard to the Default Requirement, with respect to any such Obligation occurs on or prior to the Repudiation/Moratorium Evaluation Date.
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 favorable 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.

Obligation is issued or incurred:

    i. a reduction in the rate or amount of interest payable or the amount of scheduled interest accruals

ii. a reduction in the amount of principal or premium payable at maturity or at scheduled redemption dates;

iii. a postponement or other deferral of a date or dates either (A) the payment or accrual of interest or (B) the payment of principal or premium;

iv. a change in the ranking in priority of payment of any Obligation, causing the Subordination of such Obligation to any other Obligation; or

v. any change in the currency or composition of any payment of interest or principal to any currency which is not a Permitted Currency.

Someone could see clearly, that credit events for situations 1-5 are straighter, but the 6th situation arises lot of discussion. Restructuring clauses are not common. For example there are difference on corporate restructuring in US and EU. For example, any corporation that restructures its obligations triggers a "chapter 11 credit event" and the CDS. In Europe, companies are able to restructure their obligations, avoiding the bankruptcy procedure.

As far as the sovereign debt restructurings are concerned, Roubini and Nowakowski (2011), point out that a sovereign debt exchange offer can therefore be planned very carefully in order the triggering a CDS could be avoided. They also underline that a voluntary restructuring that does not rely on changes in domestic legislation or on the use of collection action clauses (CACs) to coerce non-participating creditors may not trigger a CDS (see Morgan Stanley 2011 for further discussion).

> "Collective action clauses (CACs) allow a large majority of bondholders/creditors to agree with debt restructuring of the bonds they hold, that is legally binding on all bond-holders, including those who vote against the restructuring. Bondholders generally opposed to such clauses, fearing that it gave debtors too much power.
>
> *Haldane A., Penalver A., Saporta V., S., Hyun Song (2005)*

In general, 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. In the case of Greece, CACs worked out to roughly €59 billion of the €177 billion of local-law Greek bonds that are in private hands. Foreign-law Greek bonds already contained CACs.

	Bankruptcy	Failure to Pay	Failure to Pay (Grace Period Extension)	Obligation Acceleration	Repudiation or Moratorium	Restructuring (Old R)	Restructuring (Mod R)	Restructuring (Mod Mod R)	Restructuring (Multiple Holder Obligation Required?)
Sovereign Bonds									
Asia	N	Y	N	N	Y	Y	N	N	Y
Singapore	N	Y	N	N	Y	Y	N	N	Y
Latin America	N	N	Y	Y	Y	Y	N	N	N
Emerging European & Middle Eastern Countries	N	N	Y	Y	Y	Y	N	N	N
Western European Countries	N	Y	N	N	Y	Y	N	N	Y
Japan	N	Y	N	N	Y	Y	N	N	N
Australia	N	Y	N	N	Y	N	Y	N	Y
New Zealand	N	Y	N	N	Y	N	Y	N	Y
Corporate Bonds									
North America	Y	Y	N	N	N	N	N	N	Y
European	Y	Y	N	N	N	N	N	Y	Y
Asian	Y	Y	N	N	N	Y	N	N	Y
Japanese	Y	Y	N	N	N	Y	N	N	N
Singapore	Y	Y	N	N	N	Y	N	N	Y
Australia	Y	Y	N	N	N	N	Y	N	Y
New Zealand	Y	Y	N	N	N	N	Y	N	Y
Emerging European	Y	N	Y	N	Y	Y	N	N	Y
Municipal Bonds									
U.S. Municipal Full Faith And Credit	N	Y	N	N	N	Y	N	N	N
U.S. Municipal General Fund	N	Y	N	N	N	Y	N	N	N
U.S. Municipal Revenue	N	Y	N	N	N	Y	N	N	N

Notes:
Mod Mod R -Modified Restructuring Maturity Limitation and Conditionally Transferable Obligation
Mod R -Restructuring Maturity Limitation and Fully Transferable Obligation

Source: ISDA, Morgan Stanley

Credit Default Events since 1997

History is full of examples of sovereign and corporate defaults. In any case debt restructuring of default is a complex, multi-step and needs years to finish up. According to Das et al. (2012) since 1950s sovereign debt restructurings have been a pervasive phenomenon, amounting to more than 600 cases in 95 countries. From this sample 186 debt exchanges were with private creditors and 447 agreements occurred the restructuring of bilateral debt with the Paris Club (official sector). Until the debt restructuring of Greek debt all events occurred in emerging economies. The consequences of debt restructurings affected the economies,

Most of the major events in the last 15 years, not including Greece, like Russia (1998, $72bn), Ecuador (1999, $6.6bn), Argentina (2001, $82bn), Uruguay (2003, $5.7bn), Ecuador (2008, $3.2bn), have or would have, in our view, triggered CDS events as the exchange occurred after a failure to pay event. Most of these debt restructurings were relatively smooth, thus they could be implemented within one or two years and with creditor participation exceeding 90%. The only outlier was Argentina in 2005. Restructurings can have serious adverse effects on the domestic economy and the financial sector, e.g., foreign and domestic banks, pension funds and insurance companies.

Although there is a wide belief and a spread myth on the complexity of Credit Default Swaps, in fact this is the simplest form used form credit risk transfer and hedge, even for speculation on the probability of default of both corporations and sovereigns. Credit Default Swaps gain a large reputation during the global financial crisis of 2008-2009 and the European debt crisis because of the huge interest that occurred since the default of Lehman Brothers, on the 16th of September 2008.

Among the 116 Moody's rated sovereigns, there were three defaults in 2012, two by the government of Greece and one by the government of Belize, according to

Moody's in "Sovereign Default and Recovery Rates, 1983-2012." Previously, only one default, by the government of Jamaica, was reported between 2009 and 2011.

Historically, the study indicates that issuer--weighted recovery rates on defaulted sovereign bonds have averaged 49% over the 1983-2012 period. However, on a value-weighted basis, recovery rates have averaged only 26%. Recoveries in 2012, as measured by post-default trading prices, were 24% in the March Greek debt exchange, 37% in the December Greek debt buyback, and 40% at the time of Belize's default.

