IMPACT OF CDS ON THE US BOND MARKET

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Abstract

The need to study the impact of credit default swaps on bond markets was borne from a desire to add to the debate which has been raging recently with regards to the role played by credit default swaps in the recent global financial and economic crisis. There have been widespread claims that CDS and the bond market are related and impact on each other.

This paper analyses CDS and bond spread for a sample of US firms and finds support for those claims. I evaluate the impact that CDS and some firm specific variables have on bond spreads.

Employing time series and panel models, I find that for 21 corporate and financial US firms, CDS and bond spreads are co integrated and CDS has a strong positive effect on bonds. The impact differs across both the corporate and financial issuers. I also find a small positive impact of earnings on spreads for a sample of 20 out of the 21 US firms.

There is also strong evidence that during the second part of the global financial crisis, the firms experienced a large shock. This evidence was not present in the initial stage of the crisis.

Acknowledgement.

To God and my parents for their constant support.

Contents

1 Introduction

Credit default swaps has been in the limelight in the last few years for all sorts of reasons. The market size for credit default swap has more than doubled each year from a total notional amount of $600 billion in 2007 to $62.2 trillion at the end of 2009. For credit default swaps, notional amount refers to the par amount of credit protection bought or sold, equivalent to debt or bond amounts, and is used to derive the premium payment calculations for each payment period, and the recovery amounts in the event of a default.

Initially hailed as an innovative form of insurance against collateralized debt obligations (CDOs) and bonds, the recent global economic crisis has seen the product being blamed for the extent of the crisis. There is relatively extensive research on the links between credit default swap spreads and stock prices. This research project however, is looking at the relationship between credit default swaps and the bond markets. The aim is to contribute to the debate as to how these products have affected corporate bonds of US high investment grade firms.

Consequently, in this chapter, the background and rationale for the study is discussed next, followed by the structure of the dissertation.

1.1 Background and Rationale

The credit markets have undergone considerable changes since the recent global economic and financial crisis of mid 2007. The causes leading into the financial crisis of 2007-2009 was notable for its systemic linkages, and the number of institutions and instruments involved Ire so numerous as to be all-encompassing. Because derivatives Ire at the centre of some of the major episodes of the financial crisis, including the near-collapse and eventual bailout of AIG, no discussion of the crisis is complete without an analysis of the role derivatives played in the turmoil.

Before the crisis, the credit markets enjoyed relatively low variation in risk and narrow credit spreads. Since the crisis in 2008, the reverse has been true and the reasons are attributable to essentially many factors. In particular, CDS notional amount had dropped by 38% by the end of 2008. At the end of June 2009, the U.S. corporate bond market had an outstanding notional of $6.8 trillion representing only a fraction of all debt securities outstanding across global corporate and government markets

Significantly, two out of many other factors which led to increased credit spreads, seem to have played roles in the current situation. The first of these factors is increased default risk, i.e. the risk of companies failing to honour their debt obligations, which occurs in an environment where companies encounter low profitability or even losses as a result of an economic downturn. The second factor has to do with a lack of liquidity in markets which naturally leads to investors requiring larger than normal compensation in the form of return rates.

The interesting aspect of studying CDS is that it insures against losses stemming from a credit event. Looking at countries, the contract protects against the default of the issuing sovereign. The premium (spread) which the protection buyer (e.g. a bank) pays to the protection seller (e.g. an insurance company) is determined by market forces and depends on the expected default risk of the respective country. CDS spreads are an indicator of the market's current perception of sovereign risk. CDS spreads also however depends on the global financial environment, in particular on US interest rates and global risk appetite.

In the US, the CDS market has grown rapidly. Governments and their agencies in trying to manage the economy are therefore faced with the challenge of identifying which of the many factors are indeed contributing to wider credit spreads and increased volatility. To do this, governments normally gauge corporate bond spreads, i.e. the difference between the yield of a corporate bond for a given credit rating and the yield of a risk free asset, e.g. sovereign bonds of US or Germany (Abid & Naijar, 2005). The difference is effectively the risk premium paid by corporate bond issuers to investors as compensation for taking on the risk, instead of investing on less risky assets.

Recently, credit derivatives have provided a means of monitoring default risk. These markets gained prominence around the mid 1990s and have grown exponentially since. It was during this time that a global financial crisis, although not at the scale of the recent global economic and financial crisis, necessitated changes in the financial markets that led to improved practices and greater transparency in the bond markets. However, the recent crisis, suggests that more needs to be done.

The most popular of these changes is the credit default swap (CDS). Siu, Erlwein and Mamon (2008, p.19) define how CDS works:

'A CDS is a financial contract involving two parties, namely, the protection buyer and the protection seller. The protection buyer pays the protection seller periodic premiums until the maturity of the contract or occurrence of a credit event, such as the default of a reference asset or entity. The protection seller pays the loss incurred by the protection buyer due to the credit event. In other words, the protection buyers secures some form of protection (similar to an insurance contract) against the impact of a credit event involving the underlying reference asset or entity, such as a corporate bond or a loan, from the protection seller. When a credit event occurs, the protection buyer also needs to pay a final accrual fee to the protection seller. In return for all the paid premiums and accrual fee, the protection seller pays the protection buyer an amount equal to the CDS notional amount face value minus the recovery value at the time when the reference entity defaults'

Default or credit risk has attracted considerable interest from various stakeholder groups like regulators, academics, and risk management professionals. This interest grew prior to the recent global crisis with financial institutions seriously incorporating risk management as a means of achieving and sustaining competitive advantage.

Basel II has also presented the opportunities for banks to determine their capital requirements based on internal risk management models, provided these banks have demonstrated effective risk management prior.

The purpose of this research is to assess the impact of CDS on the bonds market, using 21 companies in the US as case studies from January 2005 to August 2010 (see appendix A). Specifically, it aims to determine whether CDS has a positive or negative relationship with bonds and the extent of that relationship, i.e. whether it is a strong or Iak relationship. Furthermore, it seeks to determine if the relationship is the same or otherwise during an economic crisis.

The impact of CDS on the bond markets in general has been the subject of much research. For example, some research focus on the extent of the relationship between CDS spreads, bond spreads, stock prices and credit ratings (Abid & Naijar, 2005). In the main, the majority of these studies focus on corporate bond spreads, with a few focusing on sovereign bond spreads.

Other studies focus on 'the local (macroeconomic) and global factors affecting the spreads. Specifically, this group tries to explain the sovereign CDS and bond spreads with more frequent data such as daily equity indices, daily volatility measures, exchange rates, and interest rates (Aktug, Vasconcelles & Brae, 2008, p.3).

Another set of research focuses on CDS pricing. For example, Niskanen (2009) looks at the pricing dynamics between CDS spreads and bond spreads by examining the pricing of default risk in both markets.

This research supports prior studies (like Longstaff et al, 2005; Hull et al, 2004; Norden and Weber, 2004) which found significant relationships between corporate bond spreads and credit risks. This research uses CDS to represent credit/default risk. Furthermore, it supports other studies which have studied the factors which determined bond prices (like Cossin & Hricko, 2002; Hull et al 2004; Shim and Zhu 2010) which include CDS prices. As far as the Researcher is aware, previous related studies have focused on commenting on whether CDS caused the recent global financial and economic crisis. However, further contribution of this study, which is a slight variation to existing studies relating to the crisis, is that it looks to determine whether the relationship between CDS and corporate bonds in AIG varied before and after the crisis.

The findings and conclusions from this study would be useful to any stakeholder who is interested in learning a bit more than the basics of CDS and how they impact on credit markets. For example, it may help to influence the decision making process of a potential investor. Policymakers are also interested in the impact of CDS market and corporate bond markets. My findings may be useful for market participants who rely on price data from different markets for trading, monitoring, or hedging against credit risk (see, e.g., Berndt et al. 2005, Norden and Weber 2005).

Even though quite a number of studies have focused on the US market, their findings did not focus on the sample criteria used in this study. One reason is that I focus on companies in the US with no less than 'A' rating on the S&P rating. Further description of the sample will be in the methods chapter of this research.

I expect the CDS market and the bond market to be cointegrated. The reasons are because prior research proved that the CDS market leads the corporate bond market (see Longstaff et al. 2003). Second, the liquidity in the CDS market is much higher than that of the corporate bond market.

The primary CDS-related issue during the crisis was that too much risk was concentrated in a firm in a market with minimal transparency, insufficiently collateralized positions at a time thus, liquidity simultaneously disappeared. One of the causes of this is the excessive reliance on leverage to enhance return. On that note, I will also look at firm leverage in my analysis of bonds and CDS.

I are able to substantiate existing empirical evidence by means of a data set covering specifically, high rated firms, different data frequencies (monthly, weekly, and daily) over a different time series from that done by previous studies as Ill as across strictly US firms. In particular, different data frequencies and the sample composition allow us to investigate the relationship between the two markets.

Analyzing time-series data from 21 individual firms over the period 2005-2010, I find that both CDS and bond spread move together for 21 U.S firms. I find on average that a strong positive evidence that CDS affects the bonds of the reference entities used in this study. Noticeably, this result is contrary to some similar studies based on US data that find a negative impact.

I also find that the impact of the CDS varies across corporate and financial institutions. Corporate institutions impact on bonds spread tends to have a negative effect compared to financial institutions based on the sample.

From my final analysis, I find that CDS trading is different during the crisis period. The global financial crisis that was examined in the sample period offered a case study for

the analysis of CDS and bond behaviour during distress. My analysis showed that the initial period of the crisis did not have a statistically significant impact on bonds but the second phase of the crisis had a strong positive and statistically significant impact on the bond spread. This suggests that CDS may have been good or bad for the crisis.

A single entity; AIG was taken from the sample and analysed based on the objective of this study since I also know that differences can occur on a case by case analysis.

1.2 Structure

In the next chapter, a review of existing literature relating to credit default swaps and bond markets is carried out. The review will include a brief introduction to CDS, followed by the two main credit models used to value CDS. The review will also cover the relationship between CDS and bond markets before discussing the main risks that affect CDS and bond spreads.

Chapter 3 describes the method employed to achieve the research objectives. This chapter will begin with a formal presentation of the research aim and objectives, as Ill as relevant hypotheses formulated to achieve the research objectives. The research design and processes followed will be included in this chapter, together with the rationale where relevant.

Chapter 4 assesses the relationship between CDS and the corporate bond market in the US, using 21 companies in the US. To assess this relationship regression analysis will be performed to determine the extent of the relationship between the two variables as Ill as the impact another variable, firm leverage, has on bond markets in comparison with CDS. The rationale for doing the latter analysis is to put the relationship between CDS and bond prices into greater context. The results from the regression for the 21 firms will also be discussed here.

Chapter 5 carries out a similar assessment between the CDS market and the corporate bond market for the US. Similarly, the analysis will be in the form of a case study and will focus on the American International Group. The emphasis is slightly different from the other reference entities used in this study. In this chapter, the idea is to assess whether the relationship between the CDS market and the corporate bond market is stronger or weaker in an economic crisis period, compared to a period of relative economic health on the benchmark companies and a single entity.

Chapter 6 is the Conclusion chapter which brings the research together and will describe the extent to which the aim, objectives and relevant hypotheses have been achieved.

1.3 Summary

The recent global economic and financial crisis has impacted financial markets in a way not seen for decades. The issues of default and liquidity risks have been topical as they both seemed to have played a role in the global recession. The role credit default swaps (CDS) have played in financial and credit markets are also the subject of intense debate.

Critics believe they were responsible for the problems and should either be banned or at the very least regulated like never before.

This project seeks to understand the relationship between the bond markets and credit default swap and the extent of that relationship at a micro level.

2 Literature Review

2.1 Introduction

Shim and Zhu 2010 in a theoretical analysis, suggests that CDS trading can loIr the cost and improve the liquidity in the bond market by completing the credit market and revealing new information about firms, and therefore creates both costs and benefit to the bond market.

There have been several empirical researches that have tried to investigate the various ways through which the CDS market affects the bond of stock market.

In this chapter, a review of literature relating to credit default swaps and the bond markets in particular are looked at. Even though credit default swaps is a relatively new research area, there has been quality research with regards to areas like their pricing dynamics with corporate and sovereign bonds, as Ill as their relationship. This chapter will help to set the scene for further work in subsequent chapters. It starts by giving a brief introduction of CDS before describing the two main models developed for CDS. Literature on the relationship between CDS and bond markets then follow before writings on the key types of risks are reviewed.

This study also examines the time and market variation of the impact of CDS trading, particularly for the firms included from the UK and the US CDS indices. One would expect that such impact will be different at different stages of the credit cycle. The relative magnitude of benefits and cost associated with CDS trading or inclusion in CDS indices tends to exhibit distinctive features during the crisis period when compared with the times when the economy was stable. The data covers the global financial crisis that started in mid-2007. This offers a holistic look into the connection between the CDS and bond markets at various phases of the credit cycle.

2.2 Introduction: Credit Derivatives and Credit Default Swaps

Since CDS gained prominence in the mid-1990s, the market has grown considerably. 'As of the end of 2007, the total notional amount of credit default swaps was estimated at $62.2 trillion, although recent efforts to eliminate offsetting trades have reduced the outstanding notional to $38.6 trillion (ISDA, 2008)' (Schwartz, 2007, p. 168, citing ISDA). Credit default swaps (CDS) are widely regarded as one of, if not the most popular credit derivatives. 'The trading volumes of CDSs are so high that they often exceed the trading volumes of the corresponding reference entities, namely, the underlying corporate bonds or loans' (Siu, Erlwein & Mamon, 2008, p.20).

CDS unifies as much as it divides. Supporters of CDS point to its penchant for effectively spreading risk and contribution to market liquidity which empowers market participants to proactively manage their portfolios. Some critics are so concerned by CDS that they believe 'a spike in interest rates could trigger a derivatives tsunami that would bring all of the major banks to their knees and cause a blow-up in world credit markets' (Schwartz, 2007, p. 168).

CDS are traded over-the-counter (OTC) which makes regulation difficult. 'Since CDS are traded entirely over-the-counter, one could argue that the true regulators are market participants themselves. Banded together as members of the International swaps and Derivatives Association (ISDA), derivatives markets participants have created system of documenting and amending trade relationships that is both flexible and robust' (Schwartz, 2007, p.170). ISDA comprises predominantly of banks.

2.3 Credit Risk Models

During this period of CDS growth, different valuation models have been developed for credit default swaps. These models fall under two categories, i.e. structural model and reduced form model. The first of the structural models was developed by Merton (1974) whereby 'debt and equity are priced by specifying a firm value process and invoking the contingent claims approach of Black and Scholes (1973) to solve for the value of the equity (which can be seen as a call option on the value of the underlying firm) and the value of the debt' (Schwartz, 2007, p. 167).

Under Merton's structural model, the risk premium is a function of 'the debt-to-value (or leverage) ratio and the volatility of the firm' (Schwartz, 2007, p. 168, citing Merton 1974). Subsequent work has resulted in Merton's work being developed further (Leland and Toft, 1996 and Leland, 1994, for example). These works have shown that default happens when an entities value process exceeds a determined threshold. The structural model has come under fire, however, for being impractical. There have been reservations about its accuracy and the difficulty to observe inputs. Consequently, the reduced form model was developed by economists like Hull & White (2000). Under this model, default is an externally determined random process relying on 'interest rate and bond market data to model a hazard rate, or conditionality probability of default. In these models the market value of a firm is assumed to be governed by a diffusion process, and the occurrence of a default is triggered by the event that the market value of the firm drops below a certain threshold level, called the default barrier' (Siu, Erlwein & Mamon, 2008, p.20).

For the reduced form models, economists like Artzner and Delbaen (1995), Lando (1998) and Duffe and Singleton (1999) model default occurrences exogenously (Siu, ErlIin & Mamon, 2008). 'In particular, the occurrence of a default is modelled by a random point process, and the time of default is described by a stopping time, which is unpredictable with respect to the information generated by the market value of a firm' (Siu, Erlwein & Mamon, 2008, p.19).

2.4 Relationship between CDS and Bond Markets

In terms of the relationship between CDS and bond markets, Zhu (2006) used co-integration test for 24 reference entities and found a stable long-run equilibrium. In this state there is little or no arbitrage opportunities, which means that CDS and bond spreads 'converge to each other, thus the basis converges to zero' (Aktug, Vasconcella & Bae, 2008, p.4). Zhu (2006) finds that in the short run however, variations are likely because CDS are highly sensitive to changes in the credit environment and also finds

that CDS leads the bond markets in terms of price discovery. Blanco, Brennan & Marsh (2005), in an identical study of 33 investment grade companies spanning 2nd January 2001 to 20th June 2002, find that variations are caused in the short run by CDS spreads leading price discovery. In the long run, the deviation is attributable to 'the imperfections in the contract specifications and measurement errors causing markets to drift away from the equilibrium' (Aktug, Vasconcella & Bae, 2008, p.4) as Ill as compensation paid in the form of liquidity premium.

Norden & Weber (2004) support the findings above in terms of CDS leading bonds in terms of price discovery. However, according to them, this only happens for the US firms, whereas the reverse is true in Europe. This insinuates that US markets are more efficient, when compared to their European counterparts. Blanco, Brennan & Marsh (2005) and Zhu (2006) also come to the same conclusion. Norden and Weber (2004) went further in an analysis of 58 entities spread across Europe, the US and Asia, finding that stock prices changes lead CDS, which in turns lead bonds. In their study, co-integration does not hold in all the entities, although it does in the majority of these entities.

Indeed, Hull, Predescu & White (2004) find that CDS increases steeply for a big sample of corporate bonds. Aktug, Vasconcella & Bae (2008) contributes to a previous study by Chan-Lau & Kim (2004) which carried out co-integration and causality tests and price discovery investigation for the CDS, stock and bond markets. The study failed to find equilibrium relationships in some countries while finding in some others and finding that in some countries, the CDS market leads price discovery whereas in others price discovery is led by either the bond or CDS markets. Aktug, Vasconcella & Bae (2008) studied 'nine emerging markets and daily spreads from 2001 to 2005. However, the price discovery tests are only performed for seven countries and 58% of the time CDS spreads are found to lead bond spreads, which is in contrast with the IMF study by Chan-Law and Kim'.

In terms of empirical work, Houweling and Vorst (2005) analyze pricing performance using the reduced form model based on CDS and corporate bond quotes. Hull, Predescu and White (2004) focus on how rating announcements affect CDS. Ericsson et al (2004, pp. 3-4) focus on credit risk. They describe how they carry out their study: 'although my focus is also on credit risk, an important distinction is that I study very different data – default swap premia rather than corporate bond yield spreads. Using default swaps rather than bonds has at least two important advantages. First, default swap premia, while economically comparable to bond yield spreads, do not require the specification of a benchmark risk free yield curve – they are already spreads. Thus I avoid any added noise arising from a mis-specified model of the risk free yield curve'.

Also Blanco et.al (2005) test the equivalence of CDS and bond spreads via cointegration technique. They show that, before the crisis, the derivatives (CDS) and the cash (bond) markets, price credit risk equally on average, concluding that the market for credit risk is efficient. I document similar results from my cointegration analysis of the spreads for the 21 reference entities used in this study.

2.5 Default and Liquidity Risks in CDS and Corporate Bond Spreads

One way to understand corporate bond spreads is to look at credit default risks. Investigators have tried to understand what proportion of corporate bond spread is as a result of default risk, and what proportion is as a result of liquidity risk. The rationale being corporate bond spreads are way too high to be attributable to default risk alone (Garcia & Yang, 2009). Furthermore, (Elton et al, 2001) argue that corporate spreads do not reflect historical default rates and recoveries. Huang and Huang (2003) also dispute that consistencies exist between corporate spreads and Merton (1974) structural models. (Garcia & Yang, 2009, p.3. citing Collin-Dufresne, Goldstein, and Martin 2001) argue that 'changes in spreads on corporate bonds are not Ill explained by changes in the factors affecting default risk and the unexplained portion appears to have a common factor.

Ueno, Baba & Sakurai (2006), stress that due to the non-necessity of principals for CDS, the CDS market enjoys greater liquidity than the bond markets, even for bonds issued by the same reference entities.

'The trading activities in the credit markets nowadays are comparable to those in the traditional markets: bond, equity, and foreign exchange' (Siu, Erlwein & Mamon, 2008, p.20). The importance of credit risks or default risks continues to play a major role in impacting upon the markets (Lie 2005). Banks are the most important investors in credit default swaps as sellers, followed by insurance companies.

