Determinants of Credit Default Swap Spread in the banking sector: The role of house prices in driving credit risk in the UK

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Abstract

The recent financial crisis that started from a housing bubble caused a dramatic increase in default risk. This paper investigates the determinants of the CDS spread in the UK banking sector considering the role of house price in driving credit risk, while taking into the standard financial determinants namely the yield spread, TED (difference between the three month UK T-Bill and the three month LIBOR) uncovering the liquidity channel, and the FTSE 100 index. Using corporate UK CDS spread related to the banking sector, covering the period from January 2004 to April 2011, we employ two different methods to analyse the long run relationship: the Johansen's method and the Dynamic Stock-Watson's (OLS) approach, and a structural VAR model to investigate the short run effects. We found strong evidence that the house price dynamics has been the key driving factor behind the recent collapse of corporate CDS market, showing a negative relationship. Furthermore, there is a negative relationship between the CDS spread and the yield spread. As short term interest rate increases, investors will demand higher yield as a compensation for bearing extra risk, influencing credit risk. In addition, the FTSE 100 index is positive and significant under DOLS method, implying that as the stock price increases, both banks' capital and its borrowing capacity rises, resulting in a higher credit risk. Furthermore, liquidity (TED) was found to be positive and significant in the long run under the DOLS method, and in the short run in the structural VAR model. Therefore, as liquidity goes up, banks tend to lend more to less credit-worthy (subprime) borrowers; thus increasing credit risk and the overall CDS spread in the banking sector.

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1. Introduction

Between 2001 and 2006, low quality underwriting standards and large lending caused an excessive number of home mortgages to default. Financial engineering as well as securitization activities allowed banks, building societies and other financial institutions to expand their lending practises and escape regulatory capital requirements through the process of passing the "hot potato" of bad loans to investors at the end of the chain, who were not aware of the risks embedded in these financial instruments. Sub-prime mortgage crisis that came into sight in summer 2007, led to huge financial losses in the credit markets. As a result, large banking corporations and other financial institutions were under the obligation to write off most of structured derivatives and securitized assets they were holding. Thus, even though financial engineering and structured credit products-tranches trading enriched the economy, brought innovation for more than a decade and allowed banks to access higher liquidity in a timelier manner, it has also made the financial system more vulnerable and prone to systemic crisis. (Taylor *et al*., 2009; and Calice *et al*., 2010).

Although the CDS market has remained relatively stable after the 2007-2008 financial crises by maintaining enough liquidity; thus allowing investors to hedge their risky exposure and speculate, CDS did play an important role in the recent financial crisis. First, there are some indications that lead us to think that CDS could have indirectly underpinned the subprime asset bubble that has caused the current financial crisis. Second, the overpriced CDS contracts gave great incentives for the US government to buy a high stake in the American International Group (AIG); an action that wiped out shareholders' investments and caused systemic crisis. In fact, CDS contracts may have given wrong incentives to investors who had high exposures in CDOs contracts.

These investors purchased CDS contracts as a measure to hedge their positions in case sub-prime CDOs defaulted. Thus, if CDS contracts were harder to obtain and were priced in a more transparent manner, investors would have been more aware of the risks associated with a particular investment and would have therefore been more reluctant to have excessive risky exposure in the sub-prime CDO market.

In this research credit default risk is measured by the Credit Default Swap (CDS) spread. A CDS contract is similar to insurance contracts, meaning that the buyer of the contract, also referred to as the protection buyer, makes a series of payments, i.e. spread, to the protection seller of the CDS. In case a credit event occurs, such as a default, restructuring or bankruptcy of the financial institution involved, the protection buyer is entitled to receive a pay off from the protection seller, usually equal to the par value of the underlying asset, typically a bond. If no credit event occurs, the protection seller receives quarterly premium payments (also referred to as the CDS spread) from the protection seller. Therefore, the CDS spread can be interpreted as the price of the credit default risk of the underlying asset. (İnci Ötker-Robe *et al*. (2010))

The CDS market started considerably growing in 2001, with an outstanding notional amount of $631.5 billion. In the last quarter of 2007, the total notional outstanding amount of CDS contracts has attained its highest point, reaching $62.2 trillion (ISDA (2010). At the end of 2008, due to the severe financial crisis, this figure more than halved, reaching $38.6 trillion and continued to decrease further (ISDA (2010)). In fact, it was estimated by the Depository Trust and Clearing Corporation (DTCC) that at the end of the third quarter of 2009, the notional amount of outstanding CDS contracts averaged $28 trillion. (ISDA (2010). Following the aftermath of the 2007-

2010 financial crises, the notional outstanding amount of CDSs diminished considerably.

Given that the recent financial crisis started from a housing bubble, which itself resulted from a sudden and sharp decline in house prices; there are strong incentives that lead us to believe that the house price index has a direct impact on the CDS spread. During the credit expansion, between 2000 and 2006, credit underwriting standards of mortgage securities was very poor. In fact, it was associated with light touch regulation and lack of supervision by the legal financial authorities. With the continuously rising house prices, and the increasing securitization activities, mortgage lending was at its peak. As long as the real estate prices were continuously increasing, lending to delinquent borrowers did not seem to be a problem for financial institutions as they could always resale houses at a higher price in the secondary market. However, when residential prices drastically plummeted and mortgage rates substantially increased; with borrowers' personal income growth reaching its lowest level, sub-prime mortgages fell in value and resulted in huge financial losses. This has caused a rise in both the overall credit risk and the CDS spread.

All the literature that evolved around credit risk, more specifically the CDS spread, focused on the theoretical and the financial determinants; thus ignoring the housing market. Researchers including Collin-Dufresne et al. (2001), Campbell et al. (2003), Cremers et al. (2004) and Benkert (2004) among others, analyzed the CDS spread focusing on firm level data, incorporating financial variables and volatility. Their findings indicate that these variables are important in explaining the CDS spread. Another important stream of the literature related to the CDS spread focused on theoretical determinants; that is accessing the importance of variables such as the risk

free rate and the yield spread in determining the CDS spread. Findings from previous research indicate that the risk free rate as well as the yield spread has a significant power in explaining the CDS spread. (Bystrom (2008), Naifar (2010), Alexander et al. (2008), Duffie et al (1999), Bevan et al. (2000), Neal et al. (2000), Lekkos et al. (2001) and In et al. (2003)). More recent researches studied the impact of credit ratings on the CDS spreads and demonstrate that they are important in determining the spread. (Hull et al. (2004), Cossin et al. (2002), Fabozzi et al. (2007)).

With the recent financial crisis, it became clear that credit risk is not only related to the interest rates, yield spread and financial leverage. Most defaults that occurred during the crisis were due to the falling house prices and increased mortgage rates. This research aims at investigating the way the house price affects the CDS spread. This is a positive contribution to the existing literature as no previous research has conducted such analysis. In addition to considering the theoretical and the financial determinants of the CDS spread, we also analyse the impact of housing market on the CDS spread. Three methods have been used in this research. After having identified the presence of a cointegrating relationship between our variables, we use the Johansen's method and the Dynamic Stock Watson's OLS approach in order to investigate the determinants of the CDS spread in the long run. We then employ the structural VAR (SVAR) model in order to analyse the short term determinants of the CDS spread.

The findings from this research suggest that the house price dynamics has been the key driving factor behind the recent collapse of corporate CDS market influencing credit risk. Both the Johansen's and the dynamic Stock Watson's methods indicate the presence of a negative relationship between the house price and the CDS spread. This

could have important implications on the CDS trading backed on mortgage securities. This finding implies that both the credit sector and the housing market are strongly related. Thus, financial distress in the housing market is highly likely to transmit to the credit market and cause a contagion to other markets.