Macroeconomic Drivers of Sovereign CDS Spread

According to Reinhart and Rogoff's book "This time is different: Eight Centuries of Financial Folly" (2008), there are five main factors that lead a country into a debt crisis or a default. These factors are the following:

i. The external government debt
ii. The amount of domestic debt
iii. Banking crises
iv. Inflation outbursts
v. Currency crashes

The fact that external debt is named as a driver of sovereign default is logical, since the inability of a nation to fulfill its external debt obligations effectively puts a nation into a state of default. History showed that every time a nation had to restructure its debt or go into default, it was caused by one or more of the earlier mentioned drivers[5].

In addition, a banking crisis, is often preceded by periods of huge economic growth. Huge capital inflows precede external debt crises on both a local and global level (Reinhart and Rogoff 2008). The current problems of Greece are an example of this.

[5] Reinhart, C. and Rogoff, K. (2008). This time is different: Eight Centuries of Financial Folly

Even though the nation has a history of default, as it has spent over 50% of its years in default. High inflation numbers also have a big influence on sovereign debt crises. All of the countries that experienced a default or debt restructuring in the past had soaring inflation rates during those periods.

Also high inflation rates, generally reveals bad monetary and exchange rate policies, and works against the stability of an economy. High rates of inflation can put any economy into even bigger problems (Mellios and Blanc 2009). History has shown that high inflation rates are often followed by currency crashes or large depreciations. When a country is in a state of default, exchange rates tend to depreciate 15% or more, according to the data collected by Reinhart and Rogoff (2008).

Since the start of the recent crisis, a vast number of academic and empirical research articles try to examine the main determinants of debt crises and the drivers of CDS spreads, as measure of credit risk and the probability of default.

Older works, like Avery and Fisher (1992) supported that the openness of an economy and the growth rates are very important determinants, for the probability of sovereign crises. Haque et al. (1998), Manasse et al. (2003) and Mellios and Blanc (2009) add some other factors, as the competitiveness of the economy, current account deficit, the levels of foreign reserves.

In this section will be reported the main macroeconomic and financial variables that affect the CDS spread, as suggested in the related literature. These variables are some basic factors that affect the CDS spreads and can measure the sovereign credit risk. Although, there is an enormous number of empirical studies, which are able to determine the basic variables that drive credit ratings, the probabilities of default, only a few detect factors that affect sovereign CDS spreads. The main factors in the literature are common, In table 1 there are the main variables and the research articles in which they are reported.

Most variable are common, for example inflation is reported in several studies. The same is for debt-to-GDP ratio, real exchange rates, competitiveness, growth, and openness. A common used factor that is not macroeconomic is "Risk Appetite". Fontana and Scheicher (2010) indicate that "Risk Appetite", the willingness of investors to take risks can explain some of the CDS variation. "Risk Appetite" was shown to have negative impact on CDS spreads as a sovereign credit risk indicator.

The analysis of euro area sovereign bond markets has typically focused on the role of fiscal fundamentals, market liquidity or market integration (Manganelli and Wolswijk, 2009). Overall, this literature looks more at migration risk (i.e. rating downgrades) than on the risk of outright default. Euro area bond market developments in the crisis are analyzed by Sgherri and Zoli (2009), Mody (2009) or Haugh et al. (2009).

The sovereign bond spreads are determined mainly by country specific characteristics, such as creditworthiness, or credit rating, its fiscal and macroeconomic fundamentals (the so-called "credit risk"). In this case, there are some fundamental variables which are used in most credit rating models. Also, liquidity risk was a basic factor, as presented by the size and depth of the local bond market. Besides this, it is well known that sovereign bond spreads are a very good measure for international risk aversion, investors' sentiment and their willingness to take additional risks. Finally, the literature suggests that credit risk is quantified by using the potential effect of announcements (good or bad news), macroeconomic news/surprises or events.

More extensively, Bernoth et al. (2004) find that fiscal variables, as budget deficits or sovereign debt, have a significant impact on sovereign bond spreads. In an other study, Faini (2006) finds also similar relationships but for EMU interest rate level.

Article	Dependent Variable	Explanatory variables
Fontana and Scheicher (2010)	Sov. CDS spread	Risk-free rate External debt Risk appetite Stock market volatility Corporate CDS spread Bid-ask spread
Bellas, Papaioannou and Petrova (2010)	Sov. CDS spread	External debt/GDP Short-term debt/reserves Interest payments/reserves Current account/GDP Fiscal balance/GDP Political risk index Openness Financial stress index & VIX Risk-free rate
Brandorf and Holmberg (2010)	Sov. CDS spread	Debt and Growth Inflation Unemployment
Alper, Forni and Gerard (2012)	Sov. CDS spread	Expected Deficit and Growth Lagged Debt Risk-free rate Central Bank policy VIX

European Debt Crisis

Since August 2007, credit markets have witnessed an unprecedented repricing of credit risk. The revaluation of credit risk started in US mortgage markets; after the subprime market collapse. Afterwards, corporate and especially investment and commercial banks followed. The peak in the corporate market came with the fall of Lehman Brothers, in the September of 2008. After this "black swan" a large number of banks both in US and Europe came into distress. Governments approved large packages to support the financial systems from a large banking crisis and in order that they could mitigate systemic risk and its adverse macroeconomic consequences.

Since late September 2008, the sovereign CDS market has attracted considerable attention. Recent market developments peaked in an unprecedented "flight to safety" episode in early May 2010 in the euro area, when investors started large scale sell-offs of a variety of risky assets. high CDS premia during the crisis may be in part due to declining risk appetite and falling market liquidity, but also to concerns about an increasing number of credit rating downgrades, rather than to principal losses on outstanding debt. This unprecedented surge in sovereign bond yield spreads reflected increasing concerns in financial markets about some governments' capacity to meet their future debt obligations. Moreover, the extremely high cost of borrowing/lending, which was shown in the sovereign bond yield spreads, was the clean signal that investors had increased risk tolerance and they were less willing to lend with lower risk premiums.

The rescue packages of the governments form the banking system lead to an increase in budget deficits and sovereign debt. This fact followed with the lack of trust, worldwide, turned the financial crisis into a sovereign one. In the euro area, sovereign debt markets, mainly in peripheral economies came under stress in the first half of 2010. Massive sell-offs were observed firstly Greek government bonds, thus Greece was the less solvent country. CDS spreads on Greek bonds jumping above 1,000 bps,

both for trading and hedging reasons. After Greece, other economies followed, like Ireland, Portugal, Spain etc.