CDS serves the same economic purpose as insurance and is an important hedging mechanism. Bond investors seeking protection for the debts that are owed buy CDS to ensure that these debts are indeed repaid. Critics of CDS do not have a problem with this desire. The problem was to do with speculators entering into the market. As Money Morning's Gilani (2008) puts it: 'If you think XYZ Corp. is in trouble, and won't be able to pay back its bondholders, you can speculate by buying, and paying premiums for, credit default swaps on their bonds, which will pay you the full face amount of the bonds if they do actually default. If, on the other hand, you think that XYZ Corp. is doing just fine, and its bonds are as good as gold, you can offer insurance to a fellow speculator, who holds the opinion opposite yours. That means you'd essentially be speculating that the bonds would not default. You're hoping that you'll collect, and keep, all the premiums, and never have to pay off on the insurance. It's pure speculation'.

That common factor could be liquidity risk, 'since corporate bond markets are much less liquid than government bond markets' (Garcia & Yang, 2009, p.3). Researchers have employed various methods to measure liquidity and default risk. These will be looked at in turn.

In terms of the relationship between corporate bond spreads and liquidity, researchers have generally found a positive relationship between the illiquidity of corporate bonds and their yield spreads (Garcia & Yang, 2009). These researchers include Chen, Lesmond and Ii (2007**)** who measured corporate bond liquidity using implicit bid-ask spreads and the frequency of zero returns**.** Research carried out by De Jong and Driessen, 2006**;** Downing, Underwood and Xing, 2007; on how liquidity is factored into corporate bond returns revealed that speculative grade bonds paid greater liquidity risk premiums

attached, in comparison to investment grade bonds. 'Most of these papers estimate models focusing on one aspect of illiquidity, such as transactions costs, inventory risk, asymmetric information, or search costs' (Garcia & Yang, 2009, p.4). Additionally, 'most papers relate their illiquidity measures to corporate spreads in regressions, and are therefore not suitable to decompose corporate bonds into liquidity and default components (Garcia & Yang, 2009, p.4).

(Garcia & Yang, 2009) finds that research into default risk reveals that default risk of corporate spreads are calculated either by using historical default rates and recoveries on the one hand, or by comparison with traded financial instruments like equity and credit derivatives.
In the former method, default risk premium is not taken into account. In other words, 'no consideration is given to the extra premium that investors require to invest in risky securities whose returns are correlated with systematic factors. In the second method, 'according to Merton (1974), equity can be treated as a call option on firm values. Corporate bonds can be treated as a portfolio holding an equivalent risk-free government bond and shorting a put option. Equity prices can be used to extract information about the firm's valuation process, which can then be used to price corporate bonds, (Garcia & Yang, 2009, p.5).

Huang & Huang (2003) have shown that structural models are prone to misspecification which calls into questions the validity of using these models to decompose corporate spreads into their default risk and liquidity components.

The use of CDS to obtain the default component is gaining popularity as it has been used by various researchers (Huang & Huang, 2003; Longstaff, Mithal and Neis, 2005). The main reason for this is because they are difficult to be affected by liquidity risk, therefore they serve as a strong measure of credit risk. While CDS are admittedly very strong candidate for the measurement of default risk, and though it is hard for them to be affected by liquidity, they are not insusceptible to liquidity risks.

'Early studies of credit derivative markets Ire closely associated with the bond markets. They focused on pricing credit derivative instruments and on determinants of yield spreads of corporate bonds' (Niskanen, 2009, p.2).

'The development of CDS pricing models has attracted more studies to focus on determining the components of corporate spreads as Ill as on predicting credit rating announcements by observing changes in CDS spreads' (Niskanen, 2009, p.2).

Indeed, Longstaff et al (2005), Buhler and Trapp (2006) among the pioneers of investigating the significance of default risk component in bond spreads using CDS discovered that a significant portion of corporate spreads is attributable to default risk.

Prior to Longstaff et al, other studies didn't find significant relationship between corporate bond spreads and credit risks (Elton 2001). 'In parallel with these studies Hull et al. (2004), Norden and Weber (2004) and Cesare (2006) studied how CDS prices and basis between CDS and credit spreads behave before credit rating announcements. In particular negative rating announcements Ire found to be anticipated in the CDS prices

several days before the announcements (Niskanen, 2009, p.3). This research study aims to lend support to the findings of studies undertaken by the likes of Longstaff et al; and Hull et al, indicating a significant relationship between corporate bonds and CDS.

Norden and Weber (2009) in an empirical analysis of bonds, stocks and CDS, find that the CDS market of the US contributes more to price discovery than the bond market. This supported Longstaff et al. (2003) that used weekly lead-lag relationships between changes in CDS spreads and stock returns of US firms. They find that the credit derivatives market led the corporate bond market. Alexander et al. (2000) investigate the relationship between daily stock and high yield corporate bonds returns at the individual firm level during the period 1994-1997. They find that an opposite movement of the bond and stock returns around those events that indicates there is an agency conflicts between bondholders and stockholders.

CDS spread and bond spread changes vary between highly rated firms and firms with poor rating. The high rated firms will exhibit less sensitivity than those with very low rating. (see Avramov et al. 2004, Blume et al. 1991, and Collin-Dufresne et al. 2001).

Longstaff et. al. (2005) studied the default and non-default component of credit spreads using CDS information and find that both specific to the bond liquidity and overall market liquidity have an impact on the non-default component.

In this paper, I contribute to the literature on credit risk pricing. I will make use of regressions to examine the relationship and the impact between credit default swap and bond spreads for given reference entities.
First, I contribute to the literature on the empirical relationship between CDS and bond spreads. This study is in line with previous studies on the dynamic relation between CDS and bond spreads, such as Blanco et. al (2005) and Norden et. al (2004). Compared to these, I look at a different time period, which goes from 2/9/2005 to 3/9/2009. I are mostly interested in understanding the impact of the 2007 financial crisis.
Other studies have looked at the factors that impact on CDS spreads, while others have looked at the pricing dynamics between CDS and corporate bond markets. For the former, Cossin & Hricko (2002) affirm that the factors that influence CDS spreads include maturity, credit ratings and volatility in line with theory. Hull et al (2004) found a strong relationship between CDS and corporate spreads. This study will look at the extent of the relationship between CDS and corporate spreads to support the pricing dynamics findings of the likes of Hull et al.

Other studies such as Zhu (2004) and Norden et.al (2004) reach similar conclusions when examining the relationship between CDS and bond spreads, Blanco et al (2005) detect cointegration for 27 out of the 33 firms in a sample of US firms; Zhu (2004) detects cointegration for 15 of the 24 firms; and Norden et al (2004) detect cointegration for 36 out of 58 firms. In general, for the US market there is cointegration in many cases.

I contribute to the empirical literature on arbitrage, cointegration and market efficiency. If two series are cointegrated [Engle and Granger (1987)] they share the same stochastic trend and are expected to drift not so far apart. There will be recovery of deviations from their long run relationship. Cointegration is used in this study to check

the long run relationship between the spreads for the reference entities used in this study

2.6 Summary

Since its inception in the nineties, the credit default swap has been the subject of keen interest. Companies envisaged that they were extremely good profit maximization tools, and therefore there was a lot of takers. The literature generally suggests a link between corporate bond markets and CDS especially in the long run with little or no arbitrage opportunities.

3 Methodology

3.1 Introduction

This chapter explains the methodology used to achieve the research objectives. As aforementioned, the aim of the project is to assess the impact of credit default swaps (CDS) at a micro level. Through the use of daily data, the analysis was based on a study of twenty one large companies. This chapter outlines the research aim, objectives and hypotheses in detail and also shows the method of analysis used to achieve the objectives.

The research aim and objectives is followed by a description of the research design employed. The third part of the Methodology chapter then details the research process before ending with the data source.

Although the results are based on a small sample of firms from the US, they are consistent with recent research on the impact of CDS on bond spreads.

3.2 Research Aims, Objectives

The aim of this research is to assess the impact of credit default swaps on bond spreads of twenty one US companies. Consequently, the following objectives must be achieved:

1. Establish the relationship between credit default swaps and bonds for twenty one companies in the US.

2. Investigate whether the relationship between credit default swaps and bond prices differed from the norm in the global financial crisis.

3.3 Research Design

Before the research was designed, the issue of paramount importance was to ensure the data obtained were credible and sufficient for meaningful analysis and conclusions. The Researcher considered several approaches before deciding on two which had strong claims to be ideal for this research project. The two approaches settled for were the time series and panel data analysis.

The time series aspect of the research relates to Objective 1, whereby secondary data is used to establish the relationship between credit default swaps and bonds for twenty one companies in the US with high credit rating, and then adopt a panel data analysis to examine the time varying effect of the CDS trading on the bond market during the crisis. Here I explain in detail the empirical methods that have been used to address these two questions. I follow an approach used by Shim and Zhu (2010).

In the time series aspect of this study, I study the long term relationship that exists between credit spreads and bonds through a cointegration test using the Dickey-Fuller test. This was done after I verified the unit- root and non-stationarity of the bond spread and CDS data.

This is important as it sets the scene for the achievement of the other objectives. By gaining insight into the main determinants of bond spreads as covered by the literature, this informs the types of independent variables that would be used in the quantitative

analysis of objective 2. The second objective, similar to the first objective will involve time series analysis.

The data covers 5 years, but offers most recent information.CDS data is provided by Markit and Thomson Reuters. This study will only look at CDS in relation to the bond market. I will analyze time series data from 21 individual firms over the period 2005-2010, I find that the CDS market clearly lead the bond market spread and vice versa.

The methods of data analysis to be used in this study is comparable to similar other studies like Norden and Weber 2005, Shim and Zhu 2010, Fung et al 2008. The final data set consist of 21 firms with observations from the years 2005-2010(see Appendix A).

The approach identifies a sample of firms that are listed on the S&P 500 that have similar characteristics. A large cross-section primary market data of bond issuances were looked at, with or without corresponding CDS trading written on the issuing firms.

The cross – sectional sample of bonds includes those issued by firms with corresponding contracts traded in the CDS market. Those issued by firms without corresponding CDS trading, have been removed from the sample. The model specifications, which are estimation with OLS, are:

$$BS_i = \beta_0 + \beta_1 CDSS_{1i} + \varepsilon_i \quad (1)$$

$$BS_i = \beta_0 + \beta_1 CDSS_{1i} + \beta_2 CRISIS1_{2i} + \beta_3 CRISIS2_{3i} + X_{4i} + Y_{5i} + D_{6i} + \varepsilon_i \quad (2)$$

$$BS_{it} = \beta_0 + \beta_1 CDSS_{it} + X_{it} + Y_{it} + \varepsilon_{it} \quad (3)$$

Where *BS* is the bond spread, defined as the difference between the yields of two bonds with different credit ratings. Most often, a corporate bond with a certain amount of risk is compared to a standard risk-free treasury bond. The bond spread will show the additional yield that could be earned from a bond which has a higher risk.