Furthermore, a negative relationship was found between the CDS spread and the yield spread in the long run. As credit risk increases, investors will demand a higher yield as a compensation for bearing extra risk. In addition, the FTSE 100 index appears to be positive and significant under the DOLS method. This implies that as the stock index increases, both banks' capital and its borrowing capacity rises, leading to a higher credit risk. Furthermore, liquidity (TED) was found to be insignificant in the long run, but in the short run, the structural VAR model indicates that it is significant and positively related to the CDS spread. Therefore, as liquidity goes up, banks tend to lend more to subprime borrowers; thus increasing credit risk and the overall CDS spread. In fact, according to the empirical findings from the structural VAR model, the only variable that appears to be statistically significant in the short run is TED. All other variables are insignificant in the short run and are only able to explain the CDS spread in the long run. This follows the economic logic given that it takes time for credit risk and the CDS spread to adjust.

In view of what has been discussed above, in this research we investigate the macroeconomic and financial determinants of the CDS spread in the UK banking sector by considering the house price, the yield spread, TED (difference between the three month UK T-Bill and the three month LIBOR) uncovering the liquidity channel, and the FTSE 100 index.

The remaining part of this paper is structured as follows: Section 2 discusses the previous literature related to the determinants of the CDS spread. Section 3 describes the type of data and proxies used for the determinants. Section 4 is divided into 5 subsections. Section 4.1 focuses on the Augmented Dickey Fuller unit root test. In section 4.2, we conduct the Zivot Andrews unit root test for structural breaks. In section 4.3, we discuss the Johansen's method. In section 4.4, the Stock and Watson's Dynamic OLS method is introduced and run on our variables, while in section 4.5 we focus on the short-term effects by applying the structural VAR model to our data. Finally, in section 5, we conclude.

2. The CDS spread determinants: background and literature

The credit derivative market has developed substantially for the last decade. Thus, understanding the determinants of credit spreads became crucial for financial regulators, traders, and economic bodies. A large body of existing literature has focused on analyzing credit defaults and investigating the reasons why the CDS spread is considered to be a better proxy for default risk compared to bond spreads. In fact, researchers used to heavily rely on bond spreads in order to get an approximation of the level of credit default risk. Duffie et al. (1999) as well as Hull et al. (2004), demonstrate that under tight and restrictive assumptions, the CDS spread should be similar to the credit spread derived from bond prices. Nevertheless, this does not hold under real world circumstances.

There are a number of reasons that make the CDS spread a better proxy for default risk. First, CDS spreads can be easily observed, while bond spreads have to be

derived using a risk free benchmark rate. Furthermore, it can be sometimes very difficult to choose the risk free rate (Houweling et al. (2005)). In addition, the estimation of the credit premium in bond spreads is usually affected by financial market variables. As a result, bond spreads tend to be negatively affected by illiquidity issues ((Sarig et al. (1989), Chen et al. (2007)). Researchers should also give consideration to different tax treatments (Elton et al. (2001), and other market microstructure factors including coupon and maturity effects. Moreover, it was found that CDS spread tend to react more rapidly to information related to the credit quality of the underlying reference entity compared to bond spreads (Blanco et al. (2005), Hull et al.(2004) and Zhu (2006)). Furthermore, findings indicate that credit ratings of long term bonds are lead by CDS spread fluctuations (Norden et al. (2004)). Given all the disadvantages of bond spreads, in this research, the CDS spread will be used as a proxy for credit default risk.

Theoretically, credit spreads can be inferred from corporate bond markets. However, recent research finds that default losses account only for a small fraction of the credit spread (Anderson et al. (2000), Delianedis et al. (2001), Hung et al. (2003))

Having explained the reasons why the CDS spread is a better proxy for default risk compared to the bond spread, the literature related to the determinants of the CDS spread is now discussed. Researchers focused on the macroeconomic determinants of the CDS spread. Bystrom (2005) used the daily fluctuations of ITraxx Europe index to find that that the theoretical determinants were important in explaining the changes in the CDS spread. In addition, Duffie et al (1997), Duffee (1998), Lekkos et al. (2001) and In et al. (2003) among others, also find that the risk free rates and the term

structure of the risk free rate are important determinants of the credit spread. These results were supported by early findings conducted by Fama (1984) and Estrella et al. (1991).

Friedman et al. (1992) demonstrate in their research that interest rate variations are the strongest factor that impact and predict default risk. Furthermore, Longstaff et al. (1995) show evidence of a negative relationship between the probability of default and the interest rate level. The authors explain that higher interest rates cause the risk neutral drift of the company's value to go up, thus leading to a lower probability of default and consequently a narrow credit spread.

This negative relationship between credit spreads and interest rates was also studied and observed by Neal et al. (2000) and Bevan et al. (2000). Their results show a negative relationship between the credit spread and interest rates in the short run which eventually inverts into a positive relationship in the long run. Estrella et al. (1991), Fehle (2003) and In et al. (2003) and Kobor et al. (2005) all found a negative relationship between the credit spread, interest rate and the yield curve. In fact, during economic downturns or company insolvencies, the interest rate level tends to be low. Thus, if a yield curve was steeper than usual, this would indicate expectations of a better economic performance in the future. In addition, Freidman et al. (1998) also analyzed in their research the CDS spread and the business cycle. The authors demonstrate that credit default tends to increase in times of recessions. Their results indicate that variations in the business cycle tend to impact on the aggregate economy and investors behaviour, affecting therefore the level of defaults. Minton (1997) on

the other hand found that the yield curve had a positive relationship with the swap spread.

Stokes et al. (1998) prove from their research that inflation is another factor that greatly affects credit default risk through its impact on input and output prices. This implies that if a firm is facing higher costs as a result of inflation, it might find it hard to carry on with its daily business obligations and achieve the targeted profit. If inflation levels reach extreme levels, this may lead the company to default on its obligations; thus increasing default risk. Duffie et al. (2007) equally find that macroeconomic variables and industrial production growth tend to be great indicators for predicting and understanding the future fluctuations of credit risk. Similarly, Carling et al. (2007) show in their research that both macroeconomic and various financial ratio variables are essential in predicting and determining default risk. Tang et al. (2010)

Collin-Dufresne et al. (2001) focused on analysing bond spread instead of the CDS spread and found that financial leverage, volatility and the yield spread have a significant power in explaining the bond spread. Similarly, Campbell et al. (2003) and Cremers et al. (2004) use company bond spreads and find that volatility explains bond spreads. In a similar vain, Benkert (2004) used various volatility measures to analyze the CDS spread, and found the presence of a negative relationship.

A new stream of research incorporated credit ratings as determinants of the CDS spread fluctuations. Researchers including Hull et al. (2004), Cossin and al. (2002), Fabozzi *et al*. (2007) and Karagozoglu *et al*. (2010) all investigated the relationship

between credit ratings and CDS spreads and came to the conclusion that ratings were important in explaining the credit risk. In addition, the sovereign credit default swap (CDS) spread has been used in order to analyse credit risk and its pricing (Alper et al., 2012).

3. Data

The data set used in this research provides great insights into analysing the behaviour of the CDS spread prior, during and after the financial crisis. The data ranges from January 2004 up to April 2011. In addition, while most of the existing literature studies CDS spreads in levels, thus giving little consideration to the non-stationarity issue and the consequent spurious regressions problem. We will analyse the changes in the CDS spread rather than focusing on CDS in terms of levels

This research uses monthly 5 Year Credit Default Swap (CDS) Index as a proxy for credit risk. The data covers the overall banking sector in the UK, denominated in the British Pound currency (£) and expressed in basis points. For the purpose of analyses, the CDS data has been converted to natural logarithms. The analyses are restricted to indices with a five year maturity as they are the most liquid type of credit default swaps (CDS). The CDS data was obtained from Thomson Reuters Datastream, the world's largest financial statistical database, and published by the Credit Market Analysis (CMA) Group, the world's leading source of independent over the counter market data. The data covers the period from January 2004, when the CDS bank sector data was first launched by the CMA group, and ends in April 2011. This data set is ideal as it allows the analysis of the CDS spread not only before and after the financial crisis, but it also captures the period when the credit market was booming.

The UK house price Index data was obtained from Datastream Thompson Reuters and published by Nationwide Anglia Building Society under the reference "Nationwide House Price Index". It has the following characteristics: monthly average; British Pound currency, it is seasonally adjusted and ranging from the period January 2004 and April 2011. Furthermore, similarly to the CDS spread, the house price index data was converted to natural logarithms. Given that houses are not similar, representing a simple average of all house prices in a specific sample would lead to incoherent inferences and incorrect result interpretation. In an ideal situation, the average price should be estimated for a fixed, representative sample of houses, all of which are resold on the open market on monthly basis. Nevertheless, in reality this is impossible to achieve. For this reason Nationwide adopts a statistical method, which simulates the ideal procedure. This allows Nationwide to use the constantly varying sample of mortgage approvals to produce a consistent index. Any changes are simply due to price fluctuations and not due to changes in the balance of the sample.

The yield spread variable is calculated as the yield of a 30 year UK Treasury bond minus 3 month UK Treasury bill. The data for both variables is monthly, ranging from January 2004 until April 2011. This can be represented as follows:

Yield Spread = Yield on a 30 year Treasury Bond – Yield on a 3 Month Treasury Note.

The 3 month Treasury bill has been obtained from Datastream Thompson Reuters and published by the UK Office of National Statistics. It represents the interest on US dollar deposits in London (3 months). It is the middle market closing rate (i.e. the mean of bid and offer) as recorded by the Bank of England in the late afternoon.

The 30 years Treasury bond yield data has also been obtained from Datastream Thompson Reuters. It represents the UK Government 30 years benchmark bid yield, denominated in the UK Sterling currency.

The liquidity spread in this research is represented by TED. The acronym formed from *T-Bill* and *ED*, the ticker symbol for the Eurodollar futures contract. Instead of the Eurodollar, we use the LIBOR rate. The data has been obtained from Thompson Reuters. It is monthly, ranging from January 2004 until April 2011. TED is defined as follows:

$$TED = 3MonthLIBOR - 3MonthUKTreasuryBill$$

Given that this research focuses on the UK financial market, FTSE 100 index was chosen as a benchmark for stock prices. The FTSE 100 is a share index of the 100 most highly capitalized UK companies listed on the London Stock Exchange The data was obtained from Thompson Reuters Datastream. It is monthly, ranging from January 2004 to April 2011 and expressed in basis points.

Table 1: Explanatory variables and expected signs on the coefficients:

Variables	**Type of the Variable**	**Description of the variables**	**Predicted Sign**
ln(CDS)	Dependant	Natural logarithm of the CDS	
ln(HP)	Explanatory	Natural logarithm of the House Price Index	(-)
Yield Spread	Explanatory	30 Year Treasury Bond - 3 Month Treasury Bill	(-)
TED	Explanatory	3 Month LIBOR – 3 Month Treasury Bill	(+)
ln(FTSE100)	Explanatory	Natural logarithm of the FTSE100 Stock Price Index.	(+)

3.1 Descriptive Statistics:

UK CDS spread:

It can be observed from figure 1, that before July 2007, before the crisis began, the CDS spread was very low, averaging 13 basis points. The reason why the level of the CDS spread was not high prior the financial crisis was due to the low perception of credit default risk in the financial system. However, in July 2007, the CDS spread started to dramatically increase, going up from 9bps in July 2007 to 176 bps in March 2008 and peaking in March 2009 at 200bps. The dramatic and sudden increase in the CDS spread was a reflection of the severe subprime mortgage crisis that affected the financial system. In fact, the period between July 2007 and March 2009 was marked by the bankruptcy of large investment banks, including AIG, Lehman Brothers, and Bear Sterns among other major banks that threatened the stability of the overall financial system.

In February 2011, the CDS spread for the UK banking sector averaged 156bp. Thus, although the level of credit risk started to gradually decrease after March 2009 as a result of the slow economic recovery, its level was still high relative to the period preceding the financial crisis. This reflects the vulnerability of the financial system to external shocks.

UK House Price Index:

From figure 1 presented below, it can be clearly observed that during the period before October 2007, the UK house price index was gradually increasing from 273 bps in January 2004 to 371bps in October 2007. That represents an almost 100bps increase over a 3 years period. However, with the beginning of the subprime

mortgage crisis, the house prices index started to drastically fall, attaining 300bps in February 2009. Although, the house price index started to progressively increase again; reaching 337bps in June 2010, it fell again to 330bps in March 2011. Thus, despite the increase in house price index after the crisis, the level of the index never came back to its peak level of 371bps that was recorded just before the beginning of the financial crisis.

The fluctuation in the house price index clearly follows the economic logic of the events. Before the financial crisis, consumers were heavily borrowing due to the low interest rates and the huge foreign funding inflow. This has created a massive credit expansion and easy borrowing to low income consumers, leading to a housing boom in the economy. In fact, most of the borrowers had very low credit ratings and were still able to obtain mortgages. Furthermore, given the increased securitization activities in the financial system, banks were not very concerned about the quality of borrowers. First, thanks to sophisticated financial engineering practises and securitization activities, banks which were granting mortgages were under no obligation to hold to the mortgages for an average period of 20 years in order to get their money back, plus interest. All banks had to do was repackage the mortgage obligations into synthetic structured products such as Mortgage Backed Securities (MBS), Retail Mortgage Backed Securities (RMBS) or Collateralized Debt Obligations (CDS) among other more complex structured products.

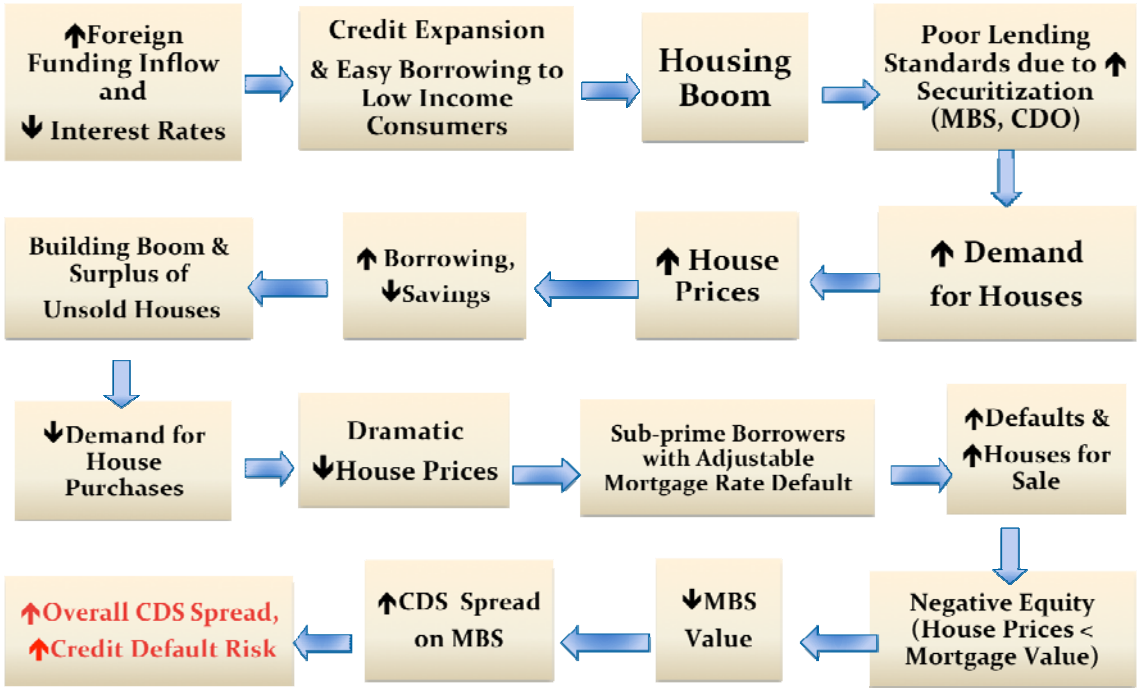
The repackaging process of mortgages and other instruments was achieved with the help of credit rating agencies and Special Purpose Vehicules (SPV) which effectively trenched the MBS and RMBs, reselling it to other parties who were better equipped to

handle the risk. This has allowed a better risk diversification but has also resulted in low lending standards. Given, the easy borrowing in the financial market, the demand for real estate purchases dramatically increased, pushing up the house prices. As a result, borrowing increased and savings decreased. This has in turn lead to a housing boom and a surplus of unsold houses, driving the real estate prices down. This period corresponds to the beginning of the sub prime mortgage crisis.