Sovereign Credit Default Swaps arisen as a valuable instrument used by investors to target countries with fiscal troubles, high levels of debt ("debt-overhang") and debt-rollover problems (re-financing). To position for a default, there is little dispute that the sovereign CDS is the most direct and effective instrument. Since the global crisis started, governments' role has grown exponentially worldwide. The resulting transfer of risk from private to public sector finally puts a price on government credibility, which is being reflected in the rise of sovereign CDS levels and interest rates globally. Even after prospects for Europe backstopping Greece's CDS spread has risen significantly, the default probability for Greece increased exponentially. Ireland, Portugal, Spain and Italy followed. There seem to be few "invincible" countries left in the world. The market also set a 4% likelihood of a US default, especially after the downgrade.

Government intervention was different across countries. Policy makers used available tools in order to regain sustainability, given the existing constraints and policy targets. For example, US economy was financed by printing money, EU countries with high debt and fiscal deficits choose austerity and ECB supported peripheral banking systems via buying sovereign bonds, throughout expanding its balance-sheet.

Although history is full of such incidents in the past of sovereign defaults on foreign liabilities, it is quite rare for countries to refuse to make payment in full in nominal terms on their domestic-currency-denominated debt. However, for countries that rely extensively on external financing, there is a chance of default; because you cannot print money to pay back foreign liabilities. For other countries that also have high and increasing debt burdens denominated in domestic currencies, the strategy may be different.

Given the causes of the crisis, when economies start to emerge from a deep recession, inflation tends to stay low (if not negative) for a period of time, due to the large

overcapacity to be absorbed. The reduction of the increases in prices supports relatively loose monetary policy, or expansionary fiscal policy, given low-debt burdens. If uncertainty persists, the government has to obtain further measures in order to restore trust, stability and growth. Under these circumstances the yield curve tends to be steeper, reflecting the concerns on the government's fiscal discipline and financing capability.

Hence, wider CDS should also mean a steeper yield curve. The correlation between interest rates and the sovereign CDS spread, however, is less certain since a weak economy tends to depress the level of interest rates while concerns over government finance tends to push it higher.

As far as the relationship of CDS spread and volatility, from a theoretical perspective, both capture the value of options. In both cases, one pays a premium and waits until the government runs into trouble with its finances. Under these structures, implied volatility and CDS spread should have a positive correlation. Wider CDS spread reflects higher uncertainty, and increased realized volatility.

Unfortunately, this relationship is much more complicated. The rise of interest rates, sometimes there might not be the default case, that allows CDS protection buyers to realize their reward, and of course, the correlation between the volatility and CDS spread may be weaker for some countries. On the contrary, countries with more external debt, or widening deficits or other imbalances (for example BOP, or current account) the correlation should be higher, especially during periods of heightened sovereign risk and uncertainty.

The relationship between volatility and CDS spread, as examined in the literature seems to have some very interesting patterns. Firstly, the correlation among the CDS spreads is extremely high during the periods of crises. This reflects the potential contagion (domino) effect, for other economies in the region or highly connected, via the banking system, or the trade channel. This fact also occurs due to the illiquidity of sovereign CDS market.

In addition, the correlation of volatilities is much lower and less certain. The relationship is positive and reflects the investors' unease over government actions that could potentially cause higher interest rates. These features create some basic trading positions for investors, given the structure of the market and the idiosyncratic economic and financial variables of countries.

Drivers of the CDS-bond basis

The difference between CDS and bond spreads is usually defined as the "basis". In a perfect market with no frictions, the basis should be zero, otherwise there would be unexploited arbitrage opportunities. Theoretically, both CDS spreads and yield spreads to risk free rates represent premiums received when taking an exposure to the risk of default of a . Furthermore, banks tend to buy CDS, instead of shorting bonds in order to hedge their credit exposures or to express a negative view on a single name, pushing the basis up. In addition, the CDS basis seems to increase with high bond liquidity. This is due to the fact that the basis will move in such a way that provides extra compensation for investors in less liquid segment/markets, favoring countries with very liquid bond markets. In the case of Greece which is a very illiquid market, the

Banks involved in bonds syndication tend to buy protection in CDS markets during the issuance, causing the basis to widen (mainly observed in corporate). On the other hand, new bonds (especially sovereign) are often issued at a higher yield in order to attract sufficient interest during auctions, depressing the basis as a result.

Not all investors are able to borrow at repo levels. Some of them may find it easier to obtain credit exposure by selling CDS than by being long the bond. This makes CDS spread relatively low versus bond spreads (to OIS / repo). This is particularly true at year end, when balance sheet reductions are working against cash positions and contributing to the cheapening of the bonds versus CDS (off balance sheet instruments). The divergence in the types of investors in each market, with bonds

mostly taken up by pension and insurance funds, while banks and short term investors are more active in CDS.

More precisely, 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 retrieve the repo rate – LIBOR or EURIBOR) and into an asset swap whereby the fixed coupon of the bond is exchanged for a floating rate (repo rate + spread). If the CDS spread were lower than the asset swap spread (negative basis), the investment strategy described shows an arbitrage opportunity. If the CDS spread were instead higher than the asset swap spread, 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).

Greece Debt Restructuring in 2012

Bankruptcy cases are events that are clear to understand, though there are special cases that need more discussion, when such an event comes to become real. For example there are many complexities that arise and concern the regulation, the power of the negotiators etc. In addition, there are main differences on the procedures concern whether the reference entity is corporation of sovereign. As a result, although the process of ISDA is the same for any entity, there are several concerns and differences for restructuring processes for sovereign debt 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 reason why this happened is due to the fact that ISDA, as far as a credit event is concerned, it is crucial to determine whether

the restructuring is voluntary or mandatory. In the case of a voluntary debt restructuring only binds those investors that agree to the restructuring. On the contrary, in the case of a mandatory restructuring the investors are not getting repaid.