The explanatory variables are similar in the two equations. The choice of the independent variables follow previous studies such as Elton et al (2001), Chen et al(2007), Ashcraft and Santos (2009), Shim and Zhu 2010.

CDSS is a variable that shows the CDS contract traded in the derivatives market. If CDS trading moves together with the market by allowing for credit risk transfer, I expect the coefficient to be positive

X is a set of firm-specific variables that include firm size and firm leverage ratio. Larger firms are typically associated with easier access to the bond market at lower cost. By contrast, high-leverage firms are viewed as riskier hence its coefficient is expected to be positive.

Y is a set of the company's specific financial variables, which includes the firm's operating income stream, represented by the earnings before interest and tax, and the firm size. I expect the operating income to have a negative effect on the bond prices, because default risk tends to be lower during the high income period (high operating income). The effects of interest rates are likely to be uncertain.

To answer the second question, my sample period covers the global financial crisis, during which the bond market has been severely affected.

Hence I also introduce two dummy variables *CRISIS1* and *CRISIS2* that defines two phases of the crisis: one dummy variable defines the period in 2007 and September 2008, the initial period of the subprime crisis; the other dummy variable defines the period during the financial issues of AIG September 2008, when the global crisis intensified and spilled (see Huang et al (2010).

In the panel data analysis, I also run an analysis with a set of firm specific variables that define the entities used in this study. The panel data model will cover only 2008-2010.

In addition, the sample firms are categorized as financial and corporate firms. By using the corporate firms as the control variables the effect of bond spreads based on the type of firm is assessed using a 0,1 dummy variable. This is to determine which set of bond issuers' (i.e. whether corporate or financial) has more effect on the bond spread. I run a number of panel regressions to see if the borrowers differ in their effect on the bonds.

The rationale for using these measures is as follows:

1) Firm size. Larger firms do not face much constraint in credit risk transfer and therefore their introduction to the derivatives market may not make significant difference to them. If that is the case, the coefficient is expected to be negative.

2) Firm leverage. Firms with higher leverages are riskier. One may expect that riskier firms may benefit more from CDS trading by allowing for credit risk transfer. The coefficient here is expected to be a negative sign.

3) Corporate firms typically behave quite differently from financial firms. The dummy variable 'D' is for corporate firms. The coefficient here should be positive since CDS trading does not add much.

3.4 Data

The analysis of my sample bonds and CDS time series is conducted on a sample of 21 U.S. firms that are listed on Table 1 with indication of sector and credit type. Data run from September 2, 2005 through September 3, 2010. The period is further partitioned into two considering that troubles for financial markets started approximately in the month of July 2007.

Bond data. The first part of my data includes information on bonds issued by U.S firms. The time series of which is retrieved from Thomson Reuters. The issuers are both corporates and financial institutions, I exclude sovereign or government sponsored entities. The sample starts from the universe of bonds issued after 2004 by firms in the U.S. Even though there is data available before this period, I choose to begin from 2005 because I will be more confident of the accuracy of the data used in this study.

The challenge for this research was to get bonds which can be matched with CDSs for more reliable comparisons. In terms of bond data, corporate bonds issued by 21 different institutions (Appendix A) will be used. Twenty one firms were chosen because this represents a good population of large firms with high quality data. AIG on the other hand was specifically chosen as its woes are apparently directly linked to CDS.

The bonds are senior bonds and must be denominated in US dollars.

The issue for the sample size is that it was not possible to get all the bonds to match the CDS in terms of maturity. In previous studies to get round this problem, the researcher used a portfolio of bonds with maturity time of less than four and a half years and more than five and a half years (Ho et al, 2010) which led to the portfolio maturity maturing the CDS's after interpolating them. Due to insufficient data, this research adopted the approach followed by Niskanen (2009) and Ho et al (2010) whereby the red reference obligations Ire applied in this research. As Niskanen (2009, p.13) writes; 'as the time to maturity between CDSs and reference bonds differ, the use of reference entities may cause some inaccuracies, because the credit yield curve is time-wise monotonic. However, the credit curve is relatively flat after 5 years, which reduces the error and in addition the dynamics of the CDS and bond pricing should be only slightly affected by the difference in maturity'. For uniformity purpose the high credit rated bonds for Standard & Poor's bonds was used in the analysis. I restrict my sample to firms that have a high credit rating of no less than A on the Fitch rating of firms in the U.S. A particular reason why only high rated companies and bonds are used is to keep the structure relatively simple.

To avoid measurement errors, bonds are straight issues with a fixed coupon and are not callable, puttable nor convertible, must be denominated in the same currency (USD) as the CDS contract, must not be subordinated or collaterised.

Another type of bond data was required for the study, i.e. risk free bond yield. This data was required to calculate the corporate bond spread, which is the difference between the corporate bond's yield and the risk free bond's yield. For this research the bonds spread over swap rates Ire used.

All the data are daily values and they have sufficient amount of observations for the sample size to be deemed credible.

Table 1 summarizes the sample bonds. Almost 80% of the bonds are issued by corporate firms, with the rest issued by financial firms.

In terms of the maturity structure, all the bonds have a maturity greater than 5 years. The bonds have low prices and high liquidity. This is not surprising as they are all high-rated bonds.

Firm's balance sheet data. The second data source is the issuers' balance sheet information, which is from Infinancials. Data used here is from 2008-2010. I include firm specific variables in the analysis; firm size, operating income, and leverage, all denominated in USD. The firm size is the last market capitalization for each firm and the firm leverage is firm's financial leverage at book, short-term debt + long-term debt / total shareholders' equity.

For the market capitalization, I use the last balance sheet information; current stock price/ total shares outstanding. I include all the reference entities in this panel analysis except Wachovia Corp due to insufficient data on the company.

CDS data

The other part of the information of the companies is the CDS data. The time series is downloaded from Thomson Reuters. Thomson Reuters is one of the leading providers of the pricing information in the CDS market. They provide daily quotes of CDS spreads for a wide range of CDS contracts, across different dimensions including the, maturity, currency and restructuring clause.

For this study, I examine CDS contracts written on U.S companies since 2005. I restrict ourselves to the most popular types of CDS contracts, i.e. 5-year maturity, denominated in US dollar, written on senior bonds and without restrictions on restructuring clause (see Packer and Zhu (2005).

Figures 1 and 2 plots the monthly time series of the number of U.S firms included in the data. It is obvious that the CDS market in the US shrunk during the global financial crisis.

For each of the sample bonds used in this study, I match them to the CDS data, this follows Shim and Zhu (2010) but I do not create a dummy variable to check whether the CDS and the bonds issued by the companies are quoted on the same day. This is because during the sample selection, companies that did not have a matching bond were eliminated from the sample. All period before and after the CDS contract that did not have a matching bond contract, has also been ignored from this study.

Since daily CDS spreads refer to constant maturity, I then compare the spreads with the bond spreads.

Macro - financial data. The final part of the data is macro-financial variable of the issuing firm, which includes the firm size represented by the market capitalization, the earnings before interest and tax and the firm leverage.

To further analyze the effect of the crisis on one of the firms from the sample. I formulated the hypothesis below to check this.

Hypothesis: there is a stronger relationship between CDS and its bond spreads for AIG during an economic crisis than in periods of relative economic stability

To accept or reject this hypothesis, credit default swap and bond spread reports in the US covering a 4 year period will be analyzed. The rationale for using a four year period is so that the analysis could include the years before and after the generally accepted start of the global financial crisis.

For the two sets of analysis a linear regression analysis will suffice with the relationship represented as follows:

$$B = \propto + \beta CDS + \varepsilon$$

The rationale for this analysis is to be able to determine whether the CDS indeed exacerbated the crisis in AIG or whether it contributed to helping the ailing insurer recover.

For the analysis, CDS spreads and bond spreads data are obtained for the period July 2007 to June 2010. The analysis involves two sets of linear regression analysis for AIG, to represent the period during the global financial and economic crisis and the period after. The data is split as follows: the first linear regression analysis covers the period July 2007 to December 2008. This period represents the period of the global economic recession. This reflects the reality in that the crisis started late in 2007 and was deeply entrenched by December 2008. The second period of the analysis, i.e. January 2009 to June 2010 is assumed to be the period after the economic crisis and is apt as it covers the period after AIG had been bailed out. Although, crisis was still in existence within this period, the period was deemed appropriate to represent the period after the economic crisis as the US government had stepped in to aid the ailing insurer in the form of a bailout in September 2008, which was prior to this period.

CDS spreads data was obtained from Markit, consisting of monthly observations for AIG for the period July 2007 to June 2010. The monthly data was downloaded unto Excel. The bond data required to calculate monthly bond spreads was then obtained. The bond yield data was obtained from Moody's and 5 year US Treasury bond yield data, obtained from Bloomberg was used to represent the risk free bond yield. The difference was then computed to give the monthly bond spread data.

The data was then split up to represent the two periods. Panel 1 represented the period of the economic crisis and included monthly observations of CDS and bond spreads for the period July 2007 to December 2008. Panel 2 represented the period outside an economic crisis and included monthly observations of CDS and bond spreads for the period January 2009 to June 2010. The two sets of linear regressions were then run and the findings are presented and discussed in Chapter 5.

3.5 Summary

This chapter has outlined the methodology to be used to achieve the research objectives. In the main, it is quantitative research aimed at bringing objectivity to the research. It has described the research design and process and also explained the rationale for using the methods.

4 Data Analysis and Results

4.1 Introduction

This chapter provides results from the time series and panel data analysis aimed at measuring the relationship between bond spread and credit default swap spread for 21 companies. To further measure the relationship between CDS spread and bond spread to assess the direct contribution of CDS spread, a panel analysis is also performed from 2008-2010 for entities excluding Wachovia corporation. OLS regression was also performed. Finally, the effect on the type of organization on bond spread was also looked at through the use of a dummy variable.

4.2 Relationship between CDS and Bond spreads

In the first part of the analysis, I believe that there is a long run relationship between the *lnbondspread* and the *lncdsspread* and therefore I estimate equation (1). As a first step, I verify the supposed unit-root non-stationarity of the CDS and bond spread series. I use the augmented Dickey-Fuller test. I run these tests for each of the 21 CDS and bond spread series. All 21 series are cointegrated. Results are shown in Table 2.

As reported, I detect a significant cointegration relationship between spreads. This is consistent with Blanco et al. (2005) and Zhu (2006).

This result suggests that the price and credit risk run equally in the long run. This is not very much a surprise as two prices that have the same risk will eventually remove the arbitrage opportunity between both markets.