At the beginning of 2007, sub-prime mortgage borrowers started heavily defaulting on their mortgage obligations and given that house prices were already decreasing, banks were no longer able to recover their loans by reselling the properties. It should be noted that financial institutions were not the only parties who suffered from the sub-prime mortgage crisis. Primary borrowers who defaulted were also in distress as a result of loosing their primary residence. In addition, there was another class of borrowers who were taking mortgage loans to later resale it into the secondary market, when real estate prices were higher, with the aim to achieve a profit (also referred to as remortgaging activities). Following the crisis, these borrowers were now holding negative equity. This has caused a further increase in the number of defaults and houses for sale. Thus, all securitized products were drastically falling in value, with most of the mezzanine tranches defaulting first. In addition, the CDS spread on Mortgage Backed Securities (MBS) was extremely high, leading to an overall increase in the CDS spread.

The high CDS spread was a reflection of the rising default risk in the financial system. The transmission channel leading to the credit crisis is explained below, in Flow Chart 1.

Flow Chart 1: The Transmission Channel Leading to the Credit Crisis.



Yield Spread:

From figure 1 below, the yield spread analysis can be split in to two different time periods: the period preceding the financial crisis (January 2004 until August 2007), and the period following the financial crisis (August 2007 to April 2011).

In the first period, before the crisis emerged, the yield curve was downward sloping, and progressively decreasing. However, from the beginning of the financial crisis, the direction of the yield curve has changed, becoming upward sloping. The yield spread can increase either as a result of higher yields being offered on long term bonds (yield on the 30 year Treasury bond) or due to the decrease on short term bond yields (yield on 3 month Treasury bond).

The yield on the long term bond increases following the higher perception of credit risk in the government sector resulting from the enormous fiscal deficit. The higher Sovereign credit risk gets later transmitted to the private sector given the close linkage between the government and private financial institutions. In addition, inflation rate is another factor that could have impacted on the shape of the yield curve. A higher inflation risk would lead to an increase in the yield of the long term bond. Furthermore, it can be observed from figure 1 that the yield curve steepened. This corresponds to the beginning of the credit crises, while from March 2009 onwards, the yield curve started to flatten, reflecting the beginning of an economic recovery.

Stock Prices:

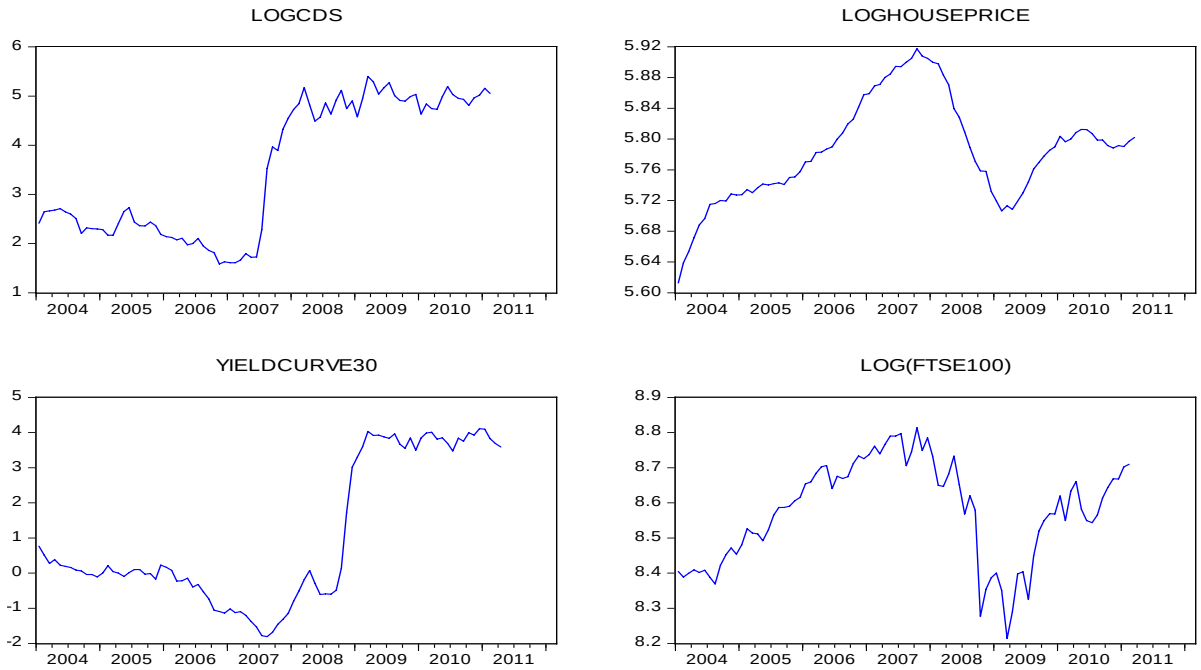
From figure 1 below, it can be observed that during the period preceding the financial crisis, the FTSE 100 index was gradually increasing, reflecting a constantly improving economic performance of the UK 100 most capitalized companies. After August 2007, with the beginning of the financial crisis, the FTSE 100 index started to drastically fall, reflecting deteriorating market conditions. This was the result of decreasing stock prices of major UK companies and financial institutions. Given that most of the companies are interlinked, defaults in one financial institution may lead to spill over effects in other banks, companies and sectors. This was exactly what happened in the recent financial crises. With the beginning of the sub-prime mortgage crisis, major investment banks collapsed, investors lost confidence in the financial system and started heavily withdrawing all their funds. This has caused bank runs (example of Northern Rock bank) and the drying up of liquidity in the financial sector. Many banks went bankrupt as they faced liquidity crisis and were unable to

repay their borrowers. This later turned into global financial crises affecting not only the housing and financial sector, but also causing distress in other sectors as people lost their jobs and were unable to cope with daily expenditures.

TED spread:

Figure 1 indicates the fluctuation of the liquidity spread between January 2004 and the April 2011, in the UK banking sector. Following the financial crisis, liquidity in the financial markets started to considerably decrease. The dramatic collapse in liquidity was recorded around September 2008, when capital markets froze and investors started withdrawing their investments from financial institutions simultaneously; thus, causing banks runs.

Figure 1: Graphical illustration of the non-stationarity of the CDS spread, House Price Index, Yield Spread and the FTSE 100 index series.



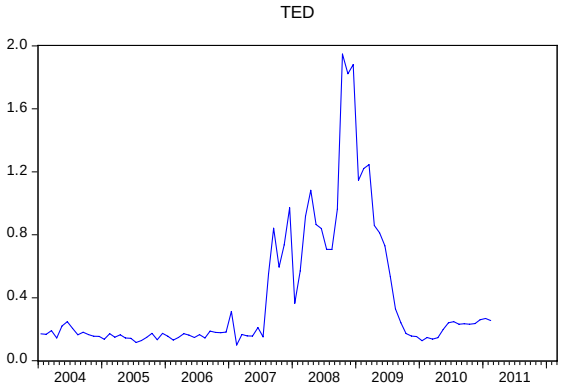


Table 2: Summarizing the descriptive statistics of the CDS spread and its determinants:

	Log(CDS)	Log(House Price Index)	Yield Spread	Log(FTSE100)	TED
Mean	3.510696	5.784637	1.000155	8.576807	0.396163
Median	3.126910	5.786867	0.082315	8.588579	0.184820
Std. Dev.	1.371441	0.066932	2.041531	0.142085	0.413779
Minimum value	1.584120	5.612982	-1.812130	8.214414	0.100070
Maximum value	5.396448	5.917414	4.108360	8.813519	1.946920

From Table 2, column 1 indicates the variations of the CDS spread between January 2004 and April 2011. The output of descriptive statistics indicates that the CDS spread index ranges from a minimum value of 1.584120 bps and a maximum value of 5.396448 bps, with the overall mean of 3.510696 reflecting the high default risk.

Column 2 describes the variations of the UK house price index between January 2004 and April 2011. The output of descriptive statistics indicates that the UK house price index ranges from a minimum value of 5.612982 bps and a maximum of 5.917414 bps, with an overall mean of 5.784637.

Column 3 describes the variations of the yield spread between January 2004 and April 2011. The output of descriptive statistics indicates that the yield spread ranges from a

minimum value of -1.812130 and a maximum of 4.108360, with the overall mean of approximately 1.

Column 4 describes the variations of the FTSE 100 index between January 2004 and April 2011. The output of descriptive statistics indicates that the FTSE 100 index ranges from a minimum value of 8.214414 bps and a maximum of 8.813519 bps, with the overall mean of 8.576807.

Column 5 describes the variations of the TED between January 2004 and April 2011. The output of descriptive statistics indicates that the TED spread ranges from a minimum value of 0.100070 and a maximum of 1.946920 with the overall mean of 0.396163.

4. Methodology

In this section, the three methods have been used in this research will be discussed. The Johansen method and the Dynamic Ordinary Least Squares (DOLS) approach were adopted in order to investigate which of our variables has the strongest capacity to explain the behaviour of the CDS spread. Both of the previously mentioned methods reflect the long run relationship between the variables. In order to analyse the short run effects, we use the structural VAR model (SVAR).

First, it is important to start with cointegration analyses which will be used in order to identify the sort of relationship that exists between the CDS spread, house price index, yield spread, TED and stock prices. Each of these variables represents different markets: the credit, housing, monetary and financial markets.

Before beginning the analyses, it is essential to test each of the variables used in this research for stationarity. The stationarity test implies testing whether a unit root exists in the times series data. There are various tests that exist to indentify presence of a unit root. In this paper, we have used the Augmented Dickey-Fuller Test (ADF). Figure 1 above clearly illustrates that the CDS, House Price Index, Yield Spread and the FTSE 100 index are all non-stationary, i.e. all of the previously mentioned variables do not have a constant mean, a constant variance and constant auto-covariances for each given lag.

4.1 Augmented Dickey-Fuller (ADF) Unit Root Test:

As it was previously mentioned the non stationarity phenomenon is very common in time series data, thus, in order to avoid the various problems that non stationarity may have on the characteristic and properties of the series and most importantly in order to eliminate the problem of spurious regression it is essential to correct the non stationarity problem through the process of differencing or detrending, depending on the model. In this section a unit root test will be applied to the Credit Default Swap (CDS) spread using the Augmented Dickey-Fuller (ADF) test as follows:

$$CDS_t = \rho CDS_{t-1} + \varepsilon_t \qquad (8)$$

Where: ρ is the parameter to be estimated and ε_t represents a white noise.

If $|p| \geq 1$, then CDS in a non stationary series and the variance of CDS increases with time and approaches to infinity. If on the other hand $|\rho| < 1$, then the CDS time series are trend stationary. Accordingly, the hypothesis of stationarity can be tested by investigating whether the absolute value of ρ is strictly less than 1.

The null and the alternative hypothesis under the Augmented Dickey-Fuller test are the following:

$$H_0 : \rho = 1$$
$$H_1 : \rho < 1$$

The ADF test builds a parametric correction for higher correlation by assuming that the CDS series follows an Auto Regressive AR(*p)* process and adding p lagged difference terms of the CDS variable to the right hand side of the test regression:

$$CDS_t = \alpha + \beta CDS_{t-1} + \gamma \sum_{i=1}^{n} CDS_{t-i} + \varepsilon_t \qquad (9)$$

This augmented specification represented in equation (9) is utilized in order to test the null and the alternative hypothesis of ADF test based on the *t* ratio. The results from the Augmented Dickey and Fuller Test and the Elliott-Rothenberg-Stock DF-GLS test are summarized in Table 3 as follows:

Table 3.1: ADF and DF-GLS Unit Root Tests Results:

Variables	ADF (τ)	ADF (μ)	DF – GLS	Inference on Integration
ln(CDS)	- 0.586490	-1.998058	-0.398609	I(1)
ln(House Price Index)	-2.237199	-2.314131	-0.909877	I(1)
Yield Spread	-0.870173	-1.874629	-0.886743	I(1)
TED	-2.135415	-2.118459	-2.011065	I(1)
ln(FTSE 100)	-1.934734	-1.922138	-1.274281	I(1)

Notes for Table 3.1: (a) ADF(τ) and ADF(μ) are tests of the unit root null hypothesis where the test regression contains a constant and no deterministic components, and a constant and a trend, respectively ***(b)*** The asymptotic 1 per cent critical values for the ADF test are: -3.51 (with constant) and -4.07 (with a constant and a linear trend). The critical value at 1 percent level for the Elliott-Rothenberg-Stock DF-GLS, with a constant is: -2.60.

The Dickey and Fuller Test was conducted with both a constant and no deterministic component, and with a constant and a trend. This is presented in the first two columns of Table 6.1. The results indicate that at 1% level, all the variables ln(CDS), ln (House

Price Index), Yield Spread, TED as well as the ln(FTSE 100)) contain a unit root and are therefore non-stationary. When the times series were tested using Elliott-Rothenberg-Stock DF-GLS, similarly to the ADF test output, the results proved to be the same, confirming the existence of a unit root and subsequent non-stationarity in our variables. The last column of Table 3.1 shows the order of integration of variables. Due the presence of the unit root, all the variables are cointegrated of order 1.

Table 3.2 below indicates that after taking ln(CDS), Yield Spread, TED and ln (FTSE 100) in first differences, the data becomes stationary; thus, integrated of order zero. These variables are statistically significant at 1% level, meaning that we can safely reject the null hypothesis of a unit root. The only variable that remains non-stationary is ln(House Price Index). The non-stationarity of this variable can be explained by the structural break that occurred during the financial crisis, Zivot and Andrews Unit Root test will be conducted on ln(House Price Index).

Table 3.2: ADF and DF-GLS Unit Root Tests Results when the data is taken in first differences:

Variables	ADF (τ)	ADF (μ)	DF – GLS	Inference on Integration
Δln(CDS)	-7.275264**	-7.251929**	-6.158968**	I(0)
Δln(House Price Index)	-2.710530	-2.544836	-1.134453	I(1)
ΔYield Spread	-5.340040**	-5.348152**	-4.386833**	I(0)
TED	-9.310985**	-9.270561**	-9.365047**	
Δln(FTSE 100)	-8.729111**	-8.682519**	-8.158638**	I(0)

Notes for Table 3.2: ** indicate t-values being significant at 1% level, implying no unit root in the series. ***(a)*** ADF(τ) and ADF(μ) are tests of the unit root null hypothesis where the test regression contains a constant and no deterministic components, and a constant and a trend, respectively ***(b)*** The asymptotic 1 per cent critical values for the ADF test are: -3.51 (with constant) and -4.07 (with a constant and a linear trend). The critical value at 1 percent level for the Elliott-Rothenberg-Stock DF-GLS, with a constant is: - 2.59.

4.2 Zivot and Andrews Unit Root Test:

The Zivot and Andrews Unit Root is performed by allowing a break at an unknown point in either the intercept, the linear trend or in both. The test is based upon the recursive estimation of a test regression. The test statistic is interpreted as the minimum t-statistic of the coefficient of the lagged endogenous variable. The outcome of the Zivot-Andrews Unit Root is presented in Table 4.

From Table 4, it can be clearly observed that the variables ln(CDS), ln(House price Index), and the Yield Spread are all stationary. Both ln(CDS) and the Yield Spread are significant at 1% level, it is therefore possible to reject the null hypothesis of a presence of a unit root. Similarly, ln(House Price Index) is significant at a 5% level, therefore it is possible to reject the null hypotheses. The only variable that contains a unit root even after allowing for a structural break is ln(FTSE 100). After conducting the Zivot and Andrews unit root for dln(FTSE 100), the series is now stationary at 1% level. This is demonstrated in Table 5.

Table 4: Zivot-Andrews Unit Root Test

Variables	Test Statistics	Structural Break Point
Ln(CDS)	-7.50618**	August 2008
Ln(House Price Index)	-5.08262*	March 2008
Yield Spread	-5.69783**	October 2008
Ln(FTSE 100)	-3.27453	September 2009
Δln(FTSE 100)	-5.99628**	April 2009

Note: Critical Values at 1% level: -5.57 and at 5% level: -5.08

Given the integrated nature of the time series data, in the next section we will test whether there exists a cointegrating relationship between ln(CDS), ln(House Price Index), Yield Spread and ln(FTSE100), along with considering TED.

4.3 Johansen Cointegration Test:

In this research we will be using the Johansen cointegration test in order to identify the number of cointegrating relationships. Before conducting this test, we first need to establish the optimal number of lags to be used in our model. For this purpose, we use the VAR Lag Order Selection Criteria. The results are presented in below Table 5.

Table 5: VAR Lag Order Selection

Lag	LR	FPE	AIC	HQ
0	NA	4.21e-05	4.21e-05	1.324539
1	819.1956	6.26e-10	6.26e-10	-9.596274
2	48.53018	4.64e-10	4.64e-10	-9.703453
3	39.48386*	3.81e-10*	3.81e-10*	-9.713028*
4	19.63113	4.23e-10	4.23e-10	-9.428607
5	19.30998	4.67e-10	4.67e-10	-9.162545
6	14.97610	5.54e-10	5.54e-10	-8.839041
7	15.83245	6.40e-10	6.40e-10	-8.558750
8	16.84717	7.17e-10	7.17e-10	-8.333392
9	19.20207	7.48e-10	7.48e-10	-8.208600
10	19.42243	7.61e-10	7.61e-10	-8.146374

Notes: * indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, HQ: Hannan-Quinn information criterion.

From Table 5, It can be clearly observed that Sequential Modified LR test Statistic, Final prediction error, Akaike information criterion as well as the Hannan-Quinn information criterion all indicate that the optimal lag length for our VAR model is 3 lags.

We estimate a VAR model with 3 lags as found to be optimal by the VAR Lag Selection Criteria (demonstrated in Table 5). The Johansen Test results show evidence that prove the existence of one cointegrating relation, using a linear model (with intercept and trend).

Table 6: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.343598	71.73126	63.87610	0.0094
At most 1	0.197909	37.21076	42.91525	0.1655
At most 2	0.141312	19.12702	25.87211	0.2733
At most 3	0.077721	6.634399	12.51798	0.3842

Notes: Trace test indicates 1 cointegrating eqn(s) at the 0.05 level, * denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values.

From Table 6, the Trace Test statistics indicates the existence of one cointegrating equations at 5% significance level. Given that the null r =1 is rejected at a 5% significance level means that there is one meaningful long-run relations between these ln(CDS), ln(House Price Index), Yield Spread and ln(FTSE 100 index).

The normalized cointegrating equation can be written as follows:

$$\ln CDS_t = 229 - 37.98 \ln HP_t - 1.20 YS_t - 1.38 \ln FTSE_t + 0.15T \qquad (14)$$

[3.989] [3.605] [0.465] [5.315]

Where **CDS**: the Credit Default Swap Spread, **HP**: House Price Index, **YS**: Yield Spread, **FTSE**: FTSE 100 Index, **T**: Time trend. It should be noted that the CDS spread; the house price index and the FTSE 100 index are all taken in natural logarithms.

In Equation (14), figures in brackets represent the t-values. Almost all the key variables included in the normalised cointegrating relations are statistically significant; this refers to the ln(House Price Index) and Yield Spread and the Time Trend. The only variable that does not appear to be statistically significant is the ln(FTSE 100). Furthermore, the signs of the coefficients turned out to be as per the apriori expectation. The long-run relationship equation can be explained as follows:

First, an increase (decrease) in the house price index by 1 percent is associated with a decrease (increase) in the credit default swap spread by about up to 37.98 percent in the sample period. Furthermore, an increase (decrease) in the yield spread by 1 percent is associated with a 1.20 decrease (increase) in the credit default swap spread. Finally, an increase (decrease) in the FTSE 100 index by 1 percent is associated with a 1.38 percent decrease (increase) in the CDS spread. However, given that the t- statistic for the FTSE 100 index is not significant, our aim is to focus on the impact of the house price index and the yield spread on the CDS spread.

From equation (14), it can be clearly observed that there is a negative relationship between the CDS spread and the house price index as expected. In fact, this follows the economic logic. CDS contracts work as insurance contracts. The CDS spread is the price that the protection buyer pays to the protection seller in order to benefit from a guarantee that in case of a default, the holder of the CDS will be covered against a default. Thus, as risk increases, the premium on the CDS contract also rises in order to reflect the higher risk. Banks and other financial institutions that were issuing CDS contracts backed on mortgages priced their CDS contracts based on house prices. In

fact, when house prices were high, even if a lender defaulted on his/her payment, it was relatively easy for the bank to recover the initial cost of the property given the continuous rising trend in the house prices. Thus, the CDS spread was narrow reflecting a low default risk. However at the end of 2006, with the beginning of the housing bubble, when house prices started to drastically collapse, the number of defaults suddenly raised. This was reflected in a much larger CDS spreads. In equation (14), the long run equation confirms this negative relationship between the CDS spread and the house price index.

Another observation that can be derived from Equation (14) is the negative relationship between the yield spread and the CDS spread. As it was previously mentioned in the literature review, the steepness of the yield curve indicates future economic activity. Thus, the steeper is the yield curve; the higher is the expected future interest rate. In fact, in times of a recession or when firms start defaulting, interest rates tend to be very low, while the CDS spread tends to increase given the higher credit risk. The higher credit risk directly impacts on the CDS spread as it is now more expensive for investors to benefit from a protection against default. This is reflected in a rising CDS spread. Therefore, there should be a negative relationship between the yield curve and the CDS spread. This negative relationship between the slope of the term structure and the swap spreads was empirically supported by Fehle (2003), In et al. (2003) and Kobor et al. (2005), Fama (1984) and Estrella and Hardouvelis (1991) among others. Another research that supports this negative relationship between swap spreads and the slope of the risk free term structure was found by Friedman and Kuttner (1992). The authors explained that the slope of the risk-free term structure was found to be pro-cyclical while the credit spreads counter-

cyclical, for this reason there should be a negative relationship between swap spreads and the slope of the risk-free term structure.

The results obtained from the Johansen's approach are summarized in table 7.

Table 7: Determinants of the CDS spread using the Johansen's Approach:

	Model 1	Model 2	Model 3	Model 4	Model 5
Log (House Price Index)	-16.16920 [5.99389]**	- 43.19819 [4.94263]**	- 37.97884 [3.98866]**	-12.81836 [5.42143]**	-12.31915 [2.31267]**
Yield Spread		- 1.201765 [3.09413]**	-1.204231 [3.60466]**		
TED				0.370977 [0.085679]	0.935764 [1.84912]
Log (FTSE100)			-1.379733 [0.46549]		0.245253 [0.09714]
Trend	0.055161 [8.23317]**	0.157168 [4.69568]**	0.151729 [5.31507]**	0.050003 [8.58935]**	0.048939 [9.07686]**
Constant	94.68693	247.7430	229.6091	75.36537	70.18846

Note: ** indicate significance at 1% level, * indicate significance at 5% level.

When we estimate the CDS determinants by using the TED variable instead of the yield spread, our model remains robust; thus, showing a negative relationship between the house price index and the CDS spread. However, both TED spread and the FTSE 100 index turn out to be insignificant.

Given the long-run relation derived in equation (14), it is now important to formulate a short-run model. This can be achieved by employing the Vector Error Correction Model (VECM). While deriving the short-term equation, the residuals obtained from the long-term relationship are incorporated into the dynamic of the short-term relationship to obtain the equilibrium level.

$$\Delta \ln CDS_t = 0.43 \ln CDS_{t-1} - 0.18 \ln CDS_{t-2} + 0.39 \ln CDS_{t-3} - 2.56 \ln HP_{t-1} - 3.30 \ln HP_{t-2} + 2.26 \ln HP_{t-3} +$$
[3.36706] [-1.29722] [2.76105] [0.67165] [-2.36137] [0.59556]

$$+ 0.02 TS_{t-1} - 0.13 TS_{t-2} + 0.17 TS_{t-3} + 1.13 \ln FTSE_{t-1} + 0.50 \ln FTSE_{t-2} + 1.27 \ln FTSE_{t-3} + \qquad (15)$$
[0.16184] [-1.13510] [1.61058] [1.97484] [0.83069] [2.08716]

It can be observed from equation (15) that the t-values are not always significant for each lagged value of our variables. This indicates that there is no equilibrium in the short run between Credit Default Swap spread (CDS), the House price Index (HP), the Yield Spread (SP) and the FTSE 100. In fact, the only variables that appear to be statistically significant from equation (15) are: $\ln CDS_{t-1}$, $\ln CDS_{t-3}$, $\ln HP_{t-2}$ and $\ln FTSE_{t-3}$. The value of t-statistics of all other variables is less than 2, and is therefore not significant. The fact that there is no adjustment in the short run equation and it follows the logic of the real CDS spread movements. In fact, the CDS spread might be extremely sensitive to factors such as unexpected changes in the financial market, sudden changes in the housing market, or fluctuations in the interest rates and stock markets. Thus, possible equilibrium can be only achieved in the long run as it may take a considerable time for the CDS spread to adjust and stabilize.

4.4 Stock Watson's Dynamic OLS Model

Stock and Watson (1993) introduced the dynamic OLS (DOLS) method that allows for variables integrated of alternative orders (i.e. a higher order of integration) and deals with the issue of simultaneity that may arise amongst the regressors. The DOLS approach is considered to be a more comprehensive method than the OLS as it has the ability to cope with small sample and dynamic sources of bias. The inconveniency of the Johansen approach is that the parameter estimates in one equation tend to be influenced by any misspecification that may exist in other equations. Therefore, the outcome may lead to wrong inferences.

The Stock Watson DOLS method of estimation corrects for regressor endogeneity by including leads and lags of first differences of the regressors, and for serially correlated errors by a GLS procedure. Furthermore, it has the same asymptotic

optimality properties as the Johansen method (Al-Azzam et al. (1999)). The DOLS method operates by augmenting the cointegrating regression with lags and leads of ΔX_t so that the resulting cointegrating equation error term is orthogonal to the entire history of the stochastic regressor innovations. This can be demonstrated in the following equation:

$$CDS_t = X_t'\beta + D_{1t}'\gamma_1 + \sum_{j=-q}^{r} \Delta X_{t+}'_j \delta + \upsilon_{1t}$$

Under the assumption that adding q lags and r leads of the differenced regressors soaks up all of the long-run correlation between u_{1t} and u_{2t}. $X_{t+}'_j$ is the vector of independent variables, D_{1t} represents a drift.

Having conducted the Johansen cointegration method in the first part of this research; it is now essential to conduct a robustness check of our results. For this purpose, the dynamic OLS method will be implemented and the outcome will be analyzed.

Table 8: Determinants of the CDS spread using the DOLS Method:

	Model 1	Model 2	Model 3	Model 4
Log (House Price Index)	-14.02065 [9.176418]**	-42.64619 [6.070436]**	-23.39485 [2.040168]**	-25.59222 [2.987228]**
Yield Spread		-1.162395 [4.160006]**	-0.402860 [0.771487]	0.025576 [0.059925]
TED			1.172692 [1.079357]	2.158376 [2.310708]**
Log (FTSE100)				6.649284 [3.060539]**
Trend	0.053776 [15.35852]**	0.152989 [6.279349]**	0.084244 [1.916873]	0.051900 [1.421926]
Constant	82.53469 [9.362419]**	245.3135 [6.139234]**	135.6079 [2.075008]*	91.70514 [1.659310]

Table 8 shows the outcome from the Dynamic Stock Watson's OLS method. The results indicate a negative and significant relationship between the CDS spread and the house price index. The same result was obtained with the Johansen's method. Thus, as house prices go down, the CDS spread goes up, reflecting the higher credit

risk as previously discussed. Once the liquidity spread (TED) and the FTSE 100 index are added to the model, the yield spread turns out to be insignificant while both TED and the FTSE 100 are positive and significant. The positive relationship between the TED spread and the CDS spread follows the economic logic. In fact, when liquidity is high in the financial market, banks tend to lend more to subprime borrowers; thus increasing credit risk and the overall CDS spread. Furthermore, the CDS spread and FTSE 100 index are also positively related. As the stock index increases, both banks' capital and its borrowing capacity rises, resulting in a higher credit risk and wider spread. Having analysed the CDS determinants in the long run using both the Johansen's and the Dynamic Stock Watson's OLS method, in the next section we will look at the short run determinants of the CDS spread using a structural VAR model.

4.5 The Structural VAR Method

After establishing the type of variables that are effective in explaining the CDS spread in the long run; it is now essential to analyse the significance of these CDS determinants in the short run. For this purpose, the structural VAR method is implemented by exploring the degree of interdependence between the CDS spread and the house price index, yield spread, TED Spread (liquidity), and the FTSE 100 index.

The short run analysis can be achieved by undertaking impulse response based shock analysis via a vector autoregression (VAR) exercise which serves as a great tool to uncover the mean effects. The main purpose of structural VAR (SVAR) estimation is to obtain non-recursive orthogonalisation of the error terms for impulse response analysis. A restricted structural VAR model will define the relationship between the

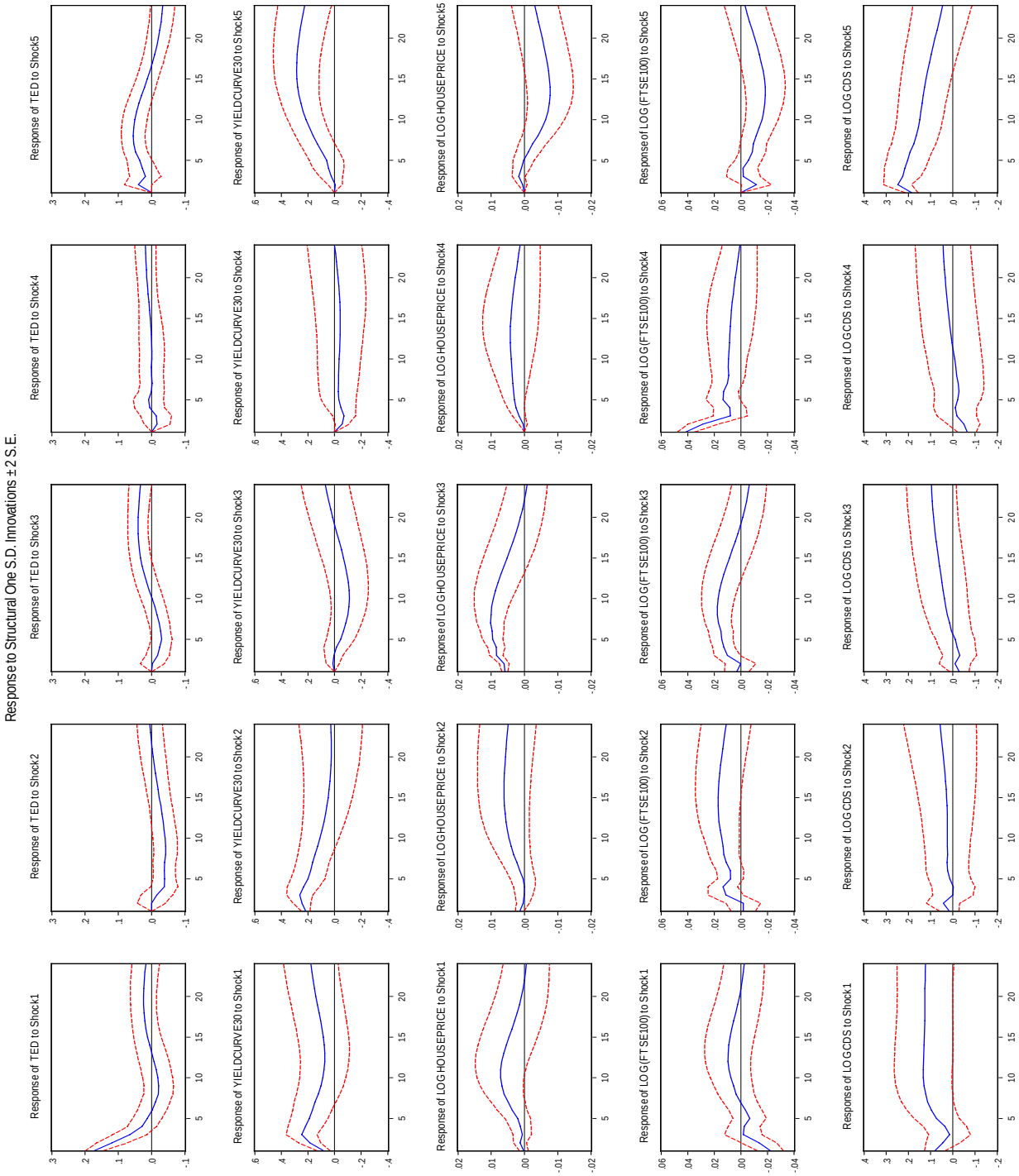
VAR residuals; that is the unexpected shocks, and the structural shocks, which are exogenous and uncorrelated with each other. This can be defined as follows:

$Ae_t = Be_t$, with: $E[u_t u_t'] = I$

Where: u_t is the vector of structural shocks, while *A* and *B* are the matrices that define the linear relationship between the structural shocks and the VAR residuals e_t.

The optimal lag selection was found to be 3 for the VAR model (see table 6). The structural VAR model is formulated with the following ordering of the endogenous variables: TED spread, Yield Spread, LOG (House Price Index), LOG (FTSE 100) and LOG (CDS spread). The reason behind this specific ordering stems from the theoretical ordering of the variables that should run from the more exogenous to the less exogenous variable. In fact, both the liquidity spread as well as the yield spread are likely to be determined by the monetary policy and the state of the economy prevailing during the specific period. However, the house price index, FTSE 100 index and the CDS spread are less exogenous than the TED spread and the yield spread. Thus, they are placed later in the ordering. The CDS spread in likely to be affected by all of the previously included variables, thus; it comes last in the ordering. Figure 2 shows the outcome from the structural VAR model. It appears that the only variable that is significant in the short run is the liquidity premium (TED spread). This can be observed from the first column, fourth row of figure 2. It indicates that the CDS spread responds positively to a shock in the liquidity premium. All the rest of variables that were significant under both the Johansen's and the Dynamic Stock Watson's OLS methods do not seem to be able to explain the CDS spread in the short run. This can be explained by the time it takes for the CDS spread to adjust, which is only achievable in the long run.

Figure 2: The determinants of the CDS spread using Structural VAR model.



5. Conclusion

The deep and continuously worsening financial crisis caused a huge distress in the global economy. It also caused a loss of confidence between investors in the financial markets. In this research we analysed the factors that impact on the Credit Default Swap spread (CDS) in the UK banking sector and analysed the type of relationship that exists between the CDS spread, the house price index, the liquidity premium (TED), the yield spread and the FTSE 100 index. Each of these variables represents four different sectors, the credit market, the housing market, the money market and the stock market.

The first method that has been used in order to analyse the long run determinants of the CDS spread is the Johansen's method. We found strong evidence that suggests that the house price dynamics has been the key-driving factor behind the recent collapse of corporate CDS market influencing credit risk. In fact the findings prove that there exists a negative relationship between the CDS spread and the UK house price index. This explains the dramatic increase in the credit risk level following the collapse in real estate prices at the beginning of the crisis. In addition, the Johansen's method indicates a negative relationship between the CDS spread and the yield spread. This reflects investors' behaviour and their risk aversion following the financial crisis. Typically, as credit risk increases, investors will demand a higher yield as a compensation for bearing more risk and continue their investments activities.

The second method that has been used in order to analyse the CDS spread determinants in the long run is the Dynamic Stock Watson's OLS method. This

method confirms all of the previous findings from the Johansen's method. In fact, it indicates the presence of a negative relationship between the CDS spread and both the house price index and the yield spread. When the liquidity premium (TED) is used instead of the yield spread, all of the CDS spread determinants become significant. The house price index and the CDS spread remain negatively related and statistically significant. In addition, the liquidity spread (TED) indicates a positive and significant relationship. As liquidity goes up, banks tend to lend more to subprime borrowers; thus increasing credit risk and the overall CDS spread. The DOLS method results also show that the FTSE 100 index is positive and significant. Thus, as the stock index increases, both banks' capital and its borrowing capacity rises, resulting in a higher credit risk

In order to analyse the short run determinants of the CDS spread, we used the structural VAR model. The only variable that appeared to be significant is the liquidity spread (TED). The rest of the CDS spread determinants were insignificant. Both the credit sector and the housing market are strongly related. Thus, financial distress in the housing market is highly likely to transmit to the credit market and cause a contagion to other markets. In order for the CDS spread to adjust and reach an equilibrium level, a longer time period is required. Thus, possible equilibrium between the credit market, the housing market, the money and the stock market can only be achieved in the long run.

This research brings a new element to the existing literature by considering the house price as a CDS spread determinant. No previous research to our knowledge has conducted such analysis in the past. In addition, this research links the

macroeconomic market to the credit market and analysis the CDS spread in the UK banking sector not only in levels but also in changes, using appropriate econometric techniques for each series. Most of the past literature studied CDS spreads only in levels, thus giving little consideration to the non-stationarity issue, resulting in spurious regressions that tend to be very often present in time series data.

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