In the case of Greece, the first thing tried was a voluntary debt restructuring agreement. So on March 1st, 2012, the ISDA Determination Committee 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. The introduction of CAC is not considered a credit event at any case, it has had the effect to bind all bondholders to a debt swap restructuring implying a significant haircut and for this reason, 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. During the Greek sovereign crisis, the Greek government imposed, with the support of the IMF and ECB, CACs with a threshold of 75%. This impacted 90% of the bond-holders, which issued under the jurisdiction of Greek courts. In the exchange, investors received new bonds with a face value of 31,5% of the old ones together with notes from the EFSF and growth warrants. The new debt follows English law.

In the Private Sector Involvement (PSI) agreement, 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 growth Warrant up to 1% after 2015 on the bonds' coupons.

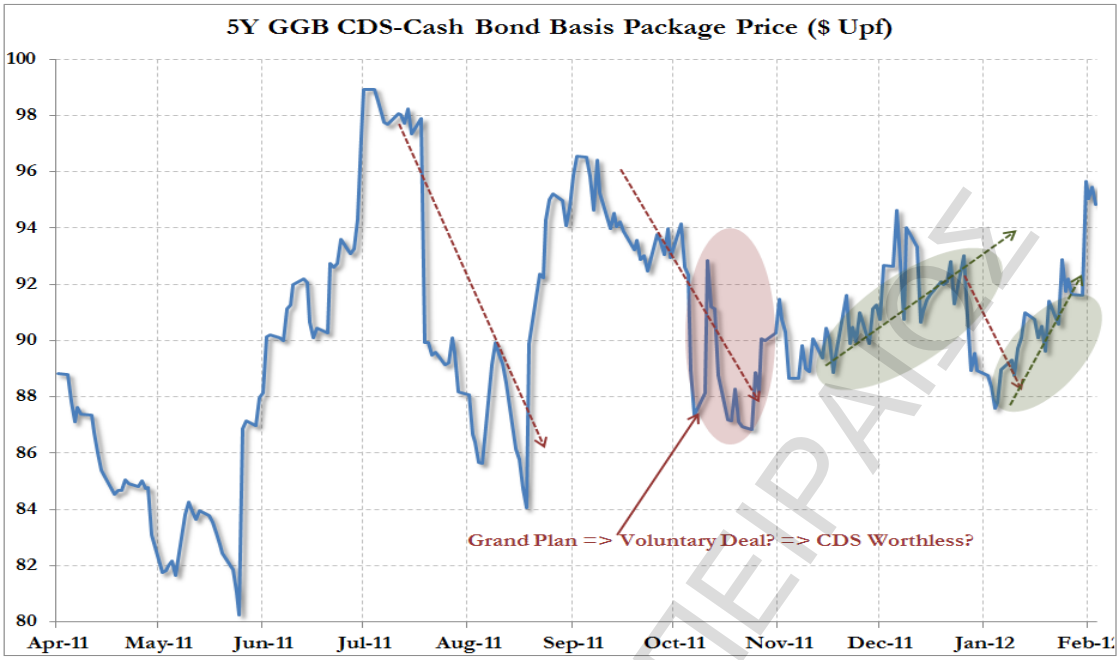
When the CDS contracts triggered, the restructuring payments calculated via the new-issued Greek bond with a 30-year maturity. The price of these bonds and the recovery rate was settled in an auction held on the 19th of March. The recovery rate was set at 21.5%, which was close to some market expectations. According to DTCC, the

settlement created $2.89 bln net cash flows, when the gross amount outstanding of Greek CDS was around $80 bln.

After the finalization of the process, it turned out that the so called “systemic impact” of the Greek credit event, was overestimated. The impact of the Greek case has been smaller than that of the Lehman Brothers default in September 2008. In fact, the exposure on Greece was lower, than the case of Lehman Brothers and the recovery rate was higher (21.5% compared with 9% for Lehman Brothers bonds). 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.

In sum, , although the Greek episode 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 addition, the Greek event has reinforced the need for supervision in this industry and more clear terms of participation to have a thorough understanding and transparency of exposure across participants and global financial 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.

Furthermore, 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 by Duffie and Thukral (2012).



Source: Zerohedge

4. Uses

Credit default swaps can be used by investors for speculation reasons, hedging and finally for arbitrage.

Speculation

Credit default swaps allow investors to speculate on possible changes in CDS spreads of single names or of market indices. Such indices can be for example the North American CDX index or the European iTraxx index. In that case, an investor who believes that an entity's CDS spreads are too low or too high, relative to the entity's bond yields. In order to profit from that view he enters to a trade, known as a basis trade, that combines an interest rate swap and a CDS with a cash bond.

Furthermore, an investor can speculate on an entity's credit quality, since generally CDS spreads increase as credit-worthiness declines and decline as credit-worthiness increases. The investor might therefore buy CDS protection on a company that it is

about to default in order to speculate. Alternatively, the investor could sell protection if he believes in a company's creditworthiness improvement. The investor selling the CDS is viewed as being "long position" on the CDS and the credit, as if the investor owned the bond. In contrast, the investor who bought protection is "short position" on the CDS and the underlying credit.

Credit default swaps opened up important new opportunities to speculators. Investors could go long on a bond without any upfront cost of buying a bond. What finally the investor need to do was only promise to pay when the event of default occurs. Shorting a bond faced difficult practical problems, such that shorting was often not feasible. That liquidity problem of bond gave space to CDS which made shorting credit possible and very popular. Since the speculator in either case does not own the bond, its position is said to be a synthetic long or a synthetic short position.

For example, a hedge fund believes that ABC Corp will soon default due to its large debt. Therefore, it buys $10 million worth of CDS protection for two years from AAA-Bank. The reference entity is ABC Corp and the spread is at 500 basis points (=5%) per annum.

- If ABC Corp does indeed default after, for example one year, then the hedge fund will have paid $500,000 to AAA-Bank, but then receives $10 million (assuming that the recovery rate is zero and that AAA-Bank has enough liquidity to cover the loss), thereby making a profit. On the other hand, AAA-Bank, and its investors, will incur a $9.5 million loss minus recovery unless the bank has somehow offset the position before the default.

- However, if ABC Corp does not default, then the CDS contract runs for two years, and the hedge fund ends up paying $1 million, without any return, thereby making a loss. In contrast, AAA-Bank, has made $1 million profit without any upfront investment, by selling protection.

