STOCKHOLM SCHOOL OF ECONOMICS

Wide Spread Trade

Can terms of trade explain sovereign CDS spreads?

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Abstract

This study reexamines the recent finding that level and volatility of terms of trade has significant explanatory power on spreads of emerging market sovereigns. In contradiction to previous results, we find no significant effect of these variables after controlling for global factors. Specifically, we find that the U.S. default yield spread dominates our local and global variables in explanatory power. We use a recent sample of quarterly CDS spreads and conduct multiple regressions on a panel of data containing 15 countries, spanning from 2004 to 2010. All variables are regressed in the first difference form and various quality tests are performed to ensure that biases to the results are minimized. In addition, our results are robust to the inclusion of various lags and dummies as well as to tests of various subsections of our sample.

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Introduction

Access to capital is an ever important issue for sovereign countries, especially for emerging market countries that need to make investments in infrastructure and development. One way for a country, and for many emerging economies the most important way, to access capital is to use the international capital markets (García-Herrero & Ortíz, 2006). Whether or not a country can do that depends on the cost of borrowing. The pricing of sovereign debt contracts is different from that of corporate loans as there is no collateral that can be seized when the loan is to a sovereign. Furthermore, there is no judicial framework that decides when a country is in default and how it can act when unable or unwilling to honor its debt contracts (Scherrer, 2010). Pricing of sovereign debt is a highly relevant subject today as fear grows that some developed countries in Europe may not be able to uphold their debt contracts. However, it has historically been the emerging market countries that have had to pay the highest premiums in order to borrow.

Lenders need to be compensated for the risk they are exposed to when betting that a country will pay them back. But what determines the price that investors are requiring in order to lend to a country? There has been extensive research done on this subject and the research is important as it can have real policy implications for countries trying to reduce their future borrowing costs. Authors have used both bond spreads as well as Credit Default Swap (CDS) spreads as a measure of credit risk pricing (Longstaff et al., 2007). Some find that global factors such as proxies for global risk aversion and world interest rates are more important than country-specific factors in explaining changes in sovereign credit risk (Pan & Singleton, 2008; Weigel & Gemmill, 2006; Longstaff et al., 2007; García-Herrero & Ortíz, 2006; Remolona et al., 2008; Remolona et al., 2007). Others have found that country-specific fundamentals such as debt ratios and GDP growth also have high explanatory power on credit risk (Jeanneret, 2008; Ferrucci, 2003; Beck, 2001; Edwards, 1984; Cantor & Packer, 1996; Eichengreen & Mody, 1998; Reinhart et al., 2003).

In the context of this debate, a recent and award-winning study by Hilscher and Nosbusch (2010) presents new findings that could help explain sovereign credit risk pricing from country specific variables. We see this as an important paper as it contradicts a trend in the literature to emphasize the importance of global variables. The authors look at both changes in level and volatility of terms of trade and conclude that these variables have a high explanatory power for changes in sovereign bond pricing for emerging market countries. In a discussion of the reasons why terms of trade has previously not been found as an explanatory variable for country risk pricing, Hilscher and Nosbusch (2010) present the hypothesis that global factors are more important when examining high frequency data, while at lower frequencies, