Determinants of the Sovereign Credit Default Swap Market

Felix Roelkens*
MSc in Business & Economics, Specialisation in Finance
Stockholm School of Economics

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Tutors:
Paolo Sodini, Department of Finance, Stockholm School of Economics
Patrick Augustin, Department of Finance, Stockholm School of Economics

Abstract: This thesis investigates the determinants of sovereign CDS market activity for a sample of 59 sovereigns during the period of 2008 to 2012. The results indicate that CDS market activity is linked to global and country-specific factors, namely investors' global risk perceptions, the global business climate, the global financial sector health, the volatility of the local business climate and the ability to pay back USD denominated debt. The impact of credit rating migrations is negligible. Furthermore, we find that global factors drive net demand for CDS protection while country-specific factors cause a reallocation of net demand for CDS protection.

Keywords: Sovereign Credit Default Swap, Trading Volume Determinants, Credit Ratings, Empirical Analysis, DTCC Trading Data

JEL Classification: F30, F34, G01, G12, G14, G15, H63

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* **Phone:** +49 178 197 4931 ǁ **E-Mail:** 40248@student.hhs.se ǀ felix.roelkens@gmail.com.

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List of Abbreviations

CBOE	Chicago Board Options Exchange
CCC	Central Counterparty Clearing
CCR	Comprehensive Credit Rating
CDS	Credit Default Swaps
CMA	Credit Market Analysis
CRSP	Center for Research in Security Prices
DTCC	Depository Trust & Clearing Corporation
EMEA	Europe, the Middle East and Africa
EU	European Union
GDP	Gross Domestic Product
IMF	International Monetary Fund
ISDA	International Swaps and Derivatives Association
MSCI	Morgan Stanley Capital International
OTC	Over-the-counter
S&P	Standard & Poor's
SDC	Sovereign Debt Crisis
SMC	Subprime Mortgage Crisis
TIW	Trade Information Warehouse
USD	US-Dollar
USA	United States of America
VIX	Volatility Index

1 Introduction

Escalating sovereign debt levels have become one of the most urging economic problems for a variety of governments, especially in Europe and North America. Since the offset of the subprime mortgage crisis (SMC) in 2008, sovereign debt levels have increased due to additional government sponsored spending programs and a continued lack of fiscal discipline, leading up to the still prevailing sovereign debt crisis (SDC). As the examples of Cyprus and Greece have shown, we have come to a point where member states of the European Union (EU) are not immune to becoming bankrupt. In addition to Cyprus and Greece, several other EU members are suffering from high debt levels. However, not only EU states are in a precarious situation but also the United States of America (USA). The country, which has been synonymous to economic power for more than a century, was at the verge of insolvency when it reached its debt ceiling on 16 May 2011. Three months later, the USA lost their AAA S&P credit rating on 5 August 2011. It was a powerful signal to investors that sovereign debt cannot be considered risk free anymore, even when issued by large and economically powerful countries.

JP Morgan created the first credit default swaps (CDS) in the early nineties and thereby facilitated the trading in corporate and sovereign credit risk. This was the initiation of the CDS market, an over-the-counter (OTC) derivative market where investors can buy default protection for both sovereign and corporate debt. Since then, CDS have become a prominent way for investors to engage in the transfer of default risk. Especially the sovereign CDS market has caught more and more attention due to the previously discussed developments. The example of Greece's credit event shows the importance of CDS for investors in practice. As Greece was opting for a voluntary restructuring, the International Swaps and Derivatives Association (ISDA) ruled that a credit event had occurred which triggered CDS payments to investors (Burne, 2012). In addition to hedging, CDS also allow investors to speculate, i.e. to short credit risk. The aggregate market statistics show that the importance of CDS has increased significantly over the last decade. The Bank for International Settlement reports that the CDS market increased from a total notional amount of $6 trillion in 2004 to a volume of $57 trillion in June 2008. In the aftermath of the recent SMC in 2008, it decreased gradually to a still significant number of 27 trillion in June 2012.[1] In recent years, academic interest in sovereign credit risk and CDS has increased as well. Much research focused on the determinants of CDS spreads and the link

[1] The underlying BIS data is available from 2004 on and can be found at http://www.bis.org/statistics/derstats.htm.

between sovereign credit risk and CDS (Augustin, 2012; Augustin and Tédongap, 2012; Ismailescu and Philips, 2012; Longstaff et al., 2011; Ang and Longstaff, 2011; Dieckmann and Plank, 2011; Ismailescu and Kazemi, 2010; Hilscher and Nosbusch, 2010). However, we know relatively little about the determinants of the CDS market in terms of market size and trading volumes. Two recent studies focus on the analysis of market size and trading volume of CDS. Oehmke and Zawadowski (2012) analyse the corporate CDS market while Berg and Streitz (2012) study the sovereign CDS market. The thesis aims to contribute to the existing research on sovereign CDS by expanding the analysis of Berg and Streitz (2012) to an extended sample of CDS data and introducing new explanatory factors in order to identify the drivers of market activity. The main idea of this thesis is to relate both global as well as country-specific factors to CDS market activity. Therefore, the research question in this paper is:

Which global and country-specific factors determine market size and trading volume in the sovereign CDS market?

In order to study the research question we apply static and dynamic panel regression analysis. In addition, we also use an event study in order to investigate the effect of credit rating migrations and outlook revisions on CDS market turnover. We derive the factors, which we use in the regression analysis from the existing literature on CDS spreads as well as from economic intuition. We identify the following factors: investors' global risk perceptions, the global business climate, the global financial sector health, the volatility of the local business climate and the ability to pay back USD denominated debt.

The results we retrieve can be summarised as follows: market activity is strongly associated with global and country-specific factors. Starting with global factors, we observe that investors' global risk perceptions are associated with market size for emerging countries and with market turnover for developed countries. The state of the global business cycle is linked to both changes in market size and market turnover. Global financial sector health is correlated to CDS market size and turnover. Turning to the country-specific factors, we observe that the ability to pay back dollar denominated debt and the volatility of the local business climate are significantly correlated to both CDS market size and turnover. We find that CDS spreads and CDS market turnover are closely tied while the link to market size is weak. With regard to credit rating migrations and outlook revisions, we find a significant influence of downgrades on market turnover. The effect is, however, small in terms of economic magnitude. The results with regard

to credit rating migrations and outlook revisions are confirmed by the event study. Altogether, one central finding is that global factors drive net demand for CDS protection while country-specific factors drive a reallocation of net demand for CDS protection across market participants. In addition, we find that global factors seem to be closer related to emerging countries than to developed countries and that both hedging and speculation are underlying drivers of CDS market activity.

The remainder of this paper is structured as follows: Section 2 gives a brief and comprehensive overview of CDS and the CDS market. Section 3 presents the literature review, topped off by the hypotheses and expected results. Section 4 deals with the data description. Section 5 covers the empirical analysis as well as the discussion followed by a critical evaluation as well as a conclusion in section 6 and 7.

2 Credit Default Swaps

2.1 The Design and Functioning of Credit Default Swaps

Generally speaking, a single-name CDS functions as an insurance contract against the event that either a firm or a sovereign defaults on its outstanding debt obligations. Both, the structure of the standard CDS contract for a sovereign and the structure of the standard CDS contract for a corporate share many features. Corporate and sovereign CDS differ in terms of market size and activity. Sovereigns are among the largest borrowers in the world and have greater liquidity and larger debt issues than corporates (Ismailescu and Philips, 2012). It is, however, sparsely researched, what drives both market size and activity. In the following, we will restrain the discussion to sovereign CDS. We have pointed out that CDS contracts function like an insurance contract. Hence, the holder of a CDS contract must also pay a fixed, periodic payment for this insurance, just like the holder of an insurance contract has to pay a regular premium. The CDS holder pays a fixed amount to the CDS issuer on a periodic basis until the occurrence of a credit event or the maturity date of the CDS. The fee is typically a constant quarterly or bi-annual amount which is defined as a percentage on the notional amount insured. One can refer to the annualised fee as the CDS price. If a credit event occurs, the buyer of the CDS is compensated by the seller for the loss incurred. The compensation in case of default is either repayment at par against physical delivery of the reference asset (physical settlement) or the notional amount

minus the post default market value of the reference asset (cash settlement).[2] In general, if a sovereign fails to meet its debt obligations, a credit event occurs. In order to have a clear definition of default on the basis of which CDS contracts can be written, the ISDA defines a credit event for a sovereign issuer as obligation acceleration, failure to pay, restructuring or repudiation/moratorium (Dieckmann and Plank, 2011). The pricing mechanism of CDS is a topic which we will not cover in this paper. For a detailed description of the pricing mechanism, refer to Duffie (1999), Hull and White (2000) and Lando (2004).

2.2 The Credit Default Swap Market

CDS contracts are traded OTC which means that they are exchanged directly between two counterparties. Thus, relatively little is known about market activity compared to other markets (e.g. stock or bond markets). During the SMC, CDS on subprime mortgages were blamed to have fuelled the market turmoil due to their opaque nature. This led to a vivid discussion on regulating CDS trading. Proponents of standardised exchange trading of CDS argue that it is necessary because it reduces counterparty risk and creates greater transparency of existing risks in the market (Stulz, 2010). Critics argue, however, that OTC trading is better suited to spur innovation in the market and to meet investors' specific derivative requirements rather than having standardised solutions.

To better understand the discussion on standardised exchange trading of CDS, we will give an example of a typical OTC CDS transaction, similar to the example in Berg and Streitz (2012). Consider two market participants X and Y. Both want to trade CDS on Spain. Thus, X buys $50m credit protection from Y. The gross notional amount outstanding is now $50m and equal to the net notional amount outstanding. Now, Y also buys $50m of credit protection from X. As a result, the gross notional amount outstanding has increased to $100m while the net notional amount outstanding is reduced to zero since both contracts cancel each other out. The process of netting and cancelling positions can become more complicated with more parties involved but the mechanism stays the same.

Trade compression reduces the notional amount outstanding of CDS contracts between two parties in order to simplify the relationship. It is a service provided by third party companies. The

[2] The dominant form of settlement in the market has been physical delivery (Blanco, Brennan and Marsh, 2005). However, with the CDS Big Bang and Small Bang protocols on 8 April and 20 June 2009, the auction process with cash settlement has become the standard form of settlement.

third party proposes a new CDS contract structure which keeps the CDS net positions of the participating firms constant while reducing the number of contracts. Another mechanism, which is constantly debated as an alternative to OTC trading is central counterparty clearing (CCC). Here all outstanding contracts are transferred to a central clearing party which nets the positions. The proponents argue that CCC will help to reduce counterparty risks significantly due to greater transparency.

Another regulatory discussion with regard to CDS markets is on the ban of naked sovereign CDS. The discussion has been primarily driven by the European SDC. If an investor buys a CDS without owning a certain amount of debt of the referenced borrower, he is buying a naked CDS. The EU passed a law which forbids naked CDS in the sovereign market from 1 November 2012 onwards (EU, 2012). The goal of this law is to stabilise credit markets as politicians blame naked sovereign CDS buyers of aggravating countries' difficult financial positions. However, academics believe that it will not help but rather lead to the opposite of the intended goal. Duffie (2010) raises concerns that regulations which restrict speculation in CDS markets could reduce market liquidity and thus raise trading execution costs for investors who are not engaging in speculation. Furthermore, a restriction on speculation in CDS markets could lower the quality of information inherent in CDS spreads with regard to the quality of sovereign issuers. This could, in the end, lead to higher borrowing costs for sovereigns.

An important question related to CDS markets and the regulatory discussions is why investors engage in CDS markets. Oehmke and Zawadowski (2012) give a literature review regarding incentives to engage in CDS markets. They link the investment in CDS markets mainly to two factors: hedging of a position in the underlying bond and speculation on the underlying bond.

3 Related Literature

3.1 Existing Literature on Credit Default Swap Market Activity

In two articles the determinants of CDS market size and activity are studied. In the first paper, Oehmke and Zawadowski (2012) analyse the determinants of the amount of net credit protection bought in the corporate CDS market. In the second paper, Berg and Streitz (2012) study the determinants of CDS market size and trading activity. Berg and Streitz (2012) differ in their

research focus from Oehmke and Zawadowski (2012) as they analyse the sovereign CDS market which has different underlying drivers compared to the corporate CDS market.

Berg and Streitz (2012) analyse the determinants of the sovereign CDS market size and trading activity. For this purpose, they study how country fundamentals, credit rating levels and migrations and macroeconomic policy affect the CDS market. They use data from the Trade Information Warehouse (TIW) by the Depository Trust & Clearing Corporation (DTCC) for the time period from July 2010 to July 2012. The dataset contains weekly data on the net notional amounts outstanding and CDS trading volume for 57 countries across the globe. The sample is restricted to single-name CDS contracts on sovereign bonds that are among the top 1,000 reference entities in terms of gross CDS amount outstanding in a given week. Berg and Streitz (2012) define two variables from this data: CDS market size (net CDS outstanding normalised by total debt) and CDS trading volume (normalised by net CDS amount outstanding) in order to scrutinise both market size and trading volume separately. The descriptive results of Berg and Streitz (2012) show a positive correlation between credit risk and outstanding credit protection, i.e. if a country's credit risk increases the amount of credit protection increases as well. Furthermore, they find that countries with large CDS market size also have high trading volume. They use regression analysis to identify the determinants of CDS market size and CDS turnover. For this purpose, they study how changes in ratings, equity markets and macroeconomic policies affect the CDS market. Their regression results can be summarised as follows: smaller countries in terms of size and countries that have a credit rating just above the investment grade cutoff, have significantly higher CDS market size levels while larger countries in terms of size and countries with below investment grade ratings have significantly higher average CDS turnover. Further, they find that weeks with both negative outlooks and downgrades are associated with a significantly higher CDS turnover. CDS market size, however, is not affected by negative rating announcements which shows that there is no increase in the net demand for CDS protection but a reallocation of net demand between different market participants.

In contrast to Berg and Streitz (2012) who study the sovereign CDS market, Oehmke and Zawadowski (2012) study the corporate CDS market. They focus on the analysis of the determinants of net credit protection bought in the CDS market and thus differ in their approach from Berg and Streitz (2012) as they focus exclusively on the net notional amount outstanding. First, Oehmke and Zawadowski (2012) aim at identifying the determinants of CDS market existence, i.e. which factors determine whether a firm becomes a traded entity in the CDS market.

Second, they identify which factors have a significant influence on the size of CDS positions. Just as Berg and Streitz (2012), they also use DTCC data from the TIW on net notional amounts outstanding. Thus, their data is also restricted to the top 1,000 reference entities in terms of gross CDS amount outstanding in a given week. Their data ranges from October 2008 to December 2011. Oehmke and Zawadowski (2012) find that for traded reference entities, disagreement about a reference entity's earnings prospects is associated with larger net notional amounts of CDS outstanding. Just as Berg and Streitz (2012) find for sovereigns, they find that firms which are close to the cutoff between investment grade and non-investment grade have larger net notional amounts of CDS outstanding. In addition, their results show that firms who have lost their investment grade status also have larger net notional amounts of CDS outstanding. According to Oehmke and Zawadowski (2012), this suggests that investors who are exposed to these firms use CDS in order to hedge their existing investment positions. They further use regression analysis in order to study the determinants of CDS market existence and the determinants of CDS market size. Here, they find that CDS markets are more likely to emerge when the underlying bonds of the entity are illiquid, implying that the bonds are hard or expensive to trade. The same can be observed if a CDS market exists. In such a case, one can find larger CDS positions for firms with illiquid underlying bonds. Oehmke and Zawadowski (2012) also study the influence of the CDS-bond basis[3] on the size of CDS outstanding and find that the CDS-bond basis has a significant influence on CDS outstanding. Firms with a more negative CDS-bond basis have more CDS outstanding. Overall, their results suggest that CDS markets function as alternative trading venues for both hedging and speculation on the underlying bond.

Besides the two studies which look at the determinants of trading and market size for CDS, there are other recent empirical studies which look at CDS positions or trading in CDS. Chen et al. (2011) analyse three months of global CDS transactions and find that trading activity in the CDS market is relatively low and contracts mostly conform to standardised contractual and trading conventions. Shachar (2011) analyses the role of liquidity provision by dealers in the CDS market and finds that order imbalances of end-users cause significant price impact. Lee (2011) uses DTCC data to test whether one can use the CDS to debt ratio to predict future stock prices and CDS spreads and finds that CDS net notional explains the respective movements of

[3] The CDS-bond basis is defined as the CDS spread minus the yield of the underlying bond minus the Treasury rate. Assuming no arbitrage, the CDS-bond basis should be approximately zero. For a more detailed description of the CDS-bond basis and the conditions which need to be fulfilled for it to be zero, refer to Duffie (1999).

CDS premia and stock prices. Ismailescu and Philips (2012) analyse the determinants and effects of CDS trading initiation on sovereign bonds. They find that CDS trading initiation is more likely following increases in local stock index volatility and the volatility risk premium and decreases in foreign currency reserves and the local currency exchange rate with the US-Dollar (USD). Augustin (2013) gives statistical and stylized facts about CDS prices, the CDS market, its players and related trading activities. He finds that sovereign CDS trade not that often even though they are highly standardized and that market participation for sovereign reference entities is rather active. In addition, he finds that emerging countries have more contracts outstanding than developed countries. The average net exposure per contract is, however, lower for emerging countries. Although these studies all deal with CDS positions and trading, none of them analyses at the determinants of CDS market size or market activity.

3.2 Determinants of Sovereign Credit Default Swap Market Activity

3.2.1 Global Factors

Longstaff et al. (2011) find that sovereign credit risk is driven more by global factors than by country-specific factors. Furthermore, Augustin (2012) uses in addition to country-specific factors also global factors in order to explain the term structure of CDS spreads and therefore of credit risk. Thus, we will focus one part of the analysis on testing whether global factors drive CDS market activity. If CDS are used to hedge against or speculate on credit risk which is driven by global factors, then global factors should also significantly influence CDS market size and CDS trading activity. The goal is to identify global factors which explain variation in CDS market size and trading activity and thus add to the existing literature on the determinants of CDS market activity.

The first factor is investors' global risk perceptions. We rely on global risk aversion in order to proxy for investors' global risk perceptions. Among others, Ismailescu and Phillips (2012), Longstaff et al. (2011), Fontana and Scheicher (2011), Hilscher and Nosbusch (2010) and Pan and Singleton (2008) find global risk aversion to exhibit significant influence on credit risk and in particular on CDS spreads.[4] The underlying reasoning to test whether investors' risk

[4] Other studies which also identify global risk aversion as an important factor influencing the pricing of credit risk comprise the following: Ang and Longstaff (2011); Caceres, Guzzo and Segoviano (2010); Ciarlone, Piselli and Trebeschi (2009); González-Rozada and Yeyati (2008); Remolona, Scatinga and Wu (2008); Ericsson, Jacobs and

aversion affects CDS market activity is that if we look at CDS spreads, we can see that spreads change not only if the underlying fundamentals change but also if a change in investors' risk aversion takes place (Fontana and Scheicher, 2010). Hence, we expect that not only the CDS spread is affected by changes in global risk aversion but also CDS market activity. As risk aversion increases, investors will want to hedge their positions more carefully. Furthermore, Ismailescu and Phillips (2012) find that global risk aversion is among the strongest predictors of sovereign CDS initiation. This strengthens the hypothesis as we expect that a factor which affects the initiation of CDS trading will also influence market size and trading volume, once the CDS is traded. The majority of the studies use the same variable to proxy for global risk aversion: the Chicago Board Options Exchange (CBOE) Market Volatility Index (VIX). The CBOE VIX is a measure of option-implied market expectations of volatility based on Standard & Poor's (S&P) 500 index options. Pan and Singleton (2008) and Hilscher and Nosbusch (2010) use the VIX as a measure of event risk in credit markets and find that it is significant in explaining CDS spreads. Longstaff et al. (2011), Ismailescu and Phillips (2012) and Fontana and Scheicher (2011) use the volatility risk premium embedded in the VIX. Longstaff et al. (2011) find that the volatility risk premium is, among the variables tested, the most significant in explaining sovereign CDS spreads. We use both the VIX and the volatility risk premium as proxies for global risk aversion. The next factor we use in order to proxy for investors' global risk perceptions is the TED spread which is the difference between the interest rate on interbank loans and the interest rate on short-term US government debt. It gives an indication of how banks perceive the credit risk between each other and thus how easily they can refinance, i.e. how liquid the interbank credit market is. It is used by investors as a reference for perceived credit risk in the overall market. This is in line with the findings of Cheung, Fung and Tsai (2010), who propose that the TED spread is an indicator of perceived credit risk in the general economy which exhibited strong predictive power during the recent SMC. Hilscher and Nosbusch (2010) propose to use the TED spread as an explanatory variable in their regression of sovereign spreads in order to capture changes in aggregate liquidity. We believe that investors' global risk perceptions can be positively or negatively correlated with variation in CDS markets, depending on whether hedging or speculation is the driving force behind investors' CDS market engagement. We expect to see a positive correlation if hedging is the driving force. Investors will want to hedge their positions

Oviedo (2007); Baek, Bandopadhyaya and Du (2005); García-Herrero and Ortiz (2005); McGuire and Schrijvers (2003).

using CDS if their risk perception is high. In contrast to that, we expect to find a negative correlation if speculation is the driving force. If investors' risk perception is low, we expect to see higher levels of CDS market activity as investors will be more prone to speculate on sovereign default, i.e. engage in high-risk transactions.

We further want to analyse whether the state of the global business cycle can explain variation in CDS markets by looking at the US treasury rate. Longstaff et al. (2011) use the five year US constant maturity treasury rate that reflects the changes in the US fixed income markets. They explain this variable choice by studies which show that shocks to the US are transmitted globally.[5] This is based on the assumption that US financial markets in general and therefore also fixed income markets incorporate information which is relevant to a broader number of countries. The reasoning here is that changes in the constant maturity rate can signal changes in US economic growth and thus also in the global business cycle since the US is the largest economy in the world. Furthermore, the constant maturity rate seems promising as an explanatory factor because Arora and Cerisola (2001) and Eichengreen and Mody (1998) claim that changes in the US interest rate will influence developing countries business conditions in particular as the US interest rate is commonly used as a reference interest rate. Arora and Cerisola (2001) suggest that from a theoretical point of view, a rise in US interest rates will increase spreads for developing countries which is confirmed by the findings of Eichengreen and Mody (1998). The reasoning is that if investors earn more in the relatively safe investment of US government debt, they will require a higher compensation for investing in relatively unsafe investments such as government debt of emerging countries. This will in the end lead to a decrease in economic activities. As a result of the European SDC, we believe that this reasoning might no longer be limited to developing or emerging countries but also applicable to highly indebted developed countries which cannot credibly ascertain their creditors to pay them back. Hence, we test whether US treasury rates can help to explain variation in CDS markets not only for developing countries but also for developed countries. We expect to see increased CDS market activity for higher levels of the constant maturity rate and thus a positive correlation. As higher constant maturity rates imply higher costs for refinancing sovereign debt, the threat of sovereign default increases and thus both

[5] Longstaff et al. (2011) refer specifically to Roll (1988) and Goetzmann, Li and Rouwenhorst (2005).

hedging as well as speculation will increase.[6] We have also seen during the past years that overall decreasing levels of the constant maturity rate were associated with overall decreasing levels of CDS market size.[7] In order to proxy for the global business cycle, we will also use another financial market variable. Longstaff et al. (2011) introduce an equity market variable: the excess return on the Center for Research in Security Prices (CRSP) value-weighted portfolio. The CRSP value weighted portfolio is the value-weighted return on all NYSE, AMEX and NASDAQ stocks minus the one month treasury-bill return. The reasoning for implementing the variable is the same as before, i.e. this variable is meaningful due to the importance of the US for the world economy. This is also in line with Ang and Longstaff (2011) who propose that systemic sovereign credit risk is strongly related to financial market variables. Furthermore, Ismailescu and Phillips (2012) use the return of the Morgan Stanley Capital International (MSCI) global stock index as a proxy for global financial market conditions. Their reasoning is based on Attinasi, Checherita and Nickel (2009) who show that global risk perceptions strongly influence sovereign debt pricing in CDS and bond markets. In contrast to Longstaff et al. (2011), Ismailescu and Phillips (2012) use the MSCI global stock index instead of the CRSP value weighted portfolio, putting less emphasis on the US equity market. We expect both equity indices to be negatively correlated with CDS market activity because if the global economy is in a good shape, the risk of default for sovereigns is lower.

The last global factor we want to use is global financial sector health. We use the MSCI World Financials Index in order to proxy for global financial sector health. Dieckmann and Plank (2011) find that the state of the world financial system has strong explanatory power for the changes in CDS spreads since the beginning of the SMC in 2008. We believe that this factor could not only have explanatory power with regard to spreads but also with regard to market size and turnover of CDS. The reason is that if the financial sector is in a bad shape it can adversely affect a country's financial position due to bailout related funds and thus also a country's ability to pay. Looking at the SMC strongly underlines this line of reasoning as many countries had to spend a lot of money supporting their financial sectors (e.g. USA). Hence, we expect to find a negative correlation between global financial sector health and CDS market activity.

[6] One could also argue that higher levels of the constant maturity rate are indicative of good economic times which would then in turn lead to lower levels of sovereign risk. This is, however, not relevant and applicable for the sample period. Therefore, we will focus on the negative refinancing effect of high constant maturity rates in the following.
[7] For a graphical illustration of the average market size (in %) over time, refer to figure 4.

3.2.2 Country-Specific Factors

From an economic model's point of view such as the Merton model (Merton, 1974), we expect country-specific factors to play a significant role in explaining changes in sovereign credit risk and movements in credit spreads and thus also in CDS trading activity.

The first country-specific factor we use in the analysis is the volatility of the local business climate. Berg and Streitz (2012) analyse whether the CDS market, i.e. the trading volume or market size, reacts to changes in country-level equity market returns. Here, the idea is that the soundness of a sovereign relates to its taxation income which contributes to a sovereigns' ability to service and repay its debt (Ismailescu and Phillips, 2012). The taxation income is dependent on the local business conditions which we proxy for by country-level equity market returns. Berg and Streitz (2012) find a positive relationship between equity market returns and market size. For trading activity, they find a U-shaped relationship, i.e. large absolute stock market returns are associated with more trading activity in the CDS market. They use MSCI country-level equity indices to calculate weekly returns. Dieckmann and Plank (2011), Longstaff et al. (2011) and Ismailescu and Phillips (2012) also use country-level equity index returns as explanatory variables as they find it to be a good proxy for the state of the local economy. Closely related to the country-level equity index returns, Dieckmann and Plank (2011) and Ismailescu and Phillips (2012) also include country-level equity index volatility as an explanatory variable. By using the volatility of the country-level equity index, it is further possible to proxy for the uncertainty in the local business climate (Ismailescu and Phillips, 2012). Ismailescu and Phillips (2012) find that uncertainty in local financial markets is among the factors which have the greatest influence on CDS trading initiation. We expect to see a negative correlation with CDS market activity for country-level equity market returns and a positive correlation with CDS market activity for country-level equity market volatility. This implies that larger uncertainty about the local business climate should lead to increased CDS activity for the respective country.

Furthermore, the level of sovereign debt and debt divided by GDP is also used in several studies as an explanatory variable. Augustin (2013) suggests that a statistical relationship between the net notional amount of CDS outstanding and the nominal amount of government debt exists.[8] However, Berg and Streitz (2012) do not find that it exhibits significant influence on

[8] Caceres, Guzzo and Segoviano (2010), Berg and Streitz (2012), Dieckmann and Plank (2011) as well as Hilscher and Nosbusch (2010) also use debt divided by GDP as an explanatory variable in their regressions.

trading volume in CDS. Hence, rather than looking at debt levels directly we focus on the ability of sovereigns to pay back their debt. Thus, another country-specific factor is the local currency exchange rate against the USD. Ismailescu and Phillips (2012) find that CDS trading initiation is more likely following increases in the local exchange rate against the USD. They argue that the exchange rate is an indicator of a county's ability to pay back its USD denominated debt. When they model the change in sovereign bond spreads, they use the exchange rate against the USD to proxy for the default likelihood of a country. The use of the exchange rate to capture a county's default probability is motivated by the work of Jahjah, Wei and Yue (2012) who find default probability and exchange rate policy to be closely linked. Dieckmann and Plank (2011) and Longstaff et al. (2011) also use the exchange rate against the USD as they find it to be an important factor in explaining variation in sovereign credit risk. In addition, we also want to look at foreign currency reserves as another explanatory factor. Ismailescu and Phillips (2012), Dieckmann and Plank (2011) and Longstaff et al. (2011) rely on this factor as well. The reason is again the ability to pay consideration, i.e. the higher the foreign currency reserves of a country the lower should be the country risk of default which might influence the trading and market size of CDS. Ismailescu and Phillips (2012) find that CDS initiation for a country is more likely following a decrease in foreign currency reserves which supports the theoretical reasoning before. Hilscher and Nosbusch (2010) scale foreign exchange reserves by GDP. Aside from the exchange rate against the USD and foreign exchange reserves, we also focus on the terms of trade of a country.[9] Bulow and Rogoff (1989) have shown that a country's terms of trade affect its ability to generate USD revenues from exports and thus affect its ability to pay off its external debt. Dieckmann and Plank (2011) and Hilscher and Nosbusch (2010) both rely on terms of trade in their analysis. Hilscher and Nosbusch (2010) find that spreads are higher for countries which experienced terms of trade shocks recently, i.e. have higher terms of trade volatility. They also find that the volatility of terms of trade is a good predictor for default risk. In general, if a country's terms of trade improve, this implies that this country can buy more units of imported goods for every unit of exported goods. However, it can also lead to reduced export volumes due to the fact that products are priced uncompetitive which adversely affects a country's balance of payments. We expect to see a negative correlation for the ability of sovereigns to pay back their

[9] The terms of trade of a country are defined as the value of its exports divided by the value of its imports.

debt and CDS market activity, i.e. as the ability to pay back decreases CDS market activity will increase.

Furthermore, we want to test whether country size and inflation are significantly associated with CDS market activity. We expect to find a correlation between size and CDS market activity, as we believe investors' interest in larger countries with larger underlying bond markets and thus higher liquidity to be higher than for smaller countries. Berg and Streitz (2012) take the GDP as a proxy for the size of the economy. They find a significant influence of GDP on both trading volumes and market size. Further, we believe inflation is indicative of how well a country manages its monetary policy. Higher inflation rates can be an indication of higher default risk implying a positive correlation. Remolona, Scatinga and Wu (2008) include inflation in their analysis of sovereign risk and find that it is significant in explaining sovereign risk.

Berg and Streitz (2012) and Oehmke and Zawadowski (2012) also use dummy variables for rating levels in their analysis of CDS markets. They take ratings as a measure of credit quality and risk. In addition, both studies also consider changes in ratings or rating outlooks influence either trading or market size significantly. They find that CDS market activity, both corporate and sovereign, is influenced by rating levels and changes in ratings or rating outlooks. This is in line with Alfonso, Furceri and Gomes (2011) who find that government yields change significantly in response to rating and outlook changes. Other studies further document the general influence of rating migrations on financial markets.[10] Hence, we rely on both rating levels as well as changes in ratings or rating outlooks in the analysis of the determinants of sovereign CDS market activity.

Furthermore, we want to use CDS spreads as an explanatory factor. As CDS spreads give an indication of the market perceived credit risk for a certain country, we expect that they are related to market activity. Duffie (2010) shows empirical evidence that the volume of CDS is not correlated with the level of spreads, while Berg and Streitz (2012) find a relationship between sovereign CDS market activity and changes in the respective sovereign CDS spreads. Thus, analysing the relationship of CDS spreads and CDS market activity will help to get a better understanding.

[10] See e.g.: Hooper, Hume and Kim (2008); Brooks, Faff, Hillier and Hillier (2004); Ferreira and Gama (2007); Gande and Parsley (2005); Kaminsky and Schmukler (2002); Pukthuanthong-Le, Elayan and Rose (2007).

3.3 Hypotheses and Expected Results

Based on the literature review, we are able to derive six main hypotheses with regard to the determinants of sovereign CDS market size and trading activity.

It has been documented by several studies that sovereign credit risk is driven significantly by global factors. Based on those studies and the underlying economic intuition discussed in the previous section, we believe that global factors also drive CDS market size and market activity. Since investors consider sovereign credit risk when deciding whether to engage in the CDS market or not, it seems very likely that global factors influence CDS market activity significantly. We believe that especially investors' global risk perceptions are strongly correlated with CDS market activity. Thus, the first hypothesis is:

Hypothesis I:

CDS market activity is driven by investors' global risk perceptions.

The sign of the effect of investors' global risk perception on CDS market activity depends on whether hedging or speculation is the driving, underlying force. In order to proxy for investors' global risk perceptions when analysing CDS market size and CDS market turnover, we use the TED spread, the VIX and the volatility risk premium. The next hypothesis is that aside from investors' global risk perceptions, the global business climate is associated with CDS market activity.

Hypothesis II:

CDS market activity size is negatively connected to the global business cycle.

We use financial market information from both equity and fixed income markets to proxy for the global business cycle. We use the MSCI World Index and the five year US constant maturity treasury rate as proxies for the business cycle and business climate. The third hypothesis is related to global financial sector health:

Hypothesis III:

CDS market activity is negatively correlated with global financial sector health.

We use the MSCI World Financials Index in order to proxy for global financial sector health. Aside from global factors, we also believe that country-specific factors play a significant role in determining CDS market activity.

Hypothesis IV:

CDS market activity is positively linked to the volatility of the local business climate.

In order to proxy for a sovereign's the volatility of the local business climate we use country-specific stock market returns and stock market volatility. Aside from the volatility of the local business climate, we believe that the ability to pay back its USD denominated debt is one of the key drivers of CDS market activity for a country.

Hypothesis V:

CDS market activity is negatively correlated with the sovereign's ability to pay back USD denominated debt.

We use the foreign exchange rate against the USD, the foreign exchange reserves to GDP ratio, terms of trade volatility and changes in terms of trade in order to proxy for a country's ability to pay back its USD denominated debt.

Furthermore, we expect that changes in credit ratings will have a limited impact on market size and market activity. As previous studies on other financial instruments and on CDS have shown, positive changes in credit ratings or credit rating outlooks have rarely a significant impact. However, based on the work of Berg and Streitz (2012), we expect that negative changes in credit ratings and credit rating outlooks significantly affect market turnover.

Hypothesis VI:

CDS market turnover is significantly increased by credit rating migrations and outlook changes.

We do not expect to see the same effect for changes in market size since Berg and Streitz (2012) have found that the total net demand for CDS is not affected by changes in credit ratings or credit rating outlooks.

4 Data

4.1 DTCC Data

We retrieve the data on CDS market size and trading volume from the DTCC, a company specialised in the provision of clearing, settlement and information services for OTC derivatives and other financial instruments. The DTCC provides trade processing and trade registration services in the CDS market and records the trades in the TIW which covers almost the whole market as all major dealers register their standard CDS trades with the DTCC.[11] As of 31 October 2008, the DTCC started to publish weekly reports on live CDS market positions based on the information recorded in the TIW. The reports comprise information on the aggregate gross notional and net notional amounts outstanding on single name reference entities as well as on the number of contracts outstanding as of the end of each week.[12] In this context, notional represents the par amount of credit protection bought or sold (DTCC, 2011). Furthermore, gross notional amount is the sum of all CDS contracts bought or sold for a single reference entity. Net notional amount is the sum of net protection bought, i.e. net notional positions are the maximum possible amounts of transfers that would take place between net buyers and sellers in case of a credit event (DTCC, 2011). In addition, the DTCC started to publish market risk transaction data as of 16 July 2010. This data gives a weekly overview over the extent to which buyers and sellers were engaging in market risk transfer activity. The DTCC (2011) defines the following three types of transactions to be included: new trades between two parties, a termination of an existing transaction and the assignment of an existing transaction to a third party.[13] Thus, transactions which do not lead to a change in market risk, such as CCC and portfolio compression, are not included (DTCC, 2011). Including market risk transaction data gives a more comprehensive picture of trading activity than looking at the weekly change in net notional amounts outstanding. If, for instance, a bank sells a CDS to an investor and then sells its short position in the CDS to another bank, the net notional amount will not be affected even though a market risk transaction has taken place. The DTCC provides information on single reference entity level. The information on both market position size and trading volume data is limited to the largest 1,000 reference entities in terms of gross notional amount outstanding. The dataset comprises 218

[11] The DTCC (2009) stated that the TIW covers 95% of all OTC credit derivatives trades done globally.
[12] For a time-series plot of aggregated weekly DTCC data for sovereigns, refer to figure 5.
[13] Assignment in this context means that one party in an existing contract assigns 100% of their notional value to another party.

weeks of market position size data and 129 weeks of trading volume data from DTCC. We have a total of 59 different sovereigns in the dataset after adjustments. We exclude Hong Kong as there is only one observation. Further, we exclude three observations for Hungary where there are two observations on the same date.[14] We keep the observation that is in line with the historical numbers.

In the analysis, we use the DTCC data as the dependent variables. We follow the approach by Berg and Streitz (2012) and define two main scaled variables: market size and market turnover. We define market size (%) as the net notional CDS amount outstanding in USD divided by government gross debt in USD. This variable is also used in Lee (2011) as a measure of investors' concerns on the credit quality of the reference entity. We define change in market size as the weekly percentage change in market size. Further, we define market turnover (%) as the weekly trading volume in USD normalised by net notional CDS outstanding in USD in that week. This approach is based on Berg and Streitz (2012) and other stock market related papers, where trading activity is also normalised by market capitalisation.[15] Since the gross notional amount will increase, even if an offsetting trade reduces the overall risk in the market, it is an imprecise measure of credit risk in the market and will thus not be used in the analysis.

As we have pointed out, the DTCC provides data for the 1,000 largest reference entities in terms of gross notional CDS amount outstanding. Therefore, we have a censoring problem, as we only observe CDS positions and market activity data which are large enough in terms of gross notional amount outstanding to make it into the largest 1,000 single-name reference entities. This limitation in available data can lead to a censoring bias when analysing the data. One problem, however, is that the censoring is based on the gross notional CDS amount outstanding while the analysis focuses on the net notional CDS amount outstanding and market risk transaction data. As we can assume that sovereigns which have gross notional CDS outstanding also have net notional CDS outstanding as well as market risk transactions, the censoring problem also applies to the variables which we use in the analysis. Therefore, we assume that the relationship of gross divided by net notional CDS outstanding and the relationship of gross notional CDS outstanding divided by market risk transactions follow the same pattern for unobserved and observed data.[16]

[14] The respective dates for which we had two observations for Hungary are the following: 30 March 2012, 6 April 2012 and 13 April 2012.
[15] See e.g. Johnson (2008) or Beck, Demirgüç-Kunt, Levine (2000).
[16] Oehmke and Zawadowski (2012) also discuss the censoring issue while Berg and Streitz (2012) do not mention it. Correcting for the censoring bias goes beyond the scope of this thesis and is left for future research.

4.2 Other Data

We source all global factors on a weekly basis except for the volatility risk premium for which we use the end of week values. We retrieve information on the MSCI World Index and the MSCI World Financials Index from Thomson Reuters Datastream and the CRSP value-weighted portfolio excess return from Kenneth French's data library. We calculate the weekly excess log return for the CRSP value-weighted portfolio (CRSP) and the weekly log return for the MSCI World Index (MSCIW) and the MSCI World Financials Index (MSCIWF). As MSCIW and CRSP are both equity market proxies for global business conditions, we check for correlation among the variables. We find that they are highly correlated with a correlation coefficient of 0.96. Hence, we only include MSCIW as a proxy for global market conditions in the analysis as it is less US centric than CRSP. We also source the TED spread from Thomson Reuters Datastream and get the data on US five year constant maturity treasuries from the Federal Reserve Statistical Release. We use the TED spread denominated in basis points (TED) and the five year treasury constant maturity rates denominated in percent (CMT). Last, we use two proxies for global risk aversion: the VIX index and the volatility risk premium. We take the end-of-week index value of the VIX Index (VIX) directly from the CBOE website. In order to get the volatility risk premium, we draw back on the data by Hao Zhou (2009) which is available on a monthly basis. Zhou defines the volatility risk premium "as the difference between the risk-neutral and objective expectations of realised variance, where the risk-neutral expectation of variance is measured as the end-of-month VIX-squared de-annualised and the realised variance is the sum of squared five-minute log returns of the S&P 500 index over the month" (Zhou, 2009). We also calculate weekly changes for all variables.

For the country-specific factors, we retrieve weekly CDS spreads from Thomson Reuters Datastream. We take CDS spreads with a maturity of five years which are denominated in USD. The data source is Thomson Reuters CDS.[17] We include the CDS spread (SPREAD) on a weekly basis denominated in basis points. Due to data availability issues, we have a total of 263 missing observations for Ecuador, Lebanon, New Zealand, Norway and Tunisia. Moving to equity market data, we retrieve the weekly country-level equity index data from Thomson Reuters Datastream. We use the respective MSCI country-index. If it is not available, we use the S&P country-level

[17] For Ecuador, Lebanon and Tunisia, we are not able to retrieve data from Thomson Reuters CDS. Thus, we rely on the data from Credit Market Analysis (CMA) for those three countries. CMA data is, however, only available through Thomson Reuters Datastream up until September 2010.

index (for Ecuador, Iceland, Latvia, Panama, Slovakia) or the local country-index (FTSE Cyprus SE20, Venezuela SE General). From this data, we calculate weekly log returns (LOC_RET) and local stock market return volatility (LOC_VOL). We calculate LOC_VOL as the rolling stock market return volatility of the domestic stock market index and choose a time window of 60 days in order to capture recent stock market volatility. Further, we use weekly exchange rate data against the USD (EXCH) from Thomson Reuters Datastream with WM/Reuters being the source.

GDP and general government gross debt data on the different countries are both sourced from the World Economic Outlook Database of the International Monetary Fund (IMF). GDP is expressed in current prices and converted to USD using the yearly average of market exchange rates. General government gross debt data is also denominated in USD. Both variables are available on a yearly basis. Using this data, we take the logarithm of GDP (LN_GDP) in order to proxy for the size of the economy. The data on foreign currency reserves and inflation is sourced through Thomson Reuters Datastream where the International Financial Statistics database of the IMF is the underlying source. Per IMF definition, foreign exchange reserves comprise foreign banknotes, bank deposits, treasury bills, short- and long-term government securities, European Currency Units, and other claims usable in the event of payment. We replace missing data points for foreign exchange reserves with the twelve month moving average. We then define foreign exchange reserves to GDP (FTG) based on monthly foreign exchange reserves and yearly GDP data. Moreover, we use the year-on-year change in the consumer price index to proxy for inflation (CPI). The data is available on a monthly basis. For some countries (Australia, New Zealand, Qatar) only quarterly data is available. Again, we replace missing data points with the twelve month moving average.

The next variables we define are both related to terms of trade. We retrieve data on terms of trade from the World Bank and follow Diekmann and Plank (2011) and Hilscher and Nosbusch (2010) in their approach to use terms of trade volatility and change in terms of trade. In order to calculate terms of trade volatility (TOT_VOL), we take the standard deviation of the yearly percentage changes in terms of trade over the last eight years. Further, we calculate the overall percentage change in terms of trade over the last five years (TOT_CHG).

The rating data is directly sourced from S&P Sovereign Rating and Country Transfer and Convertibility Assessment Histories. We focus on rating data from S&P as previous research by Gande and Parsley (2005) and Reisen and von Maltzan (1999) indicates that S&P ratings occur more frequently, precede those of other rating agencies and are less anticipated by market

participants. We follow Gande and Parsley (2005) and convert the explicit credit ratings into numerical values using a rating scale from one to twenty-two where AAA takes the highest value and SD the lowest. In order to consider not only the letter rating but also the outlooks, we define a comprehensive credit rating (CCR). Therefore, we add or subtract numerical values assigned to the credit outlook to the explicit credit rating.[18] Further, we derive dummy variables for weeks in which up- or downgrades occur. In addition, we also want to include the information contained in outlook revisions. Hence, we derive dummy variables for positive and negative outlook changes. We define a positive outlook change as an improvement in the outlook, i.e. for instance if the outlook was negative and becomes watch negative. This allows us to capture any changes that occur due to improvements or deteriorations in the credit rating.[19]

5 Empirical Analysis

5.1 Descriptive Analysis

Table 1: Summary Statistics for DTCC Data

Variable	N	Mean	StD	p0.25	Median	p0.75
CDS Market Characteristics (weekly)						
Gross Notional amount outstanding (in mio USD)	12,036	40,480	50,068	8,210	20,457	53,028
Net Notional amount outstanding (in mio USD)	12,036	3,783	4,842	824	1,927	4,566
Contracts outstanding	12,036	2,882	2,786	775	1,802	4,258
Market Size (in %)	12,036	2.8	4.7	0.9	1.5	2.7
Weekly Trading Volume (in mio USD)	6,851	733	1,375	57	240	782
Weekly Contracts Traded	6,851	62	95	7	27	77
Market Turnover (in %)	6,851	14.9	19.5	5.0	10.5	18.9

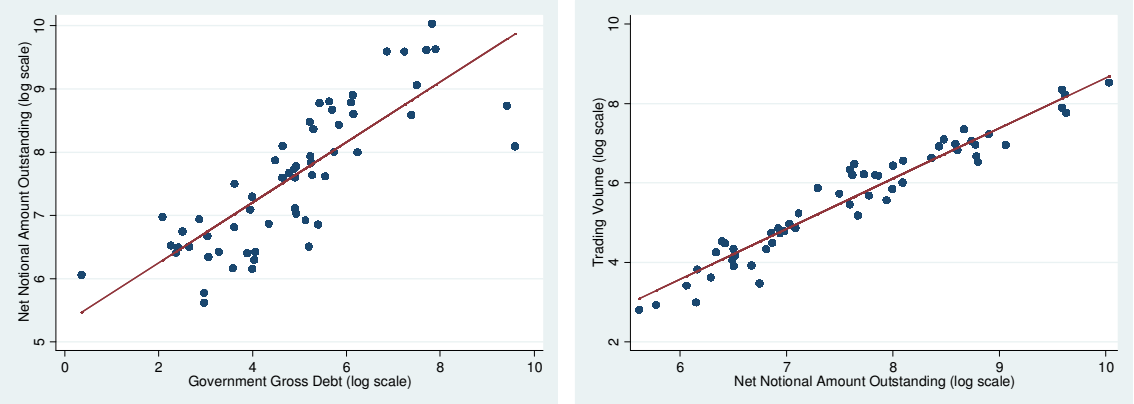
Table 1 presents summary statistics for the DTCC data. We have DTCC data on CDS outstanding for a total of 59 countries over 218 weeks. The total amount of observations is 12,036 because we do not have data on every country at every point in time.[20] For the trading volume, we observe data for 58 countries over 129 weeks.[21] We do not observe trading volume for Ecuador. The mean net notional amount outstanding per week over the sample is 3,783 million USD and thus only nine percent of the mean gross notional amount outstanding per week. Looking at the weekly trading volume, we see a weekly mean trading volume of 733 million

[18] For further details regarding the credit rating scale, refer to table 7 in the appendix.
[19] For a detailed overview table of the variables and data sources used, refer to table 8 in the appendix.
[20] We have less than 218 observations for a total of twelve countries: Australia, Cyprus, Ecuador, Egypt, Greece, Lebanon, New Zealand, Saudi Arabia, Slovenia and Tunisia.
[21] The trading volume data is also only for 20 countries available over 129 weeks.

USD while the weekly median is 240 million USD. The distribution for trading volume is positively skewed.[22]

Figure 1 graphically illustrates the relationship between the mean net notional amount outstanding and gross government debt as well as the relationship between the mean trading volume and the mean net notional amount outstanding on a country-by-country basis.

Figure 1: Illustration of the relationship between net notional amount outstanding, trading volume and debt



We can see from figure 1 that the logarithm of the net notional amount of CDS outstanding is positively correlated with the logarithm of government gross debt with a correlation coefficient of 0.81. Hence, the larger gross government debt, the larger is the net notional amount of CDS outstanding. An even higher correlation coefficient of 0.97 can be observed for the logarithm of trading volume and the logarithm of net notional amount of CDS outstanding. This indicates that countries with larger net notional amounts outstanding have higher trading volumes (or vice versa). The results from figure 1 support the choice of scaled variables: market size and market turnover. The mean weekly market size is 2.8% while the median is 1.5%. This shows that the net credit protection outstanding is small compared to the outstanding amount of debt, i.e. only a small portion of debt is insured against default. The mean market turnover is 14.9% while the median is 10.5%. Hence, we can see that on average 14.9% of net notional CDS outstanding are traded every week. The distribution is, however, heavily positively skewed indicating a long right tail.

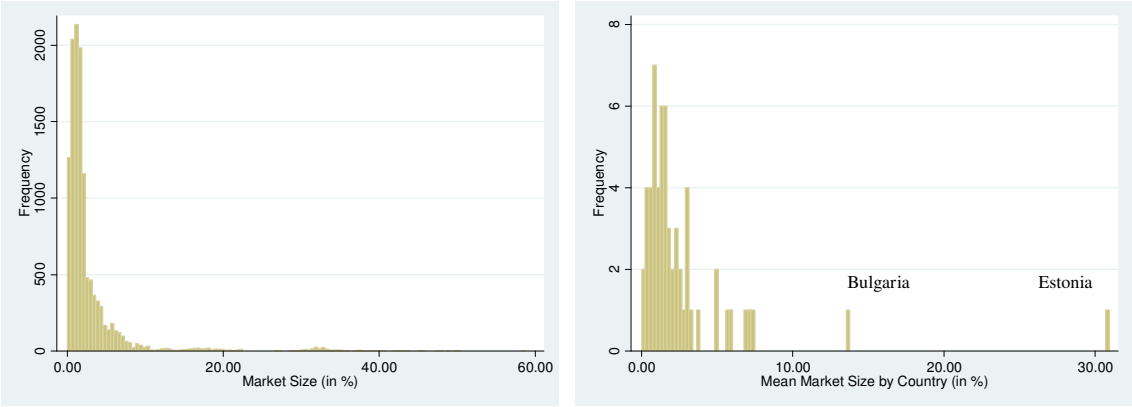
If we look at the DTCC data by sovereign type, we see that developed countries have a mean net notional amount outstanding of 5,572 million USD which is more than twice the mean

[22] For graphical illustration of the frequency distribution of gross and net notional amount outstanding as well as trading volume, refer to figure 6 in the appendix.

amount of emerging countries.[23] However, looking at the mean market size, we see that both developed and emerging countries have a mean market size of 2.7% and 2.8% respectively. Thus, we can infer that there is no increased demand for credit protection for emerging countries compared to developed countries or vice versa.[24] We further look at the DTCC data by region. The mean net notional amount outstanding with 4,027 million USD as well as the mean market size with 3.3% are largest for EMEA.[25]

In addition, we also want to look at the DTCC data on a country-level basis. Four out of the five largest countries in terms of weekly mean net notional amount outstanding are European countries. Italy has a weekly mean net notional amount outstanding of 22,630 million USD. The next four largest countries Germany, France, Spain and Brazil all have a mean value of approximately 15 billion USD. The smallest five countries in terms of weekly mean net notional amount outstanding are Tunisia, Cyprus, Estonia, Lebanon and Saudi Arabia. In terms of market size, we see that Estonia and Bulgaria have by far the largest mean market size with 30.9% and 13.7% respectively. The next three largest countries in terms of market size are Latvia, Iceland and Kazakhstan. They vary in terms of market size from 6.9% to 7.3%. When looking at the frequency distribution of market size and mean market size by country in figure 2, it becomes obvious that Estonia and Bulgaria are strong outliers. If you look at the data for Bulgaria and Estonia in detail, you see that the values for market size are high across the whole sample, i.e. the large mean market size is not driven by one outlier solely.

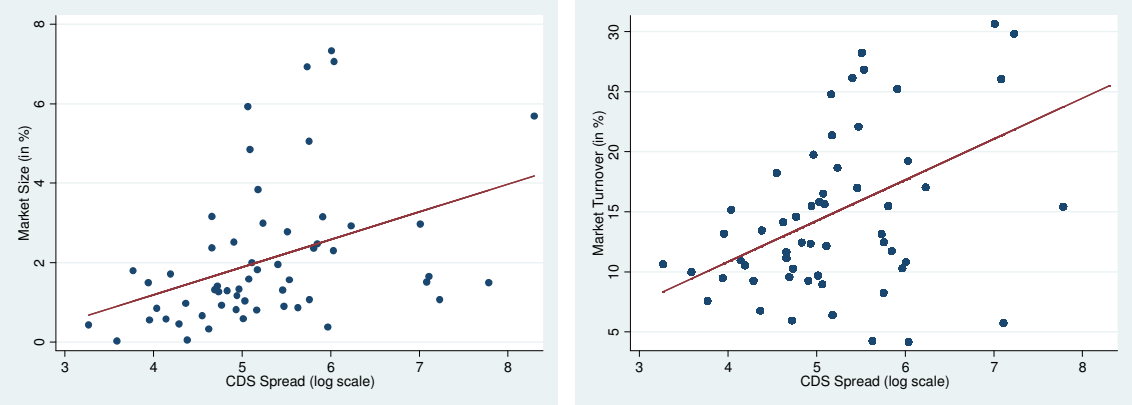
Figure 2: Frequency distribution for market size and mean market size by country



[23] We use the World Economic Outlook segmentation for developed and emerging countries. We have 26 developed and 33 emerging countries in the dataset. For information about which country is considered developed and emerging, refer to table 11.
[24] For detailed summary statistics by sovereign type, refer to table 9 in the appendix.
[25] For detailed summary statistics by region, refer to table 10 in the appendix.

Another important observation is that the ten largest countries in terms of market size and the ten largest countries in terms of market turnover all have above median CDS Spreads. Figure 3 graphically illustrates the positive relationship between the countries' mean market size, mean market turnover and mean CDS spread.[26]

Figure 3: Illustration of the relationship between market size, market turnover and CDS spreads



The relationship between market size and CDS spreads is also observed by Berg and Streitz (2012) and can be interpreted as indicative of a positive correlation between outstanding credit protection and credit risk. The relationship between market turnover and CDS spreads is indicative of a positive correlation between traded credit protection and credit risk. The ten smallest countries in terms of market size and market turnover also all have below median CDS spreads (with two exceptions for both market size and market turnover). The smallest countries in terms of market size are the United States, Japan, China, Egypt and Norway. Looking at market turnover, the largest countries are Ukraine, Argentina, Russia, Spain and Turkey while the smallest countries are Iceland, Lebanon, Cyprus, Tunisia and Slovenia.[27]

With regard to the countries' S&P credit rating, we can see that 77% of observations are above BBB- and thus investment grade. Hence, 23% of observations are below investment grade. We observe 29 upgrades, 68 downgrades, 73 positive outlook changes and 84 negative outlook changes within the sample period. If we look at the different rating categories separately, we can see that investment grade rated sovereigns have on average 4,205 million USD of net notional CDS outstanding which is almost twice the amount of non-investment grade rated sovereigns. This translates to an average market size of 3.1% for investment grade rated sovereigns while non-investment grade rated firms have an average market size of 2.4%. This is particularly

[26] We exclude Estonia and Bulgaria from the graph as they skew the graphical illustration.
[27] For detailed summary statistics by country, refer to table 11 in the appendix.

interesting because one could assume that the worse the credit rating the more protection is bought by investors to either hedge against or speculate on default. Sovereigns that are just above the investment grade cutoff, i.e. sovereigns with a rating of BBB or BBB-, have significantly higher market size with an average of 4.7%. Turning to market turnover, we can see that investment grade rated firms have an average market turnover of 14.3% while non-investment grade rated firms have an average market turnover of 17.9%. The figures suggest that even though the relative market size is larger for investment grade countries, the relative trading activity is larger for non-investment grade countries. The findings with regard to market size and market turnover confirm the results by Berg and Streitz (2012). When we look at the mean market turnover in weeks with a rating up- or downgrade, we can observe a significant difference to weeks without a change in the rating. The average market turnover is 23.8% in weeks with a downgrade and 27.2% in weeks with an upgrade. If no rating change takes place the average market turnover is 14.8%. From those results we can infer that rating changes seem to significantly affect a sovereign's market turnover.[28]

For summary statistics of the global and country-specific factors used in the analysis, refer to table 13 in the appendix.

5.2 Regression Specification

In order to investigate the determinants of CDS market size and the determinants of CDS market turnover, we will focus on two baseline panel regressions. We use linear regression analysis with fixed effects estimation in order to estimate the regression coefficients. First, we run a static panel regression in order to investigate which global factors and country characteristics are connected to CDS market size. We focus on weekly market size as the dependent variable. This gives us the following baseline panel regression on the determinants of CDS market size:

$$y_{it} = \beta X_t + \gamma Z_{it} + u_i + \varepsilon_{it} \quad (1)$$

Vector X_t contains the global factors TED, CMT, VIX and VRP while vector Z_{it} contains the country-specific factors SPREAD, EXCH, CCR, FTG and LN_GDP. The variables which we use in the analysis are available at different data frequencies.[29] We also include country fixed effects u_i in order to account for time-independent, constant sovereign characteristics. We

[28] For detailed summary statistics by credit rating, refer to table 12 in the appendix.
[29] For an overview of which variable is available at which frequency, refer to table 8.

specifically do not include time fixed effects as we already include the vector X_t which takes account of non-country specific effects across time.

Second, we focus on the dynamic analysis of the data. We use weekly changes in market size and weekly market turnover as the dependent variable y_{it}. We are looking at the two variables in order to analyse what the drivers of trading activity in CDS markets are. Further, we use changes in global and country-specific factors as explanatory factors. The baseline panel regression specification on the determinants of market activity is:

$$\Delta y_{it} = \beta X_Change_t + \gamma Z_Change_{it} + \Delta y_{it-1} + u_i + \varepsilon_{it} \quad (2)$$

Vector X_Change_t contains the changes in global factors ΔTED, MSCIW, MSCIW^2, MSCIWF, MSCIWF^2, ΔCMT, ΔVIX and ΔVRP while vector Z_Change_{it} contains the changes in country-specific factors LOC_RET, LOC_VOL, ΔSPREAD, ΔSPREAD^2, ΔEXCH, CPI, TOT_VOL and TOT_CHG. We also include the lagged dependent variable as an explanatory factor. We include squared variables in order to test whether a non-linear relationship exists.[30] Again, we also include country fixed effects u_i and no time fixed effects.

For the dynamic panel regression analysis, we use first-differenced data in order to ensure that the data is stationary and that possible autocorrelation is reduced. Furthermore, we define standardized variables for the dependent and independent variables for all regressions. We rescale the dependent and independent variables to have a mean of 0 and a standard deviation of 1. This way the results are easier to interpret and it allows us to compare the magnitude of the beta coefficients directly.

Finally, we also run a regression in order to investigate the influence of rating migrations on CDS market activity. Therefore, we use weekly changes in market size and weekly market turnover as the dependent, left-hand side variable y_{it}. As explanatory variables, we use dummy variables for weeks in which upgrades (UP), downgrades (DOWN), positive (POS) or negative (NEG) changes in outlooks occurred. The regression specification is as follows:

$$\Delta y_{it} = \beta UP_{it} + \gamma DOWN_{it} + \delta POS_{it} + \theta NEG_{it} + \pi CONTR_{it} + \Delta y_{it-1} + u_i + \varepsilon_{it} \quad (3)$$

We include country fixed effects u_i and both global as well as country-specific factors as control variables. The vector CONTR contains the control variables ΔTED, MSCIW, MSCIW^2,

[30] We follow Berg and Streitz (2012) who use squared equity market variables and squared CDS spreads. We do not include squared local stock market returns LOC_RET^2 as we found no relationship with any left-hand variable.

MSCIWF, MSCIWF^2, ΔCMT, ΔVIX, ΔVRP, LOC_RET, LOC_VOL, ΔSPREAD, ΔSPREAD^2, ΔEXCH, CPI, TOT_VOL and TOT_CHG. Again, we also include the lagged dependent variable as an explanatory factor. The dummy variables UP and DOWN are exclusive, i.e. either UP or DOWN can take the value one. The same is true for POS and NEG. However, it can happen that a change in credit rating and a change in credit rating outlook appear simultaneously. In order to account for autocorrelation of the standard errors within the different sovereign groups, we use clustered standard errors by sovereign for all regressions in section 5.3.

5.3 Regression Analysis

5.3.1 Static Analysis

Table 2 displays the regression results for the baseline regression (1). In column (I), we use global factors as explanatory variables while in column (II) we use country-specific factors. The main focus, however, lays on column (III) and (IV) where we include global and country-specific factors as explanatory variables. In column (III) we use the whole sample. The sample in column (IV) is adjusted for the outliers Estonia and Bulgaria. As discussed in section 5.1, the market size values for both countries are significant outliers and thus we adjust the sample in order to get representative results for the sample. In column (V) and (VI), we restrict the sample to developed and emerging countries respectively. Again, we take out Estonia and Bulgaria. The regressions are all run on a weekly basis. We will centre the discussion on column (IV) in the following.

We can see that the association of global factors and CDS market size is strong in terms of significance. Out of the four global factors we test, three are statistically significant. Looking at column (IV), we find that three global factors, namely the TED spread, the level of the five year treasury constant maturity rate and the VIX are all associated with market size. CMT is significant at the one percent level, VIX is significant at the five percent level and TED is significant at the ten percent level. In terms of economic magnitude, the TED spread and the level of the five year treasury constant maturity rate are the largest significant global factors. A one standard deviation increase in CMT and TED is associated with a 0.04 standard deviation increase in market size. For VIX, we can see that a one standard deviation increase is linked to a 0.02 standard deviation increase in market size. Thus, the three factors are economically meaningful though the effect is small. All three factors have a positive sign. We use the level of the TED spread and the VIX in order to proxy for investors' global risk perceptions. Hence, we

see that for higher levels of investors' risk perceptions, we also observe higher levels of CDS market size.

Table 2: Determinants of CDS Market Size

VARIABLES	(I) Market Size (%) weekly All	(II) Market Size (%) weekly All	(III) Market Size (%) Weekly All	(IV) Market Size (%) weekly All excl. outliers	(V) Market Size (%) Weekly Developed	(VI) Market Size (%) weekly Emerging
Global Factors						
TED	0.03*		0.04*	0.04*	-0.02**	0.07*
	(0.02)		(0.02)	(0.02)	(0.01)	(0.03)
CMT	0.08***		0.10**	0.04***	0.00	0.07***
	(0.02)		(0.04)	(0.01)	(0.01)	(0.02)
VIX	0.04***		0.05**	0.02**	0.01	0.03**
	(0.02)		(0.02)	(0.01)	(0.01)	(0.01)
VRP	-0.00		0.01	-0.01	0.00	-0.00
	(0.00)		(0.01)	(0.01)	(0.00)	(0.01)
Country-Specific Factors						
SPREAD		0.01	-0.01	0.01	0.01*	0.05
		(0.02)	(0.01)	(0.01)	(0.00)	(0.07)
EXCH		0.09	0.11	0.04	0.87	-0.01
		(0.14)	(0.17)	(0.14)	(0.52)	(0.19)
FTG		0.17	0.29	-0.07	-0.21***	0.05
		(0.30)	(0.29)	(0.07)	(0.06)	(0.07)
LN_GDP		-0.62*	0.41	-0.32	0.24	0.14
		(0.34)	(0.61)	(0.33)	(0.16)	(0.37)
CCR		-0.02	-0.19	0.02	0.13***	-0.28
		(0.12)	(0.16)	(0.05)	(0.04)	(0.17)
Constant	0.00**	0.00**	0.00	-0.00***	-0.00***	-0.00*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	12,036	11,773	11,773	11,337	5,105	6,232
R-squared	0.90	0.89	0.91	0.79	0.93	0.75
Adj. R-squared	0.90	0.89	0.91	0.78	0.93	0.75

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Furthermore, we use the level of the five year constant maturity rate in order to proxy for the global business cycle. We find that CMT is positively correlated with market size and in terms of economic magnitude and significance the most important factor. Thus, higher levels of CMT are linked to higher levels of market size. This is what we expected, especially when we look at column (VI) where we can see that the effect is more pronounced for emerging countries. Hence, a higher level of the US constant maturity rate is associated with larger CDS market size. This is in line with what theory predicts namely that higher levels of US interest rates will adversely affect developing countries' ability to pay as it becomes harder to refinance their own debt at low rates. This leads, ultimately, to a higher probability of default which is reflected in an increased demand for default insurance, i.e. larger CDS market size. If we look at column (V) and (VI), we can see that the positive association with global factors is stronger for emerging than for developed countries. All three factors that were found significant for the entire sample are also significant when only looking at emerging countries. The economic magnitude, however, is

larger for all factors. Hence, both the association of market size with investors' global risk perceptions as well as with the global business cycle are significantly stronger for emerging than for developed countries. Looking at developed countries, we can see that only the association with the TED spread remains significant at the five percent level. The association of the TED spread with developed countries is, however, negative. This is astonishing as we expected to find higher levels of market size for higher levels of the TED spread across all countries.

Looking at column (IV), we can see that the country-specific factors are not correlated with CDS market size when looking at the whole sample. The same is true when only looking at emerging countries. However, if we focus on column (V) we can see that developed countries are correlated with three out of the five country-specific factors. We see that SPREAD is significant at the ten percent level, FTG at the one percent level and CCR at the one percent level as well. In terms of economic magnitude, SPREAD is the smallest. For a one percent change in SPREAD, we observe a 0.01 standard deviation change in market size, i.e. the relationship is positive. However, due to the low significance and the low economic magnitude the effect is negligible and not economically meaningful. This is in line with Duffie (2010) who finds that levels of CDS spreads are not related to CDS volumes. Looking at FTG, we can see that a one standard deviation change is linked to a 0.21 standard deviation change in market size. The effect is negative, i.e. an increase in FTG leads to a decrease in market size. The results are in line with theory as higher levels of foreign exchange reserves decrease the country risk of default. Ismailescu and Phillips (2012) also find that CDS trading initiation is more likely after a decrease in foreign exchange reserves. We can see from the results that the ability to pay consideration is strongly correlated with investors' buying decisions of CDS. The next country-specific factor is CCR. For a one standard deviation change in CCR, we can see a 0.13 standard deviation change in market size. The effect is positive. The positive relationship indicates that sovereigns with a higher credit rating have a larger CDS market size. This is in line with the findings in the descriptive statistics section. However, it is counterintuitive that investors buy more CDS of better rated sovereigns as the credit rating is supposed to indicate the financial soundness. The result can most likely be explained by the SDC as there were several European countries which were relatively high ranked in terms of their credit rating when the SDC started. As the SDC spread, investors increased their CDS holdings for those countries while the ratings remained relatively high for most of them due to the bailout funds initiated by the EU. The results with regard to CCR might also be seen as additional support for hedging activity. Since banks are

large holders of highly rated government bonds and started to hedge their bond positions as their creditworthiness deteriorated in order to reduce capital requirements during the recent crises, we can observe a positive association of market size and CCR. Both the effects of CCR and FTG are economically meaningful in terms of the size of the effect, especially compared to the global factors.

Overall, the results from the static regression analysis indicate that the economic magnitude of country-specific factors is significantly higher than that of global factors. Comparing the results from column (III) and (IV), it becomes obvious why we exclude the outliers Estonia and Bulgaria. Though global factors are only affected in terms of economic magnitude, country-specific factors are skewed as the outliers change the signs of the factors. Especially for the highly significant variables CCR and FTG, we can see that the results are strongly influenced by whether we include the outliers or not.[31] Last, we want to note that, in contrast to Berg and Streitz (2012), we do not find that larger countries have smaller CDS market size. We do not find LN_GDP to be significantly correlated with market size. The result is robust to the type of sovereign we look at.

5.3.2 Dynamic Analysis

In the following, we will turn from the static analysis of the determinants of the level of market size towards the dynamic analysis of the determinants of market activity. We will investigate which factors are associated with changes in market size and market turnover. Table 3 and 4 display the regression results for the baseline regression (2). In table 3, the dependent variable is weekly change in market size in percent while in table 4 the dependent variable is weekly market turnover. We have six different specifications in both tables. In column (I), we use global factors and country-specific factors as explanatory variables while in column (II) and (III) we restrict the sample by sovereign type. In column (IV) - (VI), we use again the full sample and the restricted sample by sovereign type. However, this time we also include the lagged dependent variable as an explanatory variable. We put the main focus on column (I) and (IV) where we include both global and country-specific factors as explanatory variables and use the whole sample.

[31] Excluding the outliers further yields results that are in line with results from other studies and thus the choice seems to be justified.

Looking at column (I) and (IV) in table 3, we can see that changes in global factors and changes in CDS market size are significantly correlated while country-specific factors hardly exhibit any association.

Table 3: Determinants of Weekly Changes in CDS Market Size

VARIABLES	(I) ΔMarket Size All	(II) ΔMarket Size Developed	(III) ΔMarket Size Emerging	(IV) ΔMarket Size All	(V) ΔMarket Size Developed	(VI) ΔMarket Size Emerging
Global Factors						
ΔTED	0.03**	0.01	0.04**	0.03**	0.01	0.04**
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
MSCIW	0.04	0.08**	0.01	0.03	0.06*	0.00
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.05)
$MSCIW^2$	-0.08***	0.01	-0.15***	-0.08***	0.01	-0.15***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.04)
MSCIWF	-0.00	-0.01	0.00	0.01	-0.00	0.01
	(0.03)	(0.04)	(0.05)	(0.03)	(0.04)	(0.04)
$MSCIWF^2$	0.08***	0.01	0.13***	0.07**	0.01	0.11***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
ΔCMT	-0.01	-0.07**	0.03**	-0.02*	-0.07***	0.03*
	(0.01)	(0.03)	(0.02)	(0.01)	(0.02)	(0.02)
ΔVIX	-0.00	0.02	-0.02	0.00	0.02*	-0.02
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
ΔVRP	-0.05***	-0.02	-0.07***	-0.03**	-0.01	-0.04**
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Country-Specific Factors						
ΔMARKET_SIZE[t-1]				-0.04***	0.02	-0.08***
				(0.01)	(0.02)	(0.02)
LOC_RET	-0.01	-0.02	-0.00	-0.01	-0.01	-0.01
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
LOC_VOL	-0.01	0.00	-0.04*	-0.00	0.00	-0.03
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
ΔSPREAD	-0.01	-0.02**	-0.04	-0.01	-0.02***	-0.05
	(0.01)	(0.01)	(0.04)	(0.01)	(0.01)	(0.04)
$\Delta SPREAD^2$	0.01	0.01**	0.57	0.01	0.01**	0.67
	(0.01)	(0.00)	(0.44)	(0.01)	(0.00)	(0.51)
ΔEXCH	0.01	0.10***	0.00	0.01	0.10***	0.01
	(0.01)	(0.03)	(0.01)	(0.01)	(0.03)	(0.01)
CPI	-0.06***	-0.08	-0.03	-0.06***	-0.08*	-0.03
	(0.02)	(0.05)	(0.02)	(0.02)	(0.04)	(0.02)
TOT_VOL	-0.00	0.03	-0.12	0.03	0.07	-0.12
	(0.05)	(0.10)	(0.09)	(0.05)	(0.09)	(0.07)
TOT_CHG	-0.04*	0.05	-0.07**	-0.04*	0.06	-0.08***
	(0.02)	(0.06)	(0.03)	(0.02)	(0.06)	(0.03)
Constant	-0.00*	0.00	0.00	0.00***	0.00*	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,716	5,299	6,417	11,656	5,274	6,382
R-squared	0.01	0.02	0.02	0.02	0.02	0.02
Adj. R-squared	0.01	0.01	0.01	0.01	0.02	0.01

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Among the country-specific factors, we can observe that CPI is significantly correlated with CDS market size changes. The effect is significant at the one percent level and it is negative, i.e. for positive changes in CPI we see a decrease in CDS market size. In terms of economic magnitude, we can see that a one standard deviation change in CPI is associated with a 0.06 standard deviation change in market size. Hence, the size of the effect is economically

meaningful. The sign is contrary to what we expected. Looking at column (II) and (III), we can see that the effect is not significant when only looking at one particular type of sovereign. Aside from CPI, we find that changes in terms of trade are also significant at the ten percent level. For a one standard deviation change in TOT_CHG, we can observe a 0.04 standard deviation change in market size. The effect is negative and economically meaningful in terms of size. The results indicate that an improvement in the terms of trade decreases CDS market size. Due to an improvement in the terms of trade sovereigns are able to buy more imported goods for the same number of exported goods. Though an improvement can also result in a deterioration of the balance of payments, it seems that the positive effect of higher prices for exported goods is dominant. The effect is even stronger both in terms of economic magnitude and significance for emerging countries. This is reasonable as an improvement in the terms of trade, especially for emerging countries, can mean a step towards the production of more elaborated products, i.e. an increased capacity to compete.

When we focus on emerging countries, we can also see that local stock market volatility is significant at the ten percent level and has a negative sign. For a one standard deviation change in LOC_VOL, we can see a 0.04 decrease in market size. This is contrary to what we expected as increasing local stock market volatility is a sign of uncertainty and should thus lead to higher levels of CDS market size. However, the effect is not robust to including the lagged dependent variable in the regression and can thus be neglected. Focusing on developed countries, we can see that increases in the exchange rate lead to increases in market size. The effect is highly significant at the one percent level and in terms of economic magnitude a one standard deviation change in ΔEXCH is linked to a 0.10 change in market size. The result is backed by theory as an increase in the exchange rate against the USD will lead to a decreased ability to pay back USD denominated debt. Both, the effects of LOC_VOL and ΔEXCH are economically meaningful. Last, we can also see that the CDS spread is correlated with changes in CDS market size for developed countries. We see that the relationship is not linear as changes in the CDS spread are associated with decreases in market size while large absolute changes are associated with increases in market size. The effect is significant for both variables at the five percent level. However, we can see again that in terms of size the effect is small and thus only economically meaningful to a limited amount.

Turning to the set of global factors, we can see that changes in investors' global risk perceptions are strongly associated with changes in market size. For an increase in the ΔTED

spread we observe an increase in CDS market size while an increase in the ΔVRP is correlated with a decrease in CDS market size. The ΔTED spread is significant at the five percent level while the ΔVRP is significant at the one percent level. In terms of economic magnitude, a one percent change in the ΔTED spread and the ΔVRP are linked to 0.03 and 0.05 changes in market size respectively. The effect is, however, solely driven by emerging countries. The same can be observed for $MSCIW^2$ and $MSCIWF^2$. Large absolute MSCIW returns are associated with decreases in CDS market size and large absolute MSCIWF returns are related to increases in CDS market size. Both effects are significant at the one percent level and for both a one standard deviation change is linked to a 0.08 standard deviation change in market size. The effect is even more pronounced when looking at emerging countries in isolation. When we look at ΔCMT, we can see that even though it is not significant for the whole sample, it becomes significant when looking at developed and emerging countries separately. For developed countries, we can observe that a one standard deviation change is associated with a 0.07 decrease in market size. The effect is significant at the five percent level. This is in line with the observations during the SMC and SDC where low interest rates were associated with increasing levels of CDS for developed countries especially in Europe. For emerging countries, the effect is positive and also significant at the five percent level. A one percent change in ΔCMT is correlated with a 0.03 change in market size. The result can be explained by the dependence of emerging countries on the US interest rate. As the US interest rate as a reference is lowered, emerging countries will find it easier to refinance at lower rates and thus will be less prone to bankruptcy. All significant global factors are economically meaningful in terms of size. Overall, we can see that changes in market size are linked to the global business cycle for developed countries and to investors' global risk perceptions and global financial sector health for emerging countries. The R-squared and the adjusted R-squared are low with values ranging between 0.01 and 0.02. This shows that even though we find significance for some factors, there must be other factors which significantly determine CDS market size. Also, we can see that the results are relatively robust to the inclusion of the lagged dependent variable which is significant at the one percent level for the whole sample and emerging countries.

We will now turn to table 4 in order to discuss the determinants of CDS market turnover over time. Looking at column (I), we can see that both global factors as well as country-specific factors influence weekly CDS trading volume.

We can see that changes in the MSCIWF, ΔCMT and VIX are correlated with market

turnover. They are all significant at the five percent level and economically meaningful in terms of size. The largest in terms of economic magnitude is MSCIWF. For a one standard deviation change in the MSCIWF we can observe a 0.11 standard deviation change in market turnover. The effect is positive indicating a positive relationship between financial sector health and market turnover.

Table 4: Determinants of Weekly CDS Trading Volume

VARIABLES	(I) Market Turnover All	(II) Market Turnover Developed	(III) Market Turnover Emerging	(IV) Market Turnover All	(V) Market Turnover Developed	(VI) Market Turnover Emerging
Global Factors						
ΔTED	0.05	0.05**	0.04	0.05*	0.05**	0.05
	(0.03)	(0.02)	(0.05)	(0.03)	(0.02)	(0.05)
MSCIW	-0.07	0.02	-0.13*	-0.10**	-0.01	-0.16**
	(0.04)	(0.05)	(0.07)	(0.04)	(0.04)	(0.07)
$MSCIW^2$	0.04	0.06	0.01	0.01	0.03	-0.01
	(0.04)	(0.05)	(0.05)	(0.03)	(0.05)	(0.05)
MSCIWF	0.11**	0.01	0.17**	0.13***	0.02	0.19**
	(0.05)	(0.04)	(0.07)	(0.04)	(0.04)	(0.07)
$MSCIWF^2$	-0.06	0.03	-0.12	-0.02	0.09	-0.08
	(0.08)	(0.08)	(0.12)	(0.08)	(0.09)	(0.12)
ΔCMT	-0.08**	0.01	-0.15***	-0.07**	-0.00	-0.14***
	(0.03)	(0.03)	(0.05)	(0.03)	(0.03)	(0.04)
ΔVIX	0.02**	0.06***	-0.00	0.02	0.05***	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
ΔVRP	-0.00	0.01	-0.01	0.00	0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Country-Specific Factors						
MARKET_TURNOVER[t-1]				0.11***	0.24***	0.08***
				(0.03)	(0.02)	(0.02)
LOC_RET	-0.05**	-0.03	-0.07**	-0.06**	-0.03	-0.08**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
LOC_VOL	0.12***	0.06	0.13***	0.10***	0.04	0.10***
	(0.04)	(0.05)	(0.05)	(0.03)	(0.04)	(0.04)
ΔSPREAD	-0.02**	-0.01***	-0.21*	-0.02**	-0.02***	-0.19
	(0.01)	(0.00)	(0.12)	(0.01)	(0.00)	(0.12)
$ΔSPREAD^2$	0.03***	0.03***	4.02***	0.03***	0.03***	3.69***
	(0.01)	(0.00)	(0.45)	(0.01)	(0.00)	(0.46)
ΔEXCH	0.01**	0.09***	0.00	0.01**	0.16***	0.00
	(0.00)	(0.03)	(0.00)	(0.00)	(0.03)	(0.00)
CPI	-0.02	0.21*	-0.05	-0.03	0.14	-0.05
	(0.05)	(0.12)	(0.05)	(0.04)	(0.10)	(0.04)
TOT_VOL	-0.00	0.22	-0.12	-0.06	-0.03	-0.10
	(0.21)	(0.46)	(0.31)	(0.20)	(0.33)	(0.29)
TOT_CHG	-0.23***	-0.13	-0.19**	-0.23***	-0.17**	-0.19**
	(0.07)	(0.09)	(0.09)	(0.06)	(0.08)	(0.08)
Constant	0.00**	-0.00	0.00***	0.00***	-0.00	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,681	2,988	3,693	6,378	2,826	3,552
R-squared	0.11	0.21	0.09	0.12	0.25	0.09
Adj. R-squared	0.10	0.20	0.08	0.11	0.23	0.08

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

We did expect to find the opposite, i.e. higher market turnover in times where the global financial sector is suffering. However, one possible explanation could be that banks are more

likely to act as a counterparty in a CDS transaction when they are not economically troubled. Therefore, a solid global financial sector health could be indicative of higher market turnover.

For ΔCMT, we see that a one standard deviation change is associated with a 0.08 decrease in market turnover. Both, the effects of MSCIWF and ΔCMT are solely driven by emerging sovereigns. For emerging countries the effects are larger in terms of economic magnitude (0.17 for MSCIWF and -0.15 for ΔCMT). We also find a correlation between market turnover and the ΔVIX which is significant at the five percent level. However, the effect is not robust to the inclusion of the lagged dependent variable and can thus be disregarded. When we look at developed sovereigns only, we also see that market turnover is significantly correlated with ΔTED. Here, we find a positive correlation which is significant at the five percent level. For a one percent change in ΔTED we can see a 0.05 standard deviation change in market turnover. Further, market turnover for developed countries is linked to ΔVIX. The effect is highly significant at the one percent level and in terms of economic magnitude a one standard deviation change in ΔVIX is connected to a 0.06 standard deviation change in market turnover. Hence, developed countries' market turnover is significantly linked to investor's global risk perceptions. For emerging countries, we already discussed the close connection with MSCIWF and ΔCMT. Further, we find a connection with MSCIW which is significant at the ten percent level. However, if we include the lagged dependent variable we see that it becomes more significant and larger in terms of economic magnitude (from -0.13 to -0.16). The results for emerging countries indicate that their CDS market turnover is closely connected to the global business cycle.

Turning to the country-specific factors, we see that TOT_CHG has the strongest link to market turnover. It is significant at the one percent level and for a one percent change in TOT_CHG we can observe a 0.23 decrease in market turnover. This is in line with the results for changes in market size. Not only the demand for CDS but also the trading volume decreases when terms of trade improve. Just as for changes in market size, the effect is driven by emerging countries. The next important factor that is significantly correlated with market turnover is the the volatility of the local business climate. We can see that both LOC_RET and LOC_VOL are highly significant. LOC_RET is significant at the five percent level and has a negative sign while LOC_VOL is significant at the one percent level and has a positive sign. The results are in line with theory as less uncertainty about the local business climate is linked to lower CDS market turnover. Again the effect is solely driven by emerging sovereigns. Aside from the volatility of

the local business climate, we can observe that ΔEXCH are associated with market turnover. The effect is significant at the five percent level and positive. For a one standard deviation change in ΔEXCH we see a 0.01 standard deviation change in market turnover. This is again what we expected based on theory because an increase in the exchange rate against the USD reduces the ability to repay USD denominated debt. The effect is driven by developed sovereigns for whom both economic magnitude and significance are higher. Last, we find a relationship between CDS market turnover and CDS spreads. For ΔSPREAD, we can see a negative effect that is significant at the five percent level. For a one standard deviation change in ΔCDS we can observe a decrease of 0.02 in market turnover. The effect is larger in terms of economic magnitude for emerging countries (-0.21) but only significant at the ten percent level. When we turn to $\Delta SPREAD^2$, we see a positive correlation that is significant at the one percent level. Hence, large absolute changes in CDS spreads are linked to high CDS market turnover. In terms of economic magnitude, a one percent change in $\Delta SPREAD^2$ is connected to a 0.03 standard deviation change for the whole sample and to a 4.02 standard deviation change for emerging countries. From this we can infer that large shocks to CDS spreads are associated with extreme trading activity in the CDS market. However, as we did not find a similar effect for changes in market size we can conclude that the overall demand for CDS is not significantly affected. Again, we see that the inclusion of the lagged dependent variable does not affect the results significantly. Compared to the regression on changes in market size, we see increased R-squared and adjusted R-squared values. Especially for developed countries the adjusted R-squared is 0.20 while it is 0.10 for the whole sample (columns (I) and (II)). Overall, we observe that the ability to pay consideration, the volatility of the local business climate and CDS spreads are all closely connected to CDS market turnover and that all effects are economically meaningful.

Table 5 displays the regression results for the baseline regression (3). In column (I) and (II), we analyse the effect of rating migrations on changes in market size. In column (III) and (IV), we do the same analysis for market turnover. We also include the control vector CONTR which we define in section 5.3 and the lagged dependent variable in column (II) and (IV).

We can see from the regression results that the only rating event that is highly significant in explaining market activity is a credit rating downgrade. Looking at changes in market size, we can see that an upgrade has a positive influence, i.e. as the result of an upgrade we see an increase in market size. This is at first counterintuitive as an upgrade indicates a higher level of credit quality. One can, however, think of institutional investors (e.g. pension funds) who are

constrained by their investment activity to investment grade rated sovereigns. As the rating increases, institutional investors might enter the market and thus hedging activity may increase for the respective bonds resulting in larger CDS market size. Since the effect is only significant at the ten percent level and very small in terms of economic magnitude (0.00), it is negligible. The effect is robust to the inclusion of the lagged dependent variable. The adjusted R-squared also remains on a low level.

Table 5: Influence of Rating Migrations on CDS Market Activity

VARIABLES	(I) ΔMarket_Size All	(II) ΔMarket_Size All	(III) Market_Turnover All	(IV) Market_Turnover All
Upgrade	0.00*	0.00*	0.01	0.01
	(0.00)	(0.00)	(0.01)	(0.01)
Downgrade	0.00	0.00	0.00***	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)
Positive Change in Outlook	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Negative Change in Outlook	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Constant	-0.00	0.00**	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Control Vector - CONTR	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Lagged Dependent Variable	No	Yes	No	Yes
Observations	11,716	11,659	6,681	6,379
R-squared	0.02	0.02	0.11	0.12
Adj. R-squared	0.01	0.01	0.10	0.10

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Looking at column (III) and (IV), we can see that market turnover is significantly correlated with credit rating downgrades. The effect is significant at the one percent level and positive, i.e. as a sovereign is downgraded we can observe increased trading activity. However, again the effect is very small in terms of economic magnitude (0.00). Hence, we can conclude that in terms of size the influence of rating migrations on CDS market activity is economically not meaningful.

5.4 Event Study

In order to investigate the influence of rating migrations on market turnover in more depth, we perform a formal event study. The underlying assumptions for the event study are: market efficiency, unanticipated events and a well-specified model for normal market turnover. The significance of the effect is measured by comparing the market turnover for the sovereign at the event date with the expected market turnover for this date. The goal is to determine whether we can observe abnormal trading activity in weeks where credit rating announcements or outlook

revisions are published.[32]

We start the event study by calculating the average market turnover for each week using the whole sample of observations. We take the average market turnover as an approximation for a representative total market turnover at each point in time. Further, we take the logarithm of the market turnover in order to analyse both, raw and log transformed data. As Ajinkya and Jain (1989) find that the log transformation of market turnover data significantly reduces the departure from normality compared to raw data, we want to include it as well in the analysis. We define the event windows from the set of observations. Therefore, we take an event window of two weeks (from t = -1 to t = 0), namely the week before the event and the week in which the event takes place. This allows us to capture potential anticipation effects by the market. Furthermore, we define an estimation window of ten weeks (from t = -15 to t = -5). In order to avoid any anticipation effects in the estimation window, we end five weeks before the event takes place. For some sovereigns, we have more than one event and the problem of overlapping events, i.e. we have events in the estimation windows of other events. One example is Greece, where we have credit rating downgrades in the weeks of 1 April 2011 and 13 May 2011. Thus, for the event in the week of 13 May 2011, we have another event in the estimation window. In order to account for this bias, we leave out the weeks from the estimation period in which the event takes place. This reduces the length of the estimation period but at the same time increases the quality of the estimation of normal market turnover.

The abnormal market turnover (AMT) for sovereign i at time t is defined as:

$$AMT_{it} = Market_Turnover_{it} - E(Market_Turnover_{it} | X_t)$$

Here, X_t is an explanatory variable or set of explanatory variables which determine the normal market turnover. We calculate the abnormal market turnover through regression analysis. The general model is:

$$\widehat{AMT}_{it} = Market_Turnover_{it} - \hat{\alpha}_i - \hat{\beta}_i X_t$$

We use two different specifications of this model to calculate the abnormal market turnover: the average market turnover model and the augmented average market turnover model. First, we run the simple model where we use the average market turnover as the explanatory variable. Formalised, the simple model is:

[32] An event study is an empirical method used to measure the effect of particular events on stock market related data such as returns, trading volume, etc. For a general overview with regard to event studies, refer to MacKinlay (1997). For an event study on market turnover, refer to Campbell and Wasley (1996).

$$Market_Turnover_{it} = \alpha_i + \beta_i \overline{Market_Turnover_t} + \varepsilon_{it}$$

Second, we run an augmented model where we also use the average market turnover as an explanatory variable but in addition we also use CMT, VIX and MSCIWF as explanatory variables, i.e. the global variables which we found to be significantly associated with market turnover. Formalised, the augmented model is:

$$Market_Turnover_{it} = \alpha_i + \beta_i \overline{Market_Turnover_t} + \gamma_i CMT_t + \delta_i VIX_t + \theta_i MSCIWF_t + \varepsilon_{it}$$

As we use an event window of two weeks, we calculate the cumulative abnormal market turnover (CAMT) for each event. We then test across the cross-section of events whether we can detect abnormal trading volume in the event window. We use the standard t-test statistic with clustered standard errors by Sovereign. The results are displayed in Table 6.

Table 6: Cross-sectional Results of Event Study

	Simple Model				Augmented Model			
Across all Events	avg. CAMT	t-test	p-value	sign.	avg. CAMT	t-test	p-value	sign.
	Raw Market Turnover							
Upgrade Events (N = 13)								
H_0: CAMT = 0	-7.52	-1.91	0.08	*	-7.93	-1.47	0.17	
Downgrade Events (N = 42)								
H_0: CAMT = 0	11.78	2.95	0.01	***	13.48	1.60	0.12	
Pos. Change in Outlook (N = 36)								
H_0: CAMT = 0	2.09	0.51	0.62		4.99	0.60	0.55	
Neg. Change in Outlook (N = 46)								
H_0: CAMT = 0	8.19	1.64	0.11		11.39	1.64	0.11	
	Log Market Turnover							
Upgrade Events (N = 13)								
H_0: CAMT = 0	0.07	0.19	0.85		-0.12	-0.18	0.86	
Downgrade Events (N = 42)								
H_0: CAMT = 0	0.48	2.30	0.03	**	1.35	1.76	0.09	*
Pos. Change in Outlook (N = 36)								
H_0: CAMT = 0	0.17	0.70	0.49		-0.08	-0.21	0.83	
Neg. Change in Outlook (N = 46)								
H_0: CAMT = 0	0.71	2.22	0.03	**	1.14	1.78	0.09	*

Clustered standard errors; *** p<0.01, ** p<0.05, * p<0.1

The results indicate significant abnormal trading volume for weeks in which credit rating downgrades occur. The simple model yields significant results at the one percent level for raw market turnover and at the five percent level for log market turnover. Looking at the results from the augmented model, we can see that downgrades are only significant at the ten percent level using log transformed market turnover. In addition, upgrades are associated with abnormal market turnover when using raw data and the simple model. The results are significant at the ten percent level. Last, we find significant market turnover for negative changes in outlooks. The results are significant at the five percent level and are robust to the choice of model. However,

they are only valid for log transformed market turnover. Overall, we can see that the significance is strongly reduced when using the augmented model to estimate abnormal market turnover. We can state that the association between rating migrations or outlook revisions and market turnover is very limited if existent at all.

5.5 Discussion

Taking together both the results from the static and the dynamic panel regression analysis, we can see that the influence of country-specific factors on market size is limited when looking at the whole sample. Here, we find that global factors, i.e. investors' global risk perceptions, the global business climate and the global financial sector health, are stronger linked to market size than country-specific factors. However, when we turn to market turnover, we find that aside from the global factors the volatility of the local business climate and the ability to pay back USD denominated debt are strongly correlated with market turnover as well. Thus, the results for the whole sample suggest that changes in global factors are strongly connected to significant changes in market size and therefore changes in the net demand for CDS protection. Country-specific factors are significantly associated with market turnover and therefore rather linked to a reallocation of net demand between different market participants.[33] In the following, we will summarise and discuss the main results with regard to the hypotheses.

We cannot reject the first hypothesis. Investors' global risk perceptions are highly correlated with CDS market size and with market turnover. Especially the TED spread is an important factor but also VRP and VIX. We find a correlation between market size and investors' global risk perceptions for emerging countries while developed countries show a correlation with investors' global risk perceptions for market turnover. The results suggest that investors engage in CDS in order to hedge and to speculate as we find a positive association between market size and risk perception for the static panel regression and a negative association for the dynamic panel regression

Furthermore, we cannot reject the second hypothesis. The global business cycle is significantly associated with CDS market size and market turnover. We find that CMT is closely related to variation in CDS markets both in terms of market size and market turnover. For the

[33] As market turnover comprises all market risk transaction but not necessarily transactions where new CDS contracts are added to the market, we can make the distinction between net demand for CDS and reallocation of CDS. If we can observe that a factor is linked to market turnover but not to market size, we can infer that this factor leads to a reallocation of CDS instead of an increase in net demand for CDS.

global equity market variable MSCIW we find a negative relationship for large absolute returns and market size changes which is in line with expectations. The third hypothesis, however, has to be rejected. We find a positive relationship for large absolute MSCIWF returns and market size. As we expected to find a clear negative relationship between CDS market activity and global financial sector health, we have to reject the third hypothesis though we can state that a correlation exists.

Moving to the country-specific factors, we cannot reject both hypotheses four and five. We do find evidence that the ability to pay back dollar denominated debt as well as the volatility of the local business climate are significantly correlated with CDS market activity. While the ability to pay consideration plays a role for both developed and emerging countries, the volatility of the local business climate is primarily correlated with market turnover of emerging countries. The only factor which does not show any association with CDS market activity is terms of trade volatility. Furthermore, we also find a significant relationship between CDS spread changes and CDS market turnover while the relationship between CDS spreads and market size seems to be negligible, i.e. changes in CDS spreads rather cause a reallocation of demand for CDS rather than in increase in net demand for CDS. Especially large absolute changes in CDS spreads are highly correlated with changes in CDS market turnover and have a significant effect. We also find that inflation is primarily correlated with changes in market size.

Last, we find that credit rating migrations and outlook changes are to a limited amount associated with increased market turnover. The event study results suggest that weeks with credit rating downgrades and negative outlook changes have significant abnormal market turnover. The effects are, however, weak in terms of significance. If we combine the event study results with the regression results, we can see that only downgrades are significantly positively correlated with market turnover. However, the economic magnitude of the effect is small. For the other event types, we do not find a significant relationship with market turnover. Hence, we can infer that the additional information that is transmitted to the market through credit rating migrations or outlook revisions is limited. Still, we cannot reject the sixth hypothesis that CDS market turnover is significantly influenced by credit rating migrations and outlook changes though we can say that the effect is negligible in terms of economic magnitude.

Looking at the dynamic panel regression results for changes in market size, we need to keep in mind that the R-squared and adjusted R-squared values are low and thus we are only able to explain a small portion of variation in market size with the selected factors.

6 Critical Evaluation, Robustness and Limitations

In order to increase the quality and the transparency of the paper, we want to discuss several limitations and critical points as well as robustness checks.

First, we want to discuss the question of data quality. Considering the CDS data, we have to keep in mind when interpreting the results that due to data availability the sample is limited to a turbulent and not necessarily representative period of time. If we look for instance at the constant maturity rate, we might find different results for economically strong times, i.e. lower CDS market size for higher CMT levels as a high level of the CMT could be indicative of a strong world economy and thus lead to reduced levels of market size . The results we retrieve are valid for the time span we investigate but they might not be transferable to other periods. Furthermore, we rely solely on CDS data from the DTCC and are not able to cross check the numbers as the DTCC is the only source that provides the data at such a detailed level. The last point which we want to mention with regard to the dataset is that we include data on the basis of data availability. Thus, it is possible that the data suffers from a selection bias as CDS data availability is not random but rather a function of the development and transparency of a country.

Second, we want to check the quality of the regression results via several robustness checks. First, we check whether the static panel regression results are robust to changing the time span from weekly to monthly. This is motivated by the fact that some of the explanatory variables are available at different data frequencies. In order to check for the robustness of the results, we take the monthly averages for all explanatory variables. We can see that the results hardly change and are thus robust to the choice of time span.[34] Furthermore, we used the twelve month moving average for missing data points in inflation and foreign exchange reserves data. We also check the robustness of the results against this assumption and find that it does not change the results. Last, we want to raise concerns about potential endogeneity and reverse causality claims. Especially, since we use different global and country-specific variables in order to proxy for investors' global risk perceptions, the global business climate, financial sector health, the volatility of the local business climate and the ability to pay back USD denominated debt, endogeneity is a viable threat. We try to account for potential endogeneity by including country-fixed effects. In addition, the results might also be exposed to reverse causality issues especially with regard to the country-specific variables. One could imagine that for instance an increase in

[34] For the regression results, refer to table 14.

CDS market size or turnover leads to increased volatility in the local stock market because as investors become cautious about their debt holdings they might also reconsider their equity investments in the respective market. The panel regression analysis could further be exposed to omitted variable bias or measurement error.

Third, we focus on the event study. One drawback of the analysis is the fact that we have to rely on weekly data. As MacKinlay (1997) discusses in his paper, relying on weekly samples brings a significant decrease in the power of the test of no event effect compared to daily samples. Furthermore, due to data availability issues we have to restrict the estimation period to ten weeks which is a relatively short period of time. The issue of overlapping events might also bias the results.

7 Conclusion and Suggestions for Further Research

When we look at both the whole sample as well as the subsamples for developing and emerging countries, we see that investors' global risk perception is connected to market size for emerging countries and to market turnover for developed countries while the state of the global business cycle is correlated with both changes in market size and market turnover. In addition, global financial sector health is linked to CDS market size and turnover. Looking at the country-specific factors, we find that the ability to pay back dollar denominated debt and the volatility of the local business climate are significantly associated with CDS market size and turnover. Furthermore, we find that CDS spreads and CDS market turnover are closely tied while the link to market size is weak. With regard to credit rating migrations and outlook revisions, we find a significant influence of downgrades on market turnover. The effect is, however, negligible.

Overall, we find that market activity is strongly associated with global and country-specific factors. Looking at the whole sample, we find that global factors drive net demand for CDS protection while country-specific factors drive a reallocation of net demand for CDS protection across market participants. Further, we can state that global factors seem to be closer related to emerging countries than to developed countries. This effect can be seen both in the static as well as in the dynamic analysis. This might be partially driven by the fact that investors consider country-specific data to be more reliable for developed countries than for emerging countries. Another driving force behind that could be that emerging countries are more dependent on the overall world economy as their economies are less self-sustaining. Thus, investors react stronger

to global factors when it comes to emerging countries. Last, we also find empirical evidence that both hedging and speculation are underlying drivers of CDS market activity which is in line with previous studies.

The study contributes to the existing literature as it is the second study that empirically analyses the determinants of sovereign CDS market activity. Compared to the first study by Berg and Streitz (2012), this study expands the set of explanatory factors to global factors and finds that global factors are relevant in determining CDS market activity. Further research should concentrate on checking the results over an extended timespan as the period of study to which this study is bound by data availability might not be representative. Furthermore, we have seen that even though we find both global and country-specific factors to be strongly correlated to CDS market activity, there is still a lot of room for improvement especially in explaining changes in CDS market size. Hence, future research should also focus on the identification of additional explanatory factors in order to get an enhanced understanding of the determinants of sovereign CDS market activity.

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9 Appendix

9.1 Appendix A - Tables

Table 7: Credit Rating and Outlook Scale for Calculation of CCR

S&P Credit Rating Scale		
Explicit Credit Rating	Numerical Value	
AAA	22	Investment Grade Rating
AA+	21	
AA	20	
AA-	19	
A+	18	
A	17	
A-	16	
BBB+	15	
BBB	14	
BBB-	13	
BB+	12	Non-Investment Grade Rating
BB	11	
BB-	10	
B+	9	
B	8	
B-	7	
CCC+	6	
CCC	5	
CCC-	4	
CC	3	
C	2	
SD	1	
Credit Outlook Scale	Numerical Value	
Positive	0.5	
Watch Positive	0.25	
Stable	0	
Watch Negative	-0.25	
Negative	-0.5	
NM	0	

Table 8: Overview of Variables and Data Sources

Variable	Definition	Frequency	Source
	Global Variables		
CMT	Five Year Treasury Constant Maturity Rates	Weekly	Federal Reserve H.15
CRSP	Excess Log Return for the CRSP Value-Weighted Portfolio	Weekly	Kenneth French Data Library
MSCIW	Log Return for the MSCI World Index	Weekly	Thomson Reuters Datastream
MSCIWF	Log Return for the MSCI World Financials Index	Weekly	Thomson Reuters Datastream
TED	TED Spread	Weekly	Thomson Reuters Datastream
VIX	CBOE Volatility Index	Weekly	CBOE
VRP	Volatility Risk Premium	Monthly	Hao Zhou Website
	Country-Specific Variables		
CPI	Year-on-Year Change in the Consumer Price Index	Monthly	Thomson Reuters Datastream
DTG	Government Gross Debt over GDP	Yearly	Thomson Reuters Datastream World Economic Outlook
EXCH	Exchange Rate against the USD	Weekly	Thomson Reuters Datastream
FTG	Foreign Exchange Reserves over GDP	Monthly	Thomson Reuters Datastream World Economic Outlook
LN_GDP	Log of GDP	Yearly	World Economic Outlook
LOC_RET	Log Return for Local Stock Index	Weekly	Thomson Reuters Datastream
LOC_VOL	Local Stock Market Volatility	Weekly	Thomson Reuters Datastream
SPREAD	CDS Spreads with Five Year Maturity	Weekly	Thomson Reuters Datastream
TOT_CHG	Terms of Trade Change	Yearly	World Bank
TOT_VOL	Terms of Trade Volatility	Yearly	World Bank
CCR	Comprehensive Credit Rating	Weekly	Standard & Poor's

Table 9: Summary Statistics for DTCC Data by Sovereign Type

Variable	N	Mean	StD	p0.25	Median	p0.75
Developed Countries						
Gross Notional amount outstanding (in mio USD)	5347	44,513	59,224	8,372	21,711	59,778
Net Notional amount outstanding (in mio USD)	5347	5,572	6,000	1,117	3,367	7,242
Contracts outstanding	5347	2,251	2,368	559	1,211	3,337
Market Size (in %)	5347	2.7	6.2	0.6	1.2	1.9
Weekly Trading Volume (in mio USD)	2988	1,078	1,758	85	411	1,206
Weekly Contracts Traded	2988	80	120	8	35	101
Market Turnover (in %)	2988	13.1	12.5	4.5	9.9	17.6
Emerging Countries						
Gross Notional amount outstanding (in mio USD)	6689	37,256	41,035	8,054	19,967	48,423
Net Notional amount outstanding (in mio USD)	6689	2,352	2,966	707	1,355	2,401
Contracts outstanding	6689	3,387	2,986	1,024	2,317	4,939
Market Size (in %)	6689	2.8	3.1	1.1	1.8	3.4
Weekly Trading Volume (in mio USD)	3863	466	896	46	160	549
Weekly Contracts Traded	3863	47	68	7	22	65
Market Turnover (in %)	3863	16.3	23.4	5.4	11.1	19.8

Table 10: Summary Statistics for DTCC Data by Region

Variable	N	Mean	StD	Min	p0.25	Median	p0.75	Max
Americas								
Gross Notional amount outstanding (in mio USD)	1974	49,078	48,359	2,792	10,367	30,075	57,091	187,838
Net Notional amount outstanding (in mio USD)	1974	3,792	4,445	373	1,503	1,986	4,309	18,997
Contracts outstanding	1974	4,137	3,514	118	1,003	3,052	5,814	13,000
Market Size (in %)	1974	2.4	2.0	0.0	1.1	1.6	3.6	8.2
Weekly Trading Volume (in mio USD)	1121	721	1,122	0	92	324	880	13,419
Weekly Contracts Traded	1121	65	90	1	10	35	90	1,444
Market Turnover (in %)	1121	16.5	18.5	0.0	6.0	11.8	20.5	259.8
Asia Ex-Japan								
Gross Notional amount outstanding (in mio USD)	1526	35,038	21,315	5,864	17,851	31,192	55,513	85,416
Net Notional amount outstanding (in mio USD)	1526	2,580	2,082	347	1,081	1,947	3,272	10,020
Contracts outstanding	1526	4,111	2,310	835	2,277	3,743	6,102	9,330
Market Size (in %)	1526	1.3	0.8	0.1	0.8	1.1	1.4	4.3
Weekly Trading Volume (in mio USD)	892	501	610	3	105	299	652	4,514
Weekly Contracts Traded	892	60	68	1	17	39	79	797
Market Turnover (in %)	892	15.6	14.0	0.4	7.3	12.3	19.4	154.0
Australia & New Zealand								
Gross Notional amount outstanding (in mio USD)	351	11,005	11,761	1,659	2,864	3,692	15,533	39,375
Net Notional amount outstanding (in mio USD)	351	1,883	1,931	354	509	596	3,008	5,909
Contracts outstanding	351	1,098	1,195	145	319	421	1,378	4,337
Market Size (in %)	351	0.9	0.3	0.2	0.7	0.9	1.1	1.6
Weekly Trading Volume (in mio USD)	216	388	515	0	30	156	515	2,514
Weekly Contracts Traded	216	45	83	1	4	13	49	604
Market Turnover (in %)	216	11.8	11.4	0.0	3.7	8.7	15.8	68.8
EMEA								
Gross Notional amount outstanding (in mio USD)	7967	40,662	55,088	1,604	7,452	18,288	50,613	395,855
Net Notional amount outstanding (in mio USD)	7967	4,027	5,343	200	787	1,842	4,918	29,460
Contracts outstanding	7967	2,385	2,507	48	691	1,310	3,427	14,344
Market Size (in %)	7967	3.3	5.6	0.2	0.9	1.7	3.2	58.7
Weekly Trading Volume (in mio USD)	4493	787	1,563	0	45	191	767	21,839
Weekly Contracts Traded	4493	60	100	1	6	21	72	1,271
Market Turnover (in %)	4493	14.5	21.1	0.0	4.4	9.8	18.5	625.0

Table 11: Summary Statistics for DTCC Data by Country

- Part I

Sovereign	Count	Sovereign Type	Net Notional amount outstanding (in mio USD)	Weekly Trading Volume (in mio USD)	Market Size (in %)	Market Turnover (in %)	Debt / GDP	CDS Spread (in bps)
Argentina	218	Emerging	2,074	648	1.1	29.8	0.50	1379
Australia	193	Developed	2,983	625	0.8	15.2	0.23	57
Austria	218	Developed	6,650	683	2.4	11.2	0.72	105
Belgium	218	Developed	5,459	925	1.2	15.5	0.97	140
Brazil	218	Emerging	14,605	2,658	1.0	15.8	0.65	153
Bulgaria	218	Emerging	1,072	120	13.7	12.7	0.16	293
Chile	218	Emerging	565	70	3.2	11.6	0.09	106
China	218	Emerging	5,356	1,073	0.3	14.1	0.25	102
Colombia	218	Emerging	1,988	235	2.0	12.1	0.35	166
Croatia	218	Emerging	613	89	2.4	15.5	0.44	332
Cyprus	37	Developed	322	19	1.6	5.7	0.88	1223
Czech Republ	218	Developed	961	89	1.3	10.3	0.38	114
Denmark	218	Developed	2,383	292	1.7	10.5	0.44	66
Ecuador	12	Emerging	605	n/a	5.7	n/a	0.20	3998
Egypt	149	Emerging	667	76	0.4	10.3	0.77	390
Estonia	218	Developed	429	30	30.9	8.1	0.07	192
Finland	218	Developed	2,141	176	1.8	7.6	0.48	44
France	218	Developed	15,025	3,737	0.7	18.2	0.84	95
Germany	218	Developed	15,185	2,373	0.6	13.2	0.80	52
Greece	178	Developed	6,537	788	1.5	15.4	1.46	2398
Hungary	216	Emerging	3,284	703	3.2	25.2	0.79	368
Iceland	218	Developed	852	32	7.1	4.2	0.93	419
Indonesia	218	Emerging	2,524	490	1.3	17.0	0.26	235
Ireland	218	Developed	4,282	756	2.3	19.2	0.93	416
Israel	218	Developed	1,017	128	0.6	9.7	0.76	150
Italy	218	Developed	22,630	5,031	0.9	22.1	1.20	238
Japan	218	Developed	6,238	1,148	0.0	13.5	2.22	80
Kazakhstan	218	Emerging	1,032	114	6.9	13.1	0.11	310

- Part II

Sovereign	Count	Sovereign Type	Net Notional amount outstanding (in mio USD)	Weekly Trading Volume (in mio USD)	Market Size (in %)	Market Turnover (in %)	Debt / GDP	CDS Spread (in bps)
Korea	218	Developed	4,605	1,008	1.3	19.8	0.34	143
Latvia	218	Emerging	678	65	7.3	10.8	0.36	406
Lebanon	158	Emerging	470	20	0.9	4.2	1.38	279
Lithuania	218	Emerging	670	49	5.1	8.3	0.36	317
Malaysia	218	Emerging	1,230	188	0.9	14.6	0.52	118
Mexico	218	Emerging	7,353	1,368	1.6	16.5	0.44	160
Netherlands	218	Developed	2,959	348	0.6	10.9	0.64	63
New Zealand	158	Developed	540	37	1.0	6.8	0.36	79
Norway	216	Developed	953	114	0.4	10.6	0.50	26
Panama	218	Emerging	659	57	5.9	9.0	0.39	158
Peru	218	Emerging	1,805	307	4.9	15.6	0.23	162
Philippines	218	Emerging	2,605	481	3.0	18.7	0.43	188
Poland	218	Emerging	2,035	491	0.8	24.8	0.54	175
Portugal	218	Developed	6,471	1,055	2.9	17.0	1.00	507
Qatar	218	Emerging	600	93	1.3	12.5	0.34	126
Romania	218	Emerging	1,194	130	2.5	11.7	0.30	347
Russia	218	Emerging	4,809	1,214	2.8	28.2	0.11	247
Saudi Arabia	93	Emerging	475	45	1.3	9.5	0.06	109
Slovakia	218	Emerging	907	76	2.5	9.3	0.41	136
Slovenia	205	Developed	789	51	3.8	6.4	0.44	178
South Africa	218	Emerging	2,272	504	1.8	21.3	0.36	176
Spain	218	Developed	14,607	4,233	1.6	26.8	0.68	253
Sweden	218	Developed	2,804	259	1.5	9.5	0.39	52
Thailand	218	Emerging	1,128	144	0.8	12.3	0.43	139
Tunisia	175	Emerging	275	16	1.4	5.9	0.44	113
Turkey	218	Emerging	5,817	1,556	2.0	26.1	0.41	222
Ukraine	218	Emerging	1,470	357	3.0	30.6	0.36	1107
United Kingd	218	Developed	8,594	1,042	0.5	9.2	0.77	73
United States	218	Developed	3,263	406	0.0	10.0	0.99	36
Venezuela	218	Emerging	1,992	562	1.5	26.0	0.42	1190
Vietnam	218	Emerging	615	88	1.1	12.5	0.51	318

Table 12: Summary Statistics for DTCC Data by Rating

		Mean Value by Explicit Credit Rating				Mean Value by Rating Category		
Explicit Credit Rating	Numerical Value	Net Notional Amount Outstanding (in mio USD)	Market Size (in %)	Market Turnover (in %)		Net Notional Amount Outstanding (in mio USD)	Market Size (in %)	Market Turnover (in %)
AAA	22	5,477	1.04	11.54	Investment Grade Rating	4,205	3.08	14.32
AA+	21	7,018	1.11	11.99				
AA	20	3,871	1.85	13.61				
AA-	19	3,903	4.41	12.97				
A+	18	5,883	2.08	11.57				
A	17	2,702	5.34	14.89				
A-	16	2,610	3.81	19.64				
BBB+	15	4,037	1.74	17.76				
BBB	14	3,357	4.98	14.72				
BBB-	13	3,193	4.44	14.48				
BB+	12	1,803	2.98	14.20	Non-Investment Grade Rating	2,176	2.39	17.94
BB	11	2,731	2.42	18.58				
BB-	10	2,305	1.80	17.82				
B+	9	1,449	1.58	27.45				
B	8	1,163	1.24	14.33				
B-	7	1,878	1.22	34.45				
CCC+	6	1,877	4.37	1.31				
CCC	5	4,775	0.96	13.83				
CCC-	4	654	5.69	n/a				
CC	3	3,660	0.76	12.72				
C	2	n/a	n/a	n/a				
SD	1	1,645	3.20	24.75				

Table 13: Summary Statistics for Global and Country-Specific Factors

Variable	N	Mean	StD	p0.25	Median	p0.75
Global Factors						
Weekly TED Spread (in bps)	218	43	36	23	31	47
Weekly CRSP Log Return (in %)	218	0.3	3.1	-1.4	0.3	1.9
Weekly MSCI World Log Return (in %)	218	0.2	3.1	-1.7	0.4	2.0
Weekly MSCI World Financials Log Return (in %)	218	0.1	4.7	-2.1	0.5	2.5
Weekly 5y Treasury Yields (in %)	218	1.6	0.7	0.9	1.7	2.2
Weekly CBOE VIX (in %)	218	25.4	11.1	17.6	21.8	29.4
Weekly Volatility Risk Premium (in %)	51	20.5	35.3	11.0	20.1	31.2
Country-specific Factors						
Weekly Local Stock Market Log Return (in %)	12,036	0.1	4.2	-1.4	0.1	1.9
Weekly Local Stock Market Volatility	12,036	1.5	1.2	0.9	1.2	1.8
Weekly CDS Spread (in bps)	11,773	285	832	86	142	279
Weekly Local Exchange Rate to USD	12,036	650.3	2,983.6	0.8	3.6	14.4
CPI Change (in %)	12,036	4.0	4.7	1.8	3.1	4.9
GDP (in bn USD)	12,036	1,023	2,263	138	285	798
Debt (in bn USD)	12,036	849	2,560	42	146	339
Foreign Exchange Reserves (in bn USD)	12,036	122	398	8	33	56
Debt to GDP (in %)	12,036	0.6	0.4	0.3	0.4	0.7
Foreign Exchange Reserves to GDP (in %)	12,036	0.2	0.2	0.0	0.1	0.2
Terms of Trade Volatility	12,036	5.2	5.0	2.1	3.2	5.7
Terms of Trade Change (in %)	12,036	4.5	18.1	-4.0	0.9	7.1

Table 14: Determinants of CDS Market Size (monthly)

VARIABLES	(I) Market Size (%) monthly All	(II) Market Size (%) monthly All	(III) Market Size (%) monthly All	(IV) Market Size (%) monthly All excl. outliers	(V) Market Size (%) monthly Developed	(VI) Market Size (%) monthly Emerging
Global Factors						
TED	0.03		0.04	0.04	-0.02**	0.07*
	(0.02)		(0.03)	(0.02)	(0.01)	(0.04)
CMT	0.08***		0.10**	0.04***	0.00	0.07***
	(0.02)		(0.04)	(0.01)	(0.01)	(0.02)
VIX	0.05**		0.06*	0.02	0.01*	0.03*
	(0.02)		(0.03)	(0.01)	(0.01)	(0.02)
VRP	-0.01		0.00	-0.01	0.00	-0.01
	(0.00)		(0.01)	(0.01)	(0.00)	(0.01)
Country-Specific Factors						
SPREAD		0.01	-0.01	0.01	0.01*	0.05
		(0.02)	(0.01)	(0.01)	(0.00)	(0.08)
EXCH		0.08	0.11	0.02	1.04*	-0.03
		(0.13)	(0.18)	(0.15)	(0.53)	(0.21)
FTG		0.16	0.31	-0.07	-0.22***	0.05
		(0.31)	(0.30)	(0.07)	(0.06)	(0.08)
LN_GDP		-0.56	0.54	-0.28	0.27	0.25
		(0.38)	(0.68)	(0.36)	(0.16)	(0.38)
CCR		-0.02	-0.22	0.01	0.13***	-0.31
		(0.13)	(0.18)	(0.06)	(0.04)	(0.20)
Constant	-0.00	0.00***	0.00	-0.00***	-0.00***	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	
Observations	2,819	2,757	2,757	2,655	1,194	1,461
R-squared	0.89	0.88	0.90	0.76	0.93	0.72
Adj. R-squared	0.89	0.88	0.90	0.75	0.93	0.72

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

9.2 Appendix B - Figures

Figure 4: Time-series plot of average CDS market size across all countries (in %)

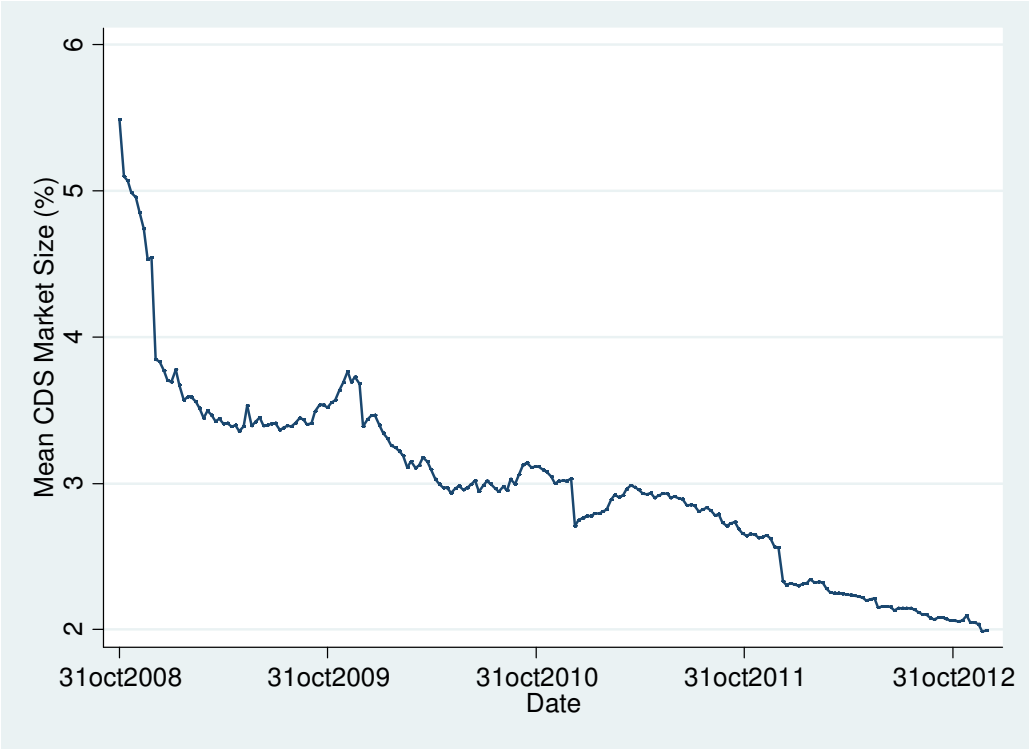
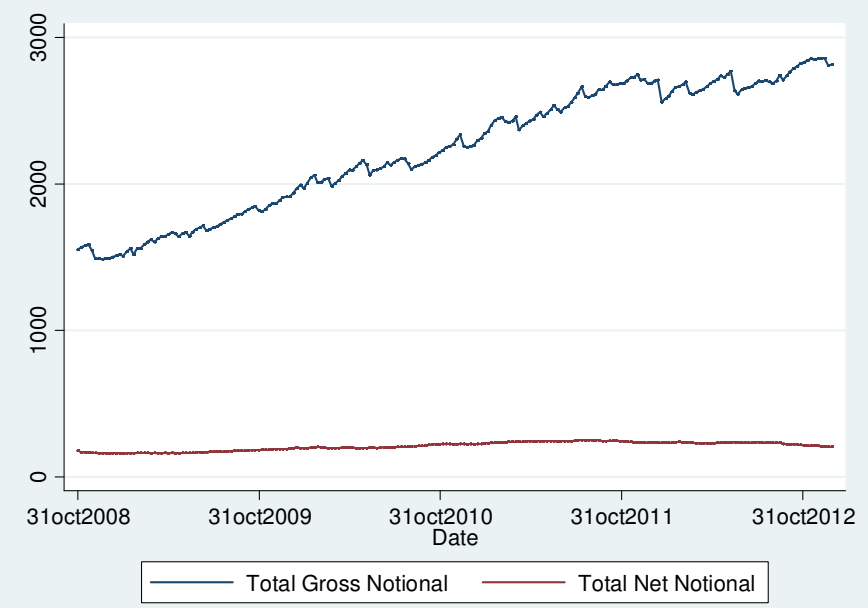


Figure 5: Time-series plot of total weekly gross notional CDS amount outstanding, net notional CDS amount outstanding and CDS trading volume for sovereigns (in billion USD)



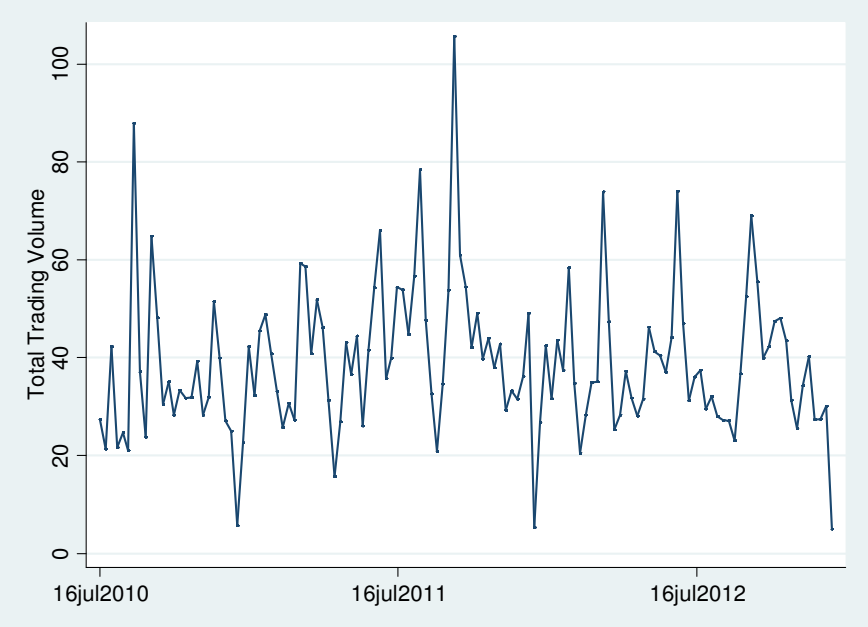


Figure 6: Frequency distribution of weekly gross notional CDS amount outstanding, net notional CDS amount outstanding and CDS trading volume for sovereigns (in million USD)