But also we might take into consideration that there is a third possibility in the above scenario. That is when the hedge fund could decide to liquidate its position after a certain period of time in an attempt to realize its gains or losses. For example:

- After one year, the market now considers ABC Corp is more likely to default, so its CDS spread has increased from 500 to 1500 basis points. The hedge fund may choose to sell $10 million worth of protection for 1 year to AAA-Bank at this higher rate. Therefore, over the two years, the hedge fund pays the bank 2 * 5% * $10 million = $1 million, but receives 1 * 15% * $10 million = $1.5 million, giving a total profit of $500,000.
- In another scenario, after one year the market now considers ABC Corp much less likely to default, so its CDS spread has decreased from 500 to 250 basis points. Again, the hedge fund may choose to sell $10 million worth of protection for one year to AAA-Bank at this lower spread. Therefore over the two years the hedge fund pays the bank 2 * 5% * $10 million = $1 million, but receives 1 * 2.5% * $10 million = $250,000, giving a total loss of $750,000. This loss is smaller than the $1 million loss that would have occurred if the second transaction had not been entered into.

Transactions such as these do not even have to be entered into over the long-term. If ABC Corp's CDS spread had increased by just a couple of basis points over the course of one day, the hedge fund could have entered into an offsetting contract immediately and made a small profit over the life of the two CDS contracts.

Naked credit default swaps

In the examples above, the hedge fund did not own any bond of ABC Corp. A CDS in which the buyer does not own the underlying debt is referred to as a naked credit default swap, estimated to be up to 80% of the credit default swap market. There is

currently a world about whether speculative uses of credit default swaps should be banned.

Critics assert that naked CDSs should be banned. Analogizing to the concept of insurable interest, critics say you should not be able to buy a CDS — insurance against default — when you do not own the bond. Short selling is also viewed as gambling. Another concern is the size of the CDS market. Naked credit default swaps are synthetic, so there is no limit in how many can be sold. The gross amount of CDSs far exceeds all corporate bonds and loans outstanding in "the real world". As a result, the risk of default is magnified leading to concerns about systemic risk.

Financier George Soros called for an outright ban on naked credit default swaps, viewing them as "toxic" and allowing speculators to bet against and "bear raid" companies or countries. His concerns were echoed by several European politicians who accused naked CDS buyers of making the crisis worse during the Greek Financial Crisis.

In contrast to this opinion and concerns, the Secretary of Treasury Geithner and Commodity Futures Trading Commission Chairman Gensler are not in favor of an outright ban on naked credit default swaps. They prefer greater transparency and better capitalization requirements. These officials think that naked CDSs have a place in the market especially for diversification purposes.

Proponents of naked credit default swaps say that short selling in various forms, whether credit default swaps, options or futures, has the beneficial effect of increasing liquidity in the marketplace. That benefits hedging activities. Without speculators buying and selling naked CDSs, banks wanting to hedge might not find a ready seller of protection. Speculators also create a more competitive marketplace, keeping prices down for hedgers. A robust market in credit default swaps can also serve as a barometer to regulators and investors about the credit health of a company or country.

Despite assertions that speculators are making the Greek crisis worse, Germany's market regulator BaFin found no proof supporting the claim. Without credit default swaps, Greece's borrowing costs would be higher while in November 2011, the Greek bonds have a bond yield of 28%.

Hedging

Credit default swaps are often used to manage the risk of default that arises from holding debt. For example, a financial institution (bank) may hedge its risk that a borrower may default on a loan by entering into a CDS contract as the buyer of protection. If the loan goes into default, the proceeds from the CDS contract cancel out the losses on the underlying debt.

In order to eliminate or reduce the risk of default, the bank could sell (that is, assign) the loan outright or bring in other banks as participants. But, these options may not meet the bank's needs. Consent of the corporate borrower is often required. The bank may not want to find loan participants which cost time and money to the bank.

If both the borrower and lender are well-known and the market learns that the bank is selling the loan, then the sale may be viewed as signaling a lack of trust in the borrower, which could severely damage the banker-client relationship. In addition, the bank simply may not want to sell or share the potential profits from the loan. When buying a CDS, the bank can lay off default risk while still keeping the loan in its portfolio. The downside to this hedge is that without default risk, a bank may have no motivation to actively monitor the loan and the counterparty has no relationship to the borrower.

A bank buying protection can also use a CDS to free regulatory capital. By offloading a particular credit risk, a bank is not required to hold as much capital in reserve against the risk of default (traditionally 8% of the total loan under Basel I or 9% in

Basel II). This frees resources the bank can use to make other loans to the same key customer or to other borrowers.

Hedging risk is not limited to banks as lenders. Holders of corporate bonds, such as banks, pension funds or insurance companies, may buy a CDS as a hedge for similar reasons. In case of a Pension fund: A pension fund owns five-year bonds issued by ABC Corp with par value of $10 million. To manage the risk of losing money if ABC Corp defaults on its debt, the pension fund buys a CDS from DDD Bank in a notional amount of $10 million. The CDS trades at 200 basis points (200 basis points = 2%). In return for this credit protection, the pension fund pays 2% of $10 million ($200,000) per annum in quarterly installments of $50,000 to DDD Bank.

- If ABC Corporation does not default on its bond payments, the pension fund makes quarterly payments to DDD Bank for five years and receives its $10 million back after five years from ABC Corp. Though the protection payments totaling $1 million reduce investment returns for the pension fund, its risk of loss due to ABC Corp defaulting on the bond is eliminated.
- If ABC Corporation defaults on its debt three years into the CDS contract, the pension fund would stop paying the quarterly premium and DDD Bank would ensure that the pension fund is refunded for its loss of $10 million minus recovery (either by physical or cash settlement). The pension fund still loses the $600,000 it has paid over three years, but without the CDS contract it would have lost the entire $10 million minus recovery.

In addition to financial institutions, large suppliers can use a credit default swap on a public bond issue or a basket of similar risks as a proxy for its own credit risk exposure on receivables.

Despite credit default swaps have been highly criticized for their role in the recent financial crisis, most observers conclude that using credit default swaps as a hedging device has a useful purpose.

Arbitrage

Capital Structure Arbitrage is an example of an arbitrage strategy that utilizes CDS transactions. (Chatiras, Manolis, and Barsendu Mukherjee. *Capital Structure Arbitrage: Investigation using Stocks and High Yield Bonds*. Amherst, MA: Center for International Securities and Derivatives Markets, Isenberg School of Management, University of Massachusetts, Amherst, 2004. Retrieved March 17, 2009) This technique relies on the fact that a company's stock price and its CDS spread should exhibit negative correlation; i.e., if the outlook for a company improves then its share price should go up and its CDS spread should tighten, since it is less likely to default on its debt. However if its outlook worsens then its CDS spread should widen and its stock price should fall.

Techniques reliant on this are known as capital structure arbitrage because they exploit market inefficiencies between different parts of the same company's capital structure. For example, mispricing between a company's debt and equity. An arbitrageur attempts to exploit the spread between a company's CDS and its equity in certain situations.

To be more specific, if a company has announced some bad news and its share price has dropped by 25%, but its CDS spread has remained unchanged, then an investor might expect the CDS spread to increase relative to the share price. Therefore a basic strategy would be to go long on the CDS spread (by buying CDS protection) while simultaneously hedging oneself by buying the underlying stock. This technique would benefit in the event of the CDS spread widening relative to the equity price, but would lose money if the company's CDS spread tightened relative to its equity.

Another interesting situation in which the inverse correlation between a company's stock price and CDS spread breaks down is during a Leveraged buyout (LBO). In common, this leads to the company's CDS spread widening due to the extra debt on

the company's books, but also an increase in its share price, since buyers of a company usually end up paying a premium.

Furthermore, a common arbitrage strategy aims to exploit the fact that the swap-adjusted spread of a CDS and the underlying cash bond issued by the reference entity, should trade closely. Misalignments in spreads may occur due to technical reasons such as:

- Shortages in a particular underlying instrument
- Specific settlement differences
- The cost of funding a position
- Existence of buyers constrained from buying exotic derivatives.

The basis, which is the difference between CDS spreads and asset swap should theoretically be close to zero. Basis trades can aim to exploit any differences to make risk-free profit.

Another example:

Suppose that company "Risky S.A." has issued a corporate bond to Company "Byer S.A." which ends in one year from now and its principal is $1,000. The coupon of the bond, paid at the end of the year, is 7%. "Byer S.A." wants to protect itself against the case "Risky S.A." cannot fulfil its obligations. It estimates that some credit events are likely to happen and result the default of "Risky S.A.". If one of these events occur before the end of the year, the value of the bond will lose 60% of its value at the maturity. "Byer S.A." contacts Company "Risky S.A." and asks to buy the protection through a CDS with the following parameters:

- The reference asset is the corporate bond issued by "Risky S.A.".
- The credit events are the ones that result the default of "Risky S.A." and hence the 60% decline on the value of the bond.

- The default payment is set to be equal to the 60% loss of "Byer S.A." in case of default.
- Maturity in one year from now.

"ABC Bank" faces the problem of the determination of the premium payment that is going to been asked (upfront) in return for this protection. Entering the CDS:

"ABC Bank" has to pay:

- $0 in case of no default;
- $1.000 X (1 + 7%) X 60% = $642 in case of default.

The idea of replication pricing is that "ABC Bank" can use a certain number of the reference asset and borrow a certain amount of cash in order to perfectly replicate the above obligations.

If x is the amount of cash invested in the risk-free rate (assumed to be 5% p.a.) and y is the number of the corporate bond obtained, we need to solve the following equations (two linear equations with two unknowns):

- x (1,05) + y 1,070 = 0 (no default)
- x (1,05) + y (1,070) 40% = 642 (default)

The solutions are x= $1,019 and y=1. This means that the portfolio:

- shorting one corporate bond and
- investing $1,019 at the risk-free rate,

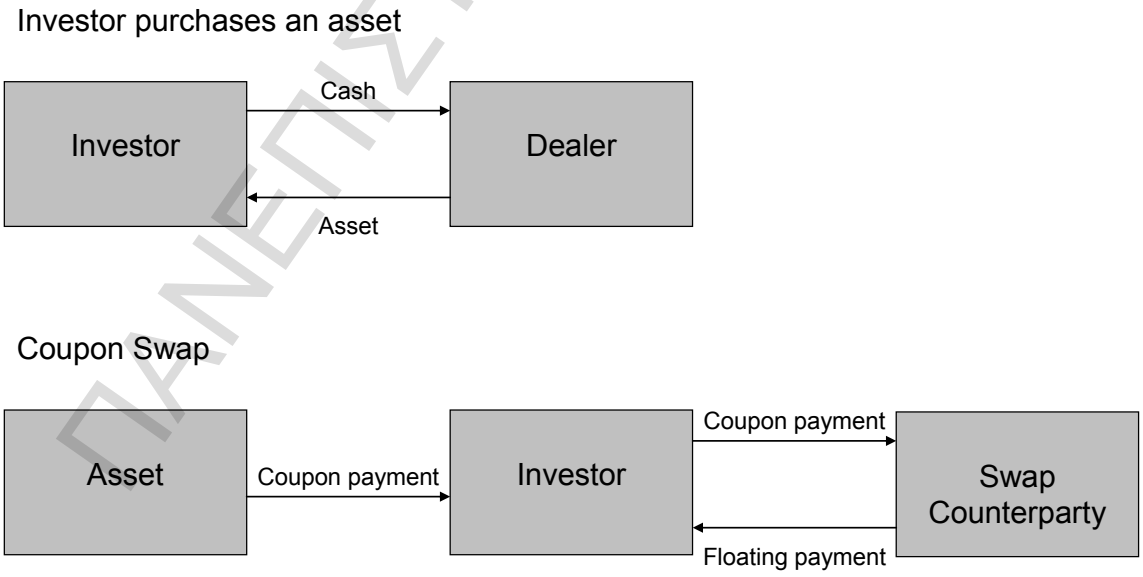
replicates the obligation of the Company S. The cost of the above portfolio is $19 and is the (unique) non-arbitrage premium payment. It should be clear to the reader that any other premium lead to an arbitrage.

The main problem in this case is that shorting of a corporate bond is not always possible. This means that replication pricing arguments cannot always be applied to CDS.

Asset Swap

An asset swap is generally a fixed rate (fixed coupon) bond that is converted into a floating coupon by way of a fixed-for-floating interest rate swap (i.e. corporate bond + IRS swap). Subsequently the purchaser of such a package picks up credit risk exposure from the bond issuer and also from the counterparty to the swap Duncan (2004).

Asset swaps are in general synthetic floating rate notes. They are a tailor-made structures, which enable an investor to purchase a fixed rate bond (or loan) and then hedge away the interest rate risk by swapping the fixed interest payments for floating. The investor assumes the credit risk that is economically comparable to purchasing a floating rate note issued by the fixed rate bond issuer. There are two components to an asset swap, the first is the fixed rate bond and the second is a fixed for floating interest rate swap of the same maturity as the bond.



Source: Duncan (2004)

Because a CDS can be synthetically replicated, CDS valuation does not have to be model dependent. Similarly it is a reasonable assumption to consider that the underlying cash market is efficient, on average. Asset swaps provide a pricing source for valuing default risk. Asset swaps provide a context for relative value, as reference assets have transparent prices. This approach also makes it possible to tie expectations about cash bond pricing to expectations about the valuation of a CDS – an important consideration when constructing any form of hedging.

The following picture shows how a CDS can be replicated. In this example the investor is selling credit default protection (i.e. equivalent to a short CDS).

In replicating the trade the investor undertakes the following:

- Purchases a cash bond with a spread T + Sc for par.
- Pays fixed on an interest rate swap (T + Ss) with the same maturity as that of the cash bond, and receives Libor.
- Finances the position (i.e. the purchase of the cash bond) in the repo market. The repo rate is quoted at a spread to Libor (L - X).
- Pledges the bond as collateral and is charged a haircut by the repo counterparty.
- Each of the four trade components may not be self-explanatory to investors unfamiliar with hedging and financing, thus these steps are expanded upon.

5. Credit Default Swaps Pricing & Valuation

According to Moody's Credit Guide "Introduction to Credit Default Swaps", written by Silvio Borelli (2009), The value of the fixed leg of a CDS corresponds to the present value of the periodic coupon payments, discounted at the risk free rate. But because those payments may cease in case of an event of default of the reference entity, they have to be weighted by the proper conditional survival probabilities[6] implied by the spread curve:

$$PV\ of\ Future\ Cash\ Flows = Spread \times \sum_{i=1}^{n} DF_i \times SP_i \times A_i$$

where:

Spread: Fixed coupon (fixed leg)

DF_i: Risk-free discount factor

SP_i: Survival Probability, is defined as 1 – Probability of Default

A: Coupon accrual period

Also, it is common that accrued and unpaid coupons become payable by the protection buyer upon an event of default, so that element must also be factored into the fixed leg calculation. The average accrual amount is approximated as the coupon rate over half of the regular coupon period, as in:

$$PV\ of\ Accrued\ Cash\ Flows\ upon\ Default = Spread \times \sum_{i=1}^{n} DF_i \times (SP_{i-1} - SP_i) \times \frac{A_i}{2}$$

[6] Survival Probabilities are defined as 1 – P, with P being the default probability, reported by credit rating companies such as Moody's.

If combine the two equations we retrieve the present value of the fixed leg of the CDS.

$$PV\ of\ Fixed\ Leg = \left[Spread \times \sum_{i=1}^{n} DF_i \times SP_i \times A_i \right] + \left[Spread \times \sum_{i=1}^{n} DF_i \times (SP_{i-1} - SP_i) \times \frac{A_i}{2} \right]$$

The value of the floating leg, on the other hand, is equal to the present value of the contingent payment, net of the recovery rate, weighted by the conditional survival probabilities.

$$PV\ of\ Floating\ Leg = (1 - R) \times \sum_{i=1}^{n} DF_i \times (SP_{i-1} - SP_i)$$

Finally, the CDS value is given by:

CDS Value = PV [Fixed Leg] – PV [Floating Leg]

CDS prices and bond spreads (i.e. the difference between the yield of a defaultable bond and a risk-free rate) are typical measures of counterparty risk. A large body of literature tries to deal with the modeling of credit default swaps spreads and identify their main determinants. This literature can be separated in two main categories (a) structural models and (b) reduced form models.

The first category of models tries to search the links between credit risk with the entity's specific characteristics. This approach was firstly documented by Merton (1974) who supported that credit risk is simply a function of the difference between the market value of assets and the value of the debt. As a result credit risk can essentially be modelled as a function of leverage and volatility.

CDS spreads can be determined not only by idiosyncratic (reference entity specific) factors of the underlying reference entity, but also by other market factors related to liquidity, uncertainty and risk aversion.

Both of these approaches have been extensively used to explain the dynamics of CDS prices and bond spreads in comparison with other variables as liquidity risk and risk premia etc. More extensively Chen et al. (2007) and Longstaff et al. (2005) found evidence that credit spreads include risk and liquidity premia components, in addition to compensation for credit risk.

Moreover, the empirical application of structural models has usually failed to prove strong correlations between reference entity specific characteristics and the credit spreads, Amato and Remolona 2003. As a result it seems that the effect of fundamental variables in order to find the explanation of credit risk is small.

6. Regression Methodology

In this thesis, we use monthly CDS spreads from Bloomberg database, The sample period is January 2008 to January 2014. The series are for 5-year CDS denominated in US dollar for the PIIGS economies (the acronym stands for Portugal, Ireland, Italy, Greece and Spain), because of the huge increase of the CDS spread during the credit crisis. We focus on the 5-year horizon as this is the common horizon for the government bond and has better liquidity. As it is mentioned in Fontana and Scheicher (2010) the approach that is used has the disadvantage that the CDS on Germany has to be omitted from the analysis. Furthermore, the benchmark role of Bunds may lead to the existence of a significant 'convenience yield'.

The sovereign CDS spreads rose dramatically from October 2008 to early 2009 with the more recent market developments in sovereign markets since November 2009. Before the crisis occurred, CDS for the five countries were converged and their

trading range was only a few digit basis points, In addition the volatility was low and also the trading volume in the CDS market.

We examine the changes in main fundamental variables, as well as changes in risk appetite with regard to sovereign risk may be among the underlying drivers of the variation of CDS spreads, Gapen et al, (2005) extended the Merton's structural modelling approach for estimating sovereign credit risk and valuation, In their research they also find that key drivers of the risk of sovereign default are the volatility of sovereign assets and a country's leverage. We start with a set of explanatory variables which comprises proxies for credit risk and for the movement of the risk-free rate. Furthermore, we include some factors, which previous research has found to be significant determinants of credit spreads (see e,g, Collin-Dufresne et al,, 2001, and Raunig and Scheicher, 2009 and Fontana and Scheicher, 2010).

GDP Growth

GDP values were collected through Eurostat and express conditions on a quarterly basis, Tang and Yan (2009) find GDP growth rate to be inversely related to the level of CDS spreads. Since our intention is to run the models on a monthly basis, we interpolated the change in GDP within each quarter to receive the monthly change in basis points. The time series of GDP growth rate contained a linear trend which we extracted by detrending the series.

Inflation and Unemployment

Eurostat reports inflation in two different ways, consumer price indices (CPIs) or the harmonized indices of consumer prices (HICP). The consumer price index is defined as a measure of the changes over time in the prices of consumer goods and services acquired, used or paid for by households.

Risk-free rate – 3m Euribor

According to the Merton (1974) model changes in the risk free rate in general are negatively related to credit spreads, A rising risk-free rate decreases the present value of the expected future cash flows, i,e, the price of the put option decreases.

Risk Aversion factor

CDS spreads may change due to changes in investors' risk aversion. The VIX index is used as a proxy,

Corporate CDS premium (iTraxx) for 5-year CDS

As a proxy for the corporate credit risk the iTraxx Main Investment Grade index is included in the model, The premium on this CDS index should also contain a proxy for investors' overall appetite for credit risk,

Country's public debt (Debt) to GDP ratio

In structural models of sovereign credit risk (Gapen et al,, 2005 and Fontana and Scheicher, 2010) it is used the country's total outstanding bonds relative to its GDP, This choice is restricted via the data availability as the amount of bonds outstanding is available in Bloomberg on a monthly frequency, Other indicators are available in higher-frequencies, It is expected that higher debt increases changes in CDS spreads,

Variable	Effect
GDP Growth	**(-)**
Country's public debt (Debt) to GDP ratio	**(+)**
Inflation	**(-)**
Unemployment	**(+)**
Risk-free rate – EONIA	**(-)**
Risk Aversion (VIX index)	**(+)**
Corporate CDS premium (iTraxx) for 5-year CDS	**(+)**
Euro/UDS Exchange rate	**(-)**

The analysis is based on a multiple regression model:

$$CDSspread_{it} = a_0 + b_1 \Delta GDP_{it} + b_2 \Delta Debt_{it} + b_3 \Delta Inflation_{it} + b_4 \Delta Unempl_{it} + b_5 \Delta EONIA_{it} + b_6 \Delta VIX_t + b_7 \Delta iTraxx_t + b_8 \Delta Curr_{it} + \varepsilon_{it}$$

where it Spread is the *CDSspread* in basis points charged annum at time t for country i, ΔGDP_{it} is the basis point change in GDP at time t for country i (GDP-growth rate), $\Delta Debt_{it}$ is the basis point change in country i's outstanding debt at time t, $\Delta Inflation_{it}$ is the basis point change in country i's inflation at time t, $\Delta Unempl_{it}$ is the basis point change in unemployment rates at time t for country i, $\Delta EONIA_{it}$ is the Euribor rate, ΔVIX_{it} is VIX index and $\Delta iTraxx_{it}$ is the iTraxx index, $\Delta Curr_{it}$ is the Euro-USD exchange rate.

We estimate the multiple regression and present the results and analysis of the regression, The following table contains the regression output fof PIIGS countries for the whole period, In the regression, autocorrelation and heteroskedasticity were found among the residuals. The Newey-West's or White's heteroskedasticity consistent covariances were used in order to retrieve robust standard errors to adjust for incorrect inference.

Table 1 – Regression results

	Portugal	Ireland	Italy	Greece	Spain
α	0.041044	0.016378	0.043486	0.026694	0.031516
GDP Growth	-0,099800	**-0,4143***	-0,0086	-1,0561	-0,284
Debt / GDP ratio	**0.557551***	0.019013	0.092351	**0.008295***	**0.486865***
Inflation	-0.103202	**-3.302004*****	-0.600342	-1.279470	-0.384006
Unemployment	0,071570	**0,08924***	0,02864	**0,12553*****	**0,09693*****
EONIA	-5,026740	-0.002858	-0.022463	**-0.104957***	-6,99718
VIX index	**0,28433*****	**0,18792****	**0,24251*****	**0,03576****	**0, 186051****
iTraxx	1,526205	**1,645678*****	**4,509718*****	1,158778	**3.389345*****
Euro/UDS	-0.346512	-0.390644	**-0.747916***	**-1.580363****	-0.286905
R^2	0,2438	**0,4874**	**0,5594**	**0,4150**	0,4135

** Significance level 5 percent*
*** Significance level 1 percent*
**** Significance level 0,1 percent*

The model seems to have low explaining ability for Portugal, for all other countries R^2 is higher than 40%. The change in GDP growth rate is inversely related to the CDS spread and is statistically significant only for Ireland, In addition, the outstanding debt seems to be related only in Greece and Spain, Inflation is negative and statistically significant to the CDS spread for Ireland only, Unemployment rate also is important for Greece and Spain, given the sharp increase the recent years and for Ireland, Euribor as a benchmark risk free rate seems to have no significance at all,

On the contrary, the VIX a very important variable for all countries examined and iTraxx was only for Italy, Spain and Ireland.

Conclusions

The crisis has led to a wide-ranging discussion on CDS. There is a large number of studies that deal with CDS spread. A main conclusion is that robust and significant evidence on the questions that have arise concern the CDS spreads are the questions is not yet available.

The main finding is that CDS spreads seems to be based in common factors, although they differ from country to country.

The output for the regression seems to have explanatory power and more significant conclusions can be drawn. The time period used in the sample contains both a period of stability and a period of high volatility. It seems that the macroeconomic variables have inconsistency in terms of significance in spite of some specific cases, like unemployment in Greece and Spain and inflation in Ireland. Finally, VIX is a really valid indicator in all cases, thus as a variable should be examined by investors in order to make their investment decisions and build hedging strategies.

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