As illustrated in figure 3, the CDS and the bond spread, of a reference entity like for example AIG, tend to move together in time. All the other CDS and bond spreads exhibit a similar pattern. For studying long-term relationships among series that have a unit root, cointegration analysis is the appropriate framework.

Overall, from equation (1), I find a strong positive and a statistically significant impact of CDS on bond spread for 21 reference entities in the US. The results show that 52 percent of variations in bond spreads were explained by CDS. The unexplained component could be linked to taxes, which could account for anything between 25 percent and 75 percent of bond spreads (Elton, 2001). According to Krainer (2004) 'one other obvious difference between corporate bond yields and government bond yields is their tax treatment; interest income paid on corporate bonds, but not government bonds, is taxable at the state level. The top marginal state tax rates generally range from 5% - 10%'.

The results suggest that, for US entities, CDS trading has a sizeable benefit for the issuers in the bond market. For a 100 basis point increase in the CDS spread, there is an 87 basis point increase in bond spread all things being equal. This could be as a result of price differentials in both markets. This price differential can be particularly due to volatility in credit conditions.

This mirrors the finding of research such as Longstaff et al (2004) which finds that default risk (of which credit default swap spread is an ideal proxy) accounts for more than 50 percent of the variation in bonds.

My result is in contrast with that of Shim and Zhu 2010 which finds a negative impact based on data for Asian entities, and also in contrast with that of Ashcraft and Santos (2009), which finds no significant impact of CDS trading based on the US data. A possible explanation for the differences in results could be the difference in the development stage of markets between the Asian and US bond market in the case of Shim and Zhu, and in the case of Ashcraft and Santos, sample size, sample period, and choice of firms.

In the second regression, from equation (2), I also examine whether the impact of CDS on the bond spread differs when firm leverage in included in the regression. Shim and Zhu (2010) find that the term between CDS trading and firm leverage has a negative impact on bond spread but this was statistically insignificant. In my time series regression analysis from Table 3, there is a positive impact and this is statistically significant. A 100 basis point increase in leverage will increase bond spread by approximately 1.8 basis points, all things being equal. An explanation for the positive relationship can be because majority of the firms in the sample under study are high-leveraged firms. This however supports previous findings like Ashcraft and Santos (2009) that following the onset of CDS trading there is an increase in bond spreads of high-leverage firms.

In the third regression, from equation (3), I examine further the magnitude of the impact of CDS on bonds if it can be different across corporate and financial issuers'. The results are shown in Tables 1 and 4 in my time series and panel analysis. I find that all things being equal, on average the effect on bond spread for the corporate issuer is lower by 5 basis points compared to the financial issuer. This difference is statistically significant. So I reject the null hypothesis that corporate bond issuers and financial firm issuers do not differ in terms of the impact of CDS on bond spreads. This result can be because corporate bonds are more evenly distributed across the sample. Another possibility is the difference in the timing of issuance between the corporate and financial issuer.

4.3 Impact of CDS during the crisis

The introduction of the CDS market is an important step to complete the credit market by allowing for trading on credit risk, and it leads to the integration of various segments of the credit market. One side effect that such integration may bring on the credit market is that it may introduce a new source of market volatility. Any unsettling occurrences in the derivatives market may spill over to the cash market, and cause the whole credit market not to function properly, as may have occurred in the current global financial crisis, of which the CDS market has been the main focus.

To find out if the impact of CDS trading varies over time, particularly during the crisis period, I re-run the time series regression by including a dummy variable *crisis1* for the initial period of the economic crisis and *crisis2,* for the second period of the crisis after the issues of AIG.

Table 3 shows the coefficients for the analysis of equation (2), as well as the confidence intervals (95%). Before discussing the results from the two OLS regression, it is important to note that, in both regressions, the two dummy variables that indicate the two phases of the financial crisis do not have the same effects on the bond spreads. The coefficients of the time dummies are very interesting. While in the first period of the

global financial crisis before the AIG issues (from July 2007 to September 2008), the US entities used in this study do not have a statistically significant effect on the bond spread. The period covering the September 2008 crisis after the issues of the AIG, shows that there is a positive relationship with the bond spread of the 21 US firms named in the sample. There is an increase in the bond spread by approximately 78 basis points. This effect is statistically significant.

The non-significant result during the first phase of the crisis could mean that other factors were responsible.

4.4 Panel Data Analysis

The panel data analysis covers the period 2008 to 2010. Table 5 reports the results of panel regressions. The result is very similar to that of the time series as the overall CDS factors play a dominant role in affecting bonds.

First, the coefficient of CDS is significantly different from zero. Exactly, the result says that for a 100 basis point increase in the CDS spread, there is an 89.6 basis point positive increase in bond spread.

The coefficient in Table 5 shows an extremely strong positive relationship between the two variables. Significant p value of zero enables the null hypothesis of a non-relationship to be confidently rejected.

However, in this instance, according to the R Square, 38 percent of the variation in bond spreads is explained by CDS spreads. It is not a surprising result however, bearing in mind that due to the economic and financial crisis, governments around the world had been putting measures in place to reduce the effects and speed up economic recovery. One of the main methods used to do this is the lowering of interest rates.

To examine the effect of the firm specific variables, I run the panel regression analysis again. With the exception of earnings, the firm specific effects do not have a statistically significant effect on basis spreads. Earning is a measure that investors can use to assess the financial health of a company. This differs across companies.

The little or no relationship between firm size and bond spreads is unsurprising, since as mentioned in the Methodology chapter, larger firms do not face much constraint in credit risk transfer.

4.5 Summary

The regression analysis above has helped to prove that first, a strong relationship exists between CDS spread and bond spreads. Second, the hypothesis that corporate firms' bond spreads are greater than financial firms was also proven through the use of a dummy variable. Third, the effect of CDS on bonds during the crisis has also be proven to be different at the two stages defined in this study.

5 Time Series Analysis of AIG

5.1 Introduction

To put the results of the benchmark entities into perspective and also to further provide the case as contained within the Special Commentary section as to there not being a one-size fits all approach, a time series regression analysis was also undertaken for the AIG company, pre- and post-AIG bailout period.

In late September 2008, AIG had to be saved by the US Treasury and Federal Reserve. A multinational company with businesses in over 130 countries, AIG had ventured into the CDS business selling CDS for assets, some of which it has now transpired were very risky, e.g. residential mortgages. As the global economic and financial crisis began to take a stranglehold, and the risk of default on bond commitments increased, AIG were forced to write down the value of its investments on CDS. The crisis was to such a level that the insurer's credit rating had to be downgraded which is a serious course of events in terms of competition.

AIG's problem worsened due to plummeting stock price which made lenders wary of lending to the company to release its liquidity burden.

This chapter provides the findings and discussion pertaining to AIG. The aim is to try and explain further objective 3 which is to see whether CDS impact on corporate bonds is different in a period of economic crisis. A brief description of the issues that put AIG in the limelight in the midst of the global crisis is covered next before the results of the two linear regression analysis are presented and discussed. A time series regression analysis is also conducted for the sample benchmark firm to help provide results that would either lead to acceptance or rejection of the null hypothesis that the relationship between CDS and bonds is not stronger during an economic crisis.

5.2 The Bailout of AIG

The shirt sponsors of Manchester United, AIG suffered the ignominy of being bailed out by the US government. In return for an 80% stake in the fallen insurer, the US government handed over $85bn. It was the action of one arm of the company that nearly led to its demise. AIG Financial Products (AIGFP) based in London, England, saw the opportunity to maximize its profit opportunities by offering protection against what was considered at the time one of the greatest financial innovations of the 20th century, collateralized debt obligations (CDO). The means to do this was through CDS, with the strategic thinking based on the premise that it is highly unlikely that there would be huge payouts as a result of default.

Initially, AIGFP was on to something very good contributing more than $3bn to the AIG group in the form of revenues within five years from previous revenues of below $800m. Unfortunately, a significant chunk of the CDOs contained subprime loans, i.e. loans from risky borrowers. AIG reckoned that even if some of these risky loans defaulted, the good borrowers would more than offset them, so it was a calculated risk that they were willing to take, from their perspective. However, unexpectedly, the risky borrowers began to default on their loans at unexpected levels. A lot of this was attributed to affordability. The introductory rates were usually temporary and would go up significantly after say two or three years. As risky homeowners started to lose their

homes through failure to meet their repayments, the effect on AIG's revenue was significant as they had to honour their commitments. AIGFP ended up costing AIG around $25bn in losses which led to a collapse of AIG's share price. AIG's predicament worsened when their credit rating was lowered by rating agencies, necessitating the insurer to provide collateral to its investors.

The downward spiral continued to the point where the US government had to intervene, citing systemic risks. In other words, in the eyes of the US government, if AIG was allowed to become insolvent, it would have a ripple effect on the US economy as a lot of institutional investors and other banks had invested in AIG.

There have been vociferous criticisms of the deal with critics arguing that AIG were in effect being rewarded for failure with taxpayers' money. Others believed the insurer was too big to fail.

Initially, the CDS took the blame for AIG's near demise. However, the argument is more balanced with more people citing human error and greed, as well as a lack of effective regulation of CDS as the reasons for the near collapse of the insurer.

5.3 Results

Another objective of this research is to investigate whether the relationship between CDS and bonds altered for the AIG firm during the recent global economic crisis. Consequently, the hypothesis tested was as follows:

Hypothesis: there is a stronger relationship between CDS and its bond spreads for AIG during an economic crisis than in periods of relative economic stability

To prove this, two sets of linear regression analysis were performed for AIG. The first linear regression analysis covered the period July 2007 to December 2008, while the second analysis covered between January 2009 and June 2010. The rationale was clear. AIG had encountered so much problems that they were bailed out by the US government in September 2008. Consequently, the first period is assumed to be the period of the economic crisis, as this was the time when AIG was most under threat. Although they were bailed out in September the period was extended until December for two reasons. First, and more importantly, this was still a period when the economic crisis was at its peak. Second, it helps to balance out the data for the analysis. Tables 6 and 7 provide the results.

Table 6 indicates that 34% of variations in bond spreads in AIG were explained by CDS. With p value below 5%, the results are statistically significant. However, the results are indicating that changes in AIG CDS spreads had little or no effect on bond spreads during the initial period of the crisis.

Table 7 also shows little or no relationship even though 45% of variation in bond spreads seemed to be caused by CDS. The relationship shows that the variation in bond prices can be explained more post crisis than during the crisis, contrary to the hypothesis and the previous results obtained from Table 3. It is perhaps due more to things like interest rates as we will see in the next section that has contributed more to the variations.

5.4 Special Commentary

The chart below lends credibility to those who believe that CDS does not harm an economy. It shows the opposite of what critics have been saying in relation to Greece, which is a country undergoing serious economic woes, currently.

Looking at figure 4, there was an increase in CDS and bond spreads at the same point in time when Greece were experiencing falling fortunes – i.e. over the three month period from end of November. According to (Reuters, 2010), 'this chart shows that the fixed-income markets are working in exactly the way that they are meant to work, and that the CDS market is the Greece grease enabling them to do so. In an efficient bond market, the secondary-market yield on any given credit's bonds is very close to the rate at which that credit can issue in the primary market. It can fluctuate up and down, but that changes the price of credit more than the availability of credit'.

The chart shows that despite Greece troubles, CDS ensured that investors did not sell off their bonds in a panic and that Greece was able to secure finance in the open market (Salmon, 2010).

In the case of the former, instead of selling off Greece sovereign bonds to stave off potential heavy losses, investors take protection in the form of CDS. CDS proponents point to the recklessness of Greece in attracting the situation they find themselves rather than due to CDS. As Salmon (2010) puts it 'in turn, the ease of hedging marginal Greece exposure in the CDS market helped to ease the fears of investors active in the primary market, and Greece has continued to be able to issue debt without interruption. So rather than demonize the CDS market and blame it for Greece's current woes, let's place the blame firmly where it belongs – with Greece itself, and its profligate ways. And let's thank the CDS market for adding enough liquidity to the bond market that Greece's fiscal woes didn't become a major liquidity crisis.

However, others were not so sure. As Boyd Erman points out: 'Credit default swaps don't kill countries and companies; bad management kills countries and companies. Yet credit default swaps – derivatives that allow traders to bet on the health of bond-issuing companies and countries – are once again in the news as the culprits in the potential downfall of Greece' (Credit Lime, 2010). The piece goes a long way to defend the honour of CDSs, instead laying the blame squarely at the feet of bad management. Of AIG, Credit Lime (2010, citing Erman) opined: 'CDSs also killed American International Group, if the headlines following its $85-billion bailout by the US government are to be believed. More realistically, AIG tried to kill itself in a spectacular act of self immolation owning to brutally bad management. The simple fact was the company wrote a bunch of insurance policies it couldn't cover, and CDSs were simply the form of insurance. If AIG had mismanaged a life insurance portfolio and ended up requiring a bailout, nobody would be demanding the end of life insurance'

The argument here is simply that credit default swaps are as good or as bad as the policies and strategies which determine how they are used.

Credit Lime (2010) gives five reasons in a nutshell as to why CDSs did not cause or exacerbate the global economic crisis.

1. 'CDS simply reflect confidence (or uncertainty) levels in future outcomes. People don't believe in Greece's ability to put through enough budget cuts to balance its budget. Perhaps like "overly-successful" or just lucky American subprime mortgages, who are having a hard time downgrading from their unaffordable mansions to one or two-bedroom apartments, it's hard to go back to a more fiscally conservative lifestyle you feel you outgrew.

2. In current sovereign debt crises, CDS represent a miniscule amount compared to the actual underlying government debts currently outstanding. In countries like the Hellenic Republic, it's about 3%.

3. Bad management creates the inherent problems at companies or governments that CDS seems to do a better or earlier job at recognizing or quantifying. In Greek's case George Papandreou probably gets all the blame although the country's problem has been years in the making and there were previous prime ministers who's spending habits have at least partially contributed to what is happening now.

4. Secrecy or uncertainty in both the CDS markets and in the accounting books of debt-issuers (corporations and governments) is what really drives panic in these crises. In Greek's case, not only is there a great deal of secrecy regarding who is actually trading or profiting in Greek CDS, but investors also don't believe in the government reported economic and financial statistics.

5. Bond prices can actually fall further than CDS prices. In Greek's case, there is evidence that at times the CDS price has reacted in a positive direction earlier, or to a greater degree than the actual bond prices and yields have. It is the bond yields that matter as far as Greece's ability to issue new debt goes'.

In Europe, the backlash against CDS has been strong. Although unproven, EU lawmakers recently passed a motion for tougher regulations aimed at curbing the perceived risks posed by CDSs. The main areas that lawmakers wish to look at are a reduction of the amount of CDSs and also for the set up of a central clearing area (Tait & Oakley, 2010)

However, according to Tait & Oakley (2010), 'findings had not revealed the type of serious endemic problems with the Greek sovereign CDS market which would support the heavy-handed regulatory approach backed by several EU member states'.

Lawder (2010) reported that derivatives experts have indeed testified that the real reason for the Greece crisis was not because of credit default swaps, but because the Greek government overspent.

So what is the impact of CDS on corporate bond markets? Whatever the impact, it cannot be said based on findings, and contrary to some literature reviewed that they have exacerbated crisis in the corporate bond markets. This is because the corporate bond markets have stayed pretty much intact throughout the global economic crisis, generally. The problem in the bond markets lay in the sovereign bond sector especially in places like Greece and Portugal. As the problem in the sovereign bond markets continue, investors, rather than cashing in are investing in CDS. So it would be difficult to state with a great deal of certainty that CDS hinder the corporate bond markets.

'CDS are seen as an early warning signal for bond markets, alerting investors to structural weaknesses before a crisis hits' (Isaacs, 2010).

5.5 Factors affecting bonds

The first of these is interest rates, which has an inverse relationship. In other words, all things being equal, when interest rates increase, bond prices tend to decrease and vice versa. For example, consider a scenario where a corporate bond currently has a yield of 5%, while interest rates are at 4%. The corporate bond will be more desirable to an investor. However, if the relevant monetary authorities were to increase interest rates to say 6%, then the corporate bond will cease being competitive. Consequently, the price of the bond will need to reduce so that the yield can once again become more attractive to investors.

As a result, an investor who is patient enough to wait until the UK's Monetary Policy Committee or its US counterpart decide to reduce interest rates, this will present a good opportunity to buy the bonds at low prices while enjoying high yield.

Secondly, inflation plays a major role in influencing bond prices (Thau, 2000). As inflation increases, bond prices normally fall. This is because 'unless the bonds are index-linked, the income they generate will fail to maintain its buying power. To compensate for this dwindling buyer power, prices of the bonds typically fall.

A third determinant of bond prices is exchange rates. Where the local currency is faring unfavourably in the foreign exchange market, the relevant government may decide to increase interest rates, which will deter bond purchases.

Last but not least, credit rating also plays a significant role in determining bond prices. The question remains in what way? Investors want to be sure they are going to reap the benefits of their investment so they look to the credit ratings given by rating agencies like Moody's, and Standard and Poor's to help them decide. Consequently, the lower the rating, the more likely it is that a company's corporate bond price will follow suit.

5.6 Summary

The analysis has shown that the hypothesis which argues that the relationship between CDS and bonds is stronger in an economic crisis has not been proven in the case of AIG. It has however been proven in the case of the benchmark companies which goes to show that the small AIG sample size of 18 observations on either side of the crisis may have contributed to the undesired results. However, since the benchmark analysis involved hundreds of observations, one can argue with a great degree of confidence that the hypothesis holds true. It also lends credence to the assertion that the relationship varies on a case by case basis.

6 Conclusion

This aim of this research is to assess the impact of credit default swaps on bond spreads at a micro level. Specifically, it looked at the relationship between CDS and bond spreads, using both panel and time series analysis over the period 2005-2010. I focus on the impact of CDS and its relationship to bonds through a time series and a panel data model analysis at different data frequencies and across a few U.S corporate and financial entities I also looked at the impact of the relationship between CDS and bonds in and out of an economic crisis from AIG's perspective and also using the 21 reference entities used in this study. I also looked at the impact of some other variables like earnings and leverage.

The research was inspired by the rapid and transformational change that has gone on, and is still going on as a result of the recent global financial crisis. The low volatility in the markets and narrow credit spreads in hindsight, seem to have been taken for granted. Since the crisis, companies are paying greater attention to default and liquidity risks as a means of achieving and sustaining competitive advantage. Credit derivatives are the most popular measures of default risk in the capital markets, especially credit default swaps, which can be likened to insurance; whether a buyer seeks protection from a seller for an asset he or she owns or do not own. The initial focus on credit default swaps as the reason for the global economic crisis is being tempered now with proponents pointing to other factors. Consequently, this research was undertaken to contribute to the debate in terms of whether CDS helped to mitigate or worsen the crisis. For such a relatively new topic, it is surprising as to the extent of research on the subject, with focus on pricing dynamics between bonds and CDS among other things. It was also hoped that the research could help investors decide whether CDS are good or bad for the bond markets in times of economic stagnation.

One of the key milestones in completing the project was to review existing literature relevant to credit default swaps and the bond markets in general. CDS definition, valuation models and the relationship between CDS and bond markets, and the key risks faced by them were covered. It was from the review of literature that the aim was finalized as were the objectives and hypotheses. The research then looked at the US by choosing twenty one multinationals to perform the analysis on.

CDS coming to prominence in the mid-90s have grown exponentially. The total notional amount stands at arguably over $62tn. One of the key features of CDS is that they often exceed their corresponding reference entity which is a unique trait. The divisive nature of CDS can be summarized thus: proponents think they effectively manage risk and contribute immensely to market liquidity, while critics point to a lack of adequate regulation to prevent abuse, which they deem the main cause of the global economic crisis. Furthermore, the critics fear a significant increase in interest rates could lead to disaster as far as derivatives are concerned.

The literature revealed a long run equilibrium relationship between CDS and bond markets with hardly any arbitrage opportunities. However, in the short run there was some evidence of variation due to the high probability of the sensitivity of CDS to changes in the credit environment among other things.

There seemed very little opposition in the literature that CDS leads the bond markets in terms of price discovery, with the exception of Norden & Weber (2004), whom while

conceding that that was the case in the US, in Europe, they found the opposite to be true; and Blanco, Brennan & Marsch (2005); and Zhu (2006) who share the same opinion.

The review of literature also found that corporate bond spreads include a combination of default and liquidity risk. Researchers like Chen, Lesmond and Wei (2007) have found that the more illiquid a corporate bond is the greater their yield spreads.

While a lot of research found a significant relationship between corporate bond spreads and credit risks, a few didn't (Elton, 2001), while the determinants of CDS spreads were identified to include maturity, credit ratings, and volatility.

Since CDS are traded over the counter, regulation is difficult. Critics fear that the absence of effective regulation turns the market into a speculative free for all.

On the subject of liquidity again, speculative grade bonds paid more in terms of liquidity risk premium compared to investment grade bonds.

First, analyzing the aggregate cointegration, I find that CDS and bond spreads in line with previous studies are cointegrated. I also find in the time series analysis that the CDS has a strong positive impact on bond spreads for 21 U.S reference entities.

In this study, the strong relationship between CDS spread and bond spread, was proven. The p value was able to prove the significance of the results. The striking thing about the results was that contrary to literature, with the exception of earnings before interest and tax, and leverage; other variables like firm size did not seem to have significant impact on bond spreads. The findings here are in line with relevant chunk of data, and research that was reviewed as part of the literature review section. Furthermore, it is quite likely that the unexplained parts were heavily influenced by interest rates.

It was proven in that there was lesser spread for the corporate firms than for financial firms as expected.

Second, I find in my time series analysis using dummy variables, the impact of CDS on bond spread during the crisis. The strong relationship between CDS and its bond spreads during an economic crisis than in periods of relative economic stability was emphatically proven, only with the exception of the initial phase of the crisis, where we did not find a statistically significant result.

While indeed CDS does lead price discovery, this research's contribution to the debate is that based on the varying results from the analysis, it is clear that one size does not fit all. In other words, while CDS will have the potential to impact negatively on the bond markets, it equally has a chance to impact positively as well. The argument that the way investors sought to exploit the opportunities provided by CDS and other credit derivatives, rather than the products themselves, was the problem seems to hold true. In other words, it would do no harm if some regulation were put in place to minimize the kind of greedy speculation that may cause an economic panic at the slightest sign of trouble.

The corporate bond markets has emerged relatively unscathed from the global crisis as is to be expected when share prices are falling. However, although out of the scope of

this research, sovereign bonds have been hit more severely. In terms of the impact of CDS on the bond market, it is safe to argue that they have the potential to both mitigate the risk and make the situation worse. As Shanahan (2010) reports:

'The cost of insuring against losses on European corporate bonds fell to the lowest levels since May after a report showed the UK economy grew almost twice as much as economists forecast in the second quarter. The Markit iTraxx Crossover Index of credit-default swaps on 50 companies with mostly high-yield credit ratings decreased 13 basis points to 500, according to JP Morgan Chase & co. prices at 9.30 a.m. in London, the lowest level since May 13. The index is a benchmark for the cost of protecting bonds against default and a decline signals improvement in perceptions of credit quality. The Markit iTraxx Europe Index of 125 companies with investment-grade ratings fell 3.25 basis points to 111, the lowest since May 14, JP Morgan prices show. The cost of protecting bank bonds from default also declined, with the Markit iTraxx Financial Index of 25 banks and insurers down 4 basis points at 130, the lowest since May 12'. While this indicates a reduction in corporate bond risks, it also captures perfectly a key point about CDS. While it can contribute to adverse occurrences in the bond markets, especially when speculators become greedy, it also serves as a good indicator as to the health of an economy.

Even in the US the signs of recovery are clear and the increased importance of the corporate bond market is noted by Wright & Paulden (2010):

'A benchmark indicator of corporate credit risk in the US fell for the third time this week as companies including United Parcel Service Inc and AT&T Inc. boosted profit forecasts. Credit Default swaps on the Markit CDX North America Investment Grade Index, which investors use to hedge against losses on corporate debt or to speculate on creditworthiness declined 2.8 basis points to a mid-price of 108.7 basis points as of 11.44am in New York, according to index administrator Markit Group Ltd. The index typically fall as investor confidence improves'. Wright & Paulden (2010, quoting Gary Jenkins, of Evolution Securities Ltd, London) explain that 'the market is focusing more and more on the earnings than the economic data. While the economic data has been slightly soft, the earnings thus far have been positive. There are a lot of investors who think that taking company risk at this stage, whether it's in equities or credit, whether it's derivatives or bonds, is actually a good thing to do. It's a relatively safe place to be. In a world of uncertainty, corporate debt does appear to offer some kind of value'.

The research would have been richer with primary data, especially one obtained through an interview with an industry professional.

The challenge for this research was to get bonds which can be matched with CDSs for more reliable comparisons.

The issue for the sample size is that it was not possible to get all the bonds to match the CDS in terms of maturity.

Obtaining data was a significant problem, for this type of research and compromises had to be made due to cost considerations.

Since credit default swap are currently traded over the counter, there are not enough avenues to gain access to accurate data.

Despite some limitations due to data imperfections and methodological issues, I think these analysis capture the impact of CDS on the entities used for this study and also the impact during the global economic crisis.

In terms of further research, it is recommended that the extent of the impact of interest rates on bond spreads be examined as this research through a review of literature found evidence of a relationship. A broader sample size can also be analysed and compared across other continents to test further the impact of the global crisis.

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APPPENDIX

Appendix A			
Refrence Entity	**Sector**	**credit type**	**ISIN**
Allergan Inc.	**Pharmaceuticals**	**Corporate**	**US01849QAN51**
American Express Bank	**Consumer Finance**	**Financial**	**US0258161092**
American International Bank	**Full Line Insurance**	**Financial**	**US026874AS63**
Amgen Inc	**Biotechnology**	**Corporate**	**US031162AH34**
AT&T corporation	**Fixed Line Telecommunications**	**Corporate**	**US00206RAB87**
Black & Decker Corporation	**Durable Household Products**	**Corporate**	**US854616AK51**
Boeing Capital Corp.	**Aerospace**	**Corporate**	**US097023AU94**
Bristol-Myers Squibb Corp	**Pharmaceuticals**	**Corporate**	**US110122AL21**
Dover corp	**Industrial Machinery**	**Corporate**	**US260003AF59**
Goldman Sachs Gp Inc	**Investment Services**	**Financial**	**US38141G1040**
Halliburton Co	**Oil Equipment & Services**	**Corporate**	**US406216AR24**
Hewlette Packard Co	**Computer Hardware**	**Corporate**	**US428236AG84**
Honey Well Intl. Inc.	**Diversified Industrials**	**Corporate**	**US438516AN69**
Johnson & Johnson	**Pharmaceuticals**	**Corporate**	**US478160AL82**
Noble Energy	**Exploration & Production**	**Corporate**	**USG65422AA86**
Occidental Petroleum	**Exploration & Production**	**Corporate**	**US674599BV68**
Oracle Corp.	**Software**	**Corporate**	**US68402LAC81**
Pitney-Bowes Inc.	**Electronic Office Equipment**	**Corporate**	**US72447WAU36**
Wachovia Corp	**Banks**	**Financial**	**US929903AE28**
Wells Fargo & Co	**Consumer Finance**	**Financial**	**US949746FJ50**
Western Union Co	**Banks**	**Financial**	**US959802AA70**

Table 1 Summary statistics of time series variables

variables	obs	mean	std. dev.	min	max
year	27426	2007.674	1.490	2005	2010
firms	27426	11.000	6.055	1	21
bonds	27426	115.149	212.049	-60.100	3197.800
cds	27426	77.758	166.750	0.000	3683.120
crisis1	27426	0.429	0.203	0	1
crisis2	27426	0.149	0.356	0	1
issuer	27426	0.810	0.393	0	1
time	27426	13713.500	7917.349	1	27426

Table 2 Dickey-Fuller test

Method	statistic	prob	95% conf.	interval	cross section	obs
Null:Unit root						
ADF	-25.340	0.000	-0.048	-0.041	21	24716
The tests statistic of -25.340 is more than the critical values at 5% in the critical values of the ADF tables. Hence, we reject the null and confirm that the variables are stationary.						

Table 3 Time series analysis

Variables	bond spread	p> /t/	95% conf.	interval	R-squared	Adj R-squared
cds spread	0.870	0.000	0.860	0.881	0.522	0.522
Firm effect						
leverage	0.018	0.000	0.013	0.024	0.557	0.557
Issuer type						
Issuer	-0.050	0.000	-0.077	-0.023	0.523	0.522
Global financial crisis						
crisis1*	0.010	0.691	-0.039	0.059	0.522	0.522
crisis2	0.783	0.000	0.753	0.812	0.569	0.569
* there maybe other factors responsible for this						

Table 4 Summary statistics of panel data variables

variables	obs	mean	std. dev.	min	max
year	60	2009.000	0.823	2008	2010
firms	60	10.600	5.978	1	20
bonds	60	152.284	113.413	-10.126	611.021
CDS	60	100.610	88.943	21.474	530.044
EBIT	60	16.779	16.217	-3.540	81.760
Market capitalization	60	56413.670	50877.410	1.250	163476.300
Leverage	60	-33.454	6601.242	-38808.650	32494.040
issuer	60	0.792	0.408	0.000	1.000

Table 5 Panel data analysis

Column1	bond spread	p> /t/	95% conf.	interval	R-squared	Adj R-squared
CDS spread	0.896	0.000	0.586	1.205	0.375	0.364
Firm specific effects						
EBIT	-2.987	0.002	-4.832	-1.142	0.174	0.130
market capitalization	0.0180	0.728	-0.085	0.121	0.376	0.354
Issuer type						
issuer	-0.654	0.006	-1.112	-0.196	0.456	0.436

Table 6 Linear regression analysis for AIG pre crisis

AIG Pre-bailout						
Regression Statistics						
Multiple R	0.582248721					
R Square	0.339013573					
Adjusted R Square	0.297701921					
Standard Error	0.677661354					
Observations	18					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	3.768512547	3.768512547	8.206246	0.011234891	
Residual	16	7.347598564	0.45922491			
Total	17	11.11611111				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2.09	0.19	10.93	0.00	1.68	2.49
CDS AIG	0.00	0.00	2.86	0.01	0.00	0.00

Table 7 Linear regression analysis for AIG post crisis

AIG Post-Bailout								
Regression Statistics								
Multiple R	0.70							
R Square	0.48							
Adjusted R Square	0.45							
Standard Error	0.23							
Observations	18							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	1	0.82	0.82	14.95	0.00			
Residual	16	0.87	0.05					
Total	17	1.69						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.76	0.09	31.17	0.00	2.57	2.94	2.57	2.94
CDS AIG	0.00	0.00	3.87	0.00	0.00	0.00	0.00	0.00

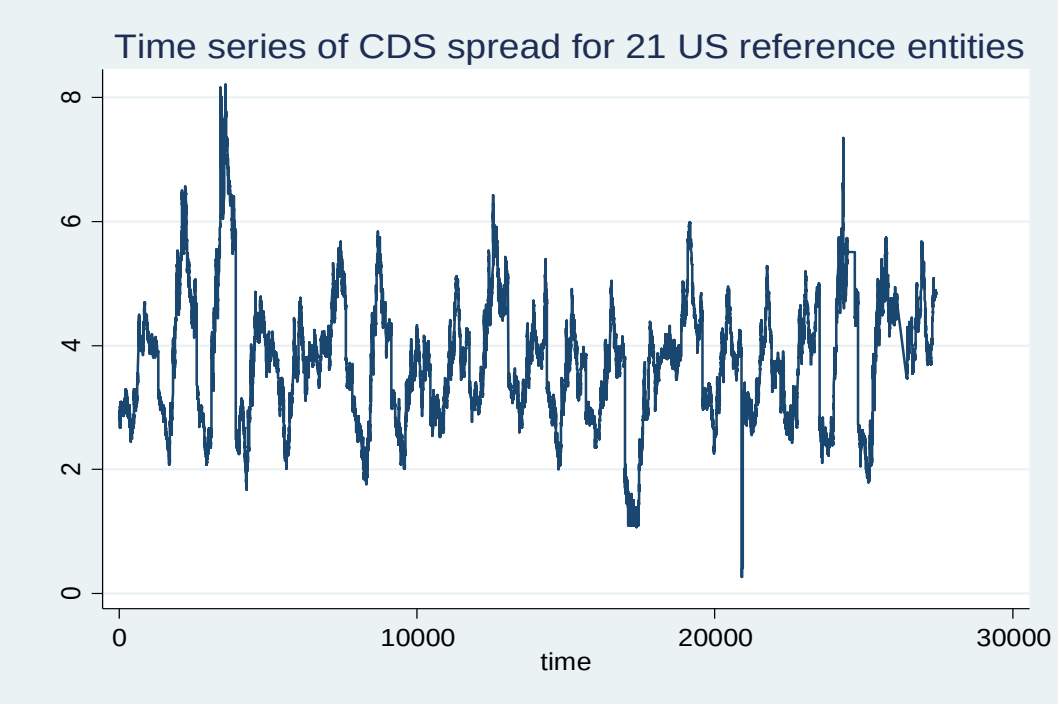

Figure 1 Time series of CDS spread for 21 US reference entities

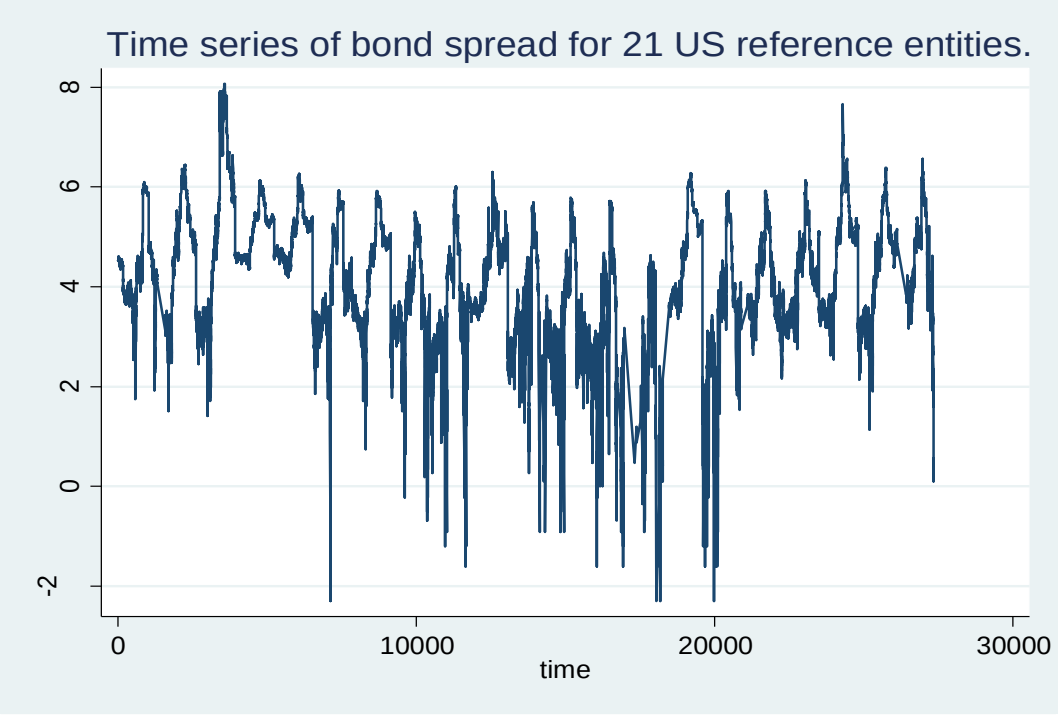

Figure 2 Time series of bond spread for 21 US reference entities

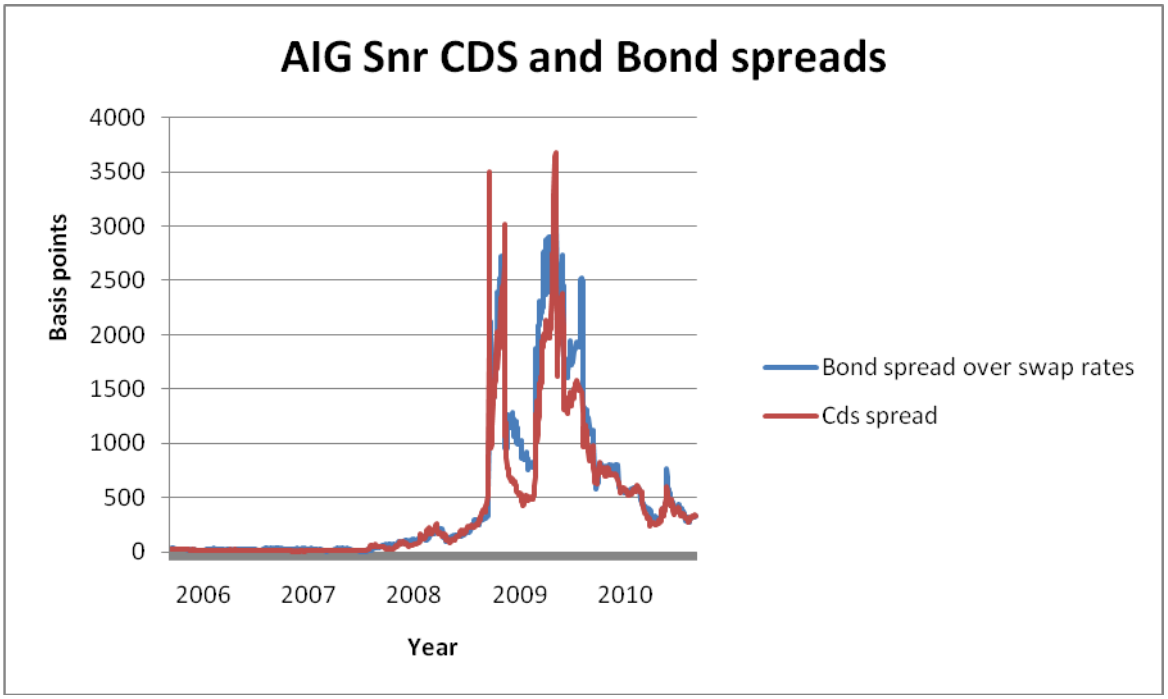

Figure 3 Time series of AIG's CDS and bond spread.The bond spread is calculated over the 5 year swap rate. Sample period is 2/9/2005- 3/9/2010.

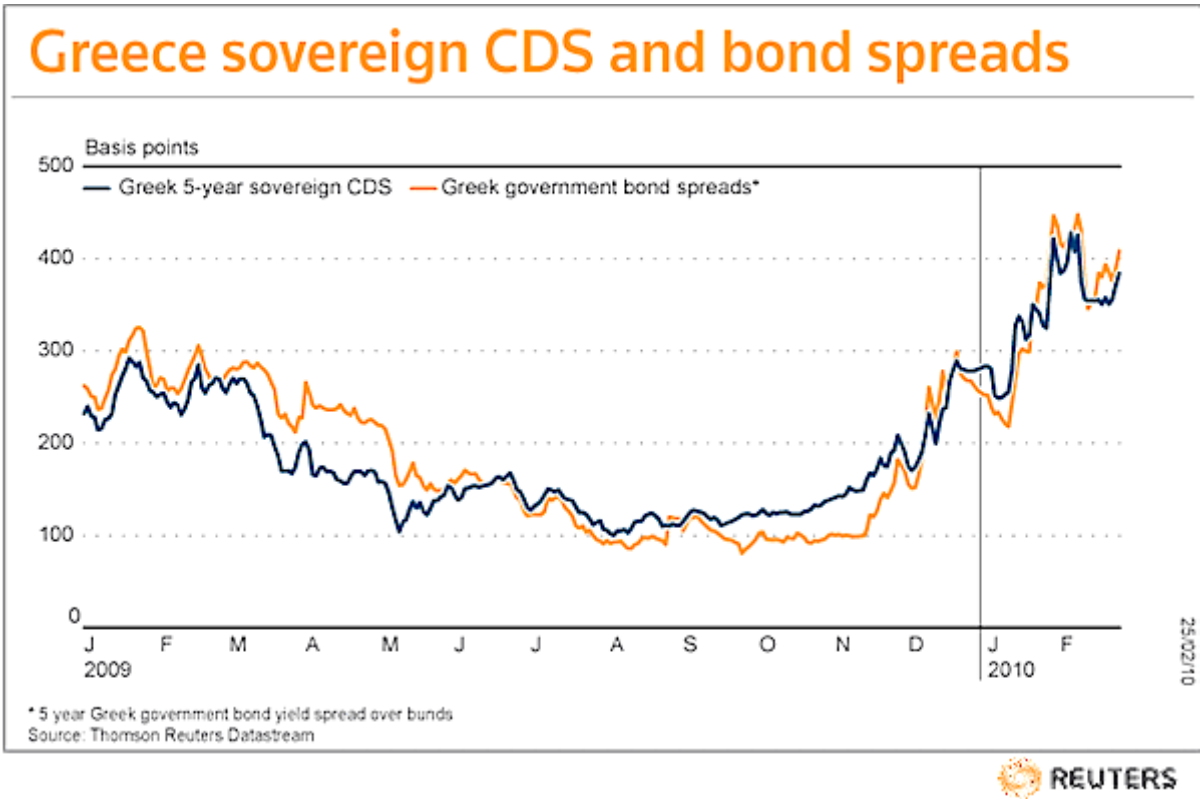

Figure 4 Greece sovereign CDS and bond spreads *(source: Reuters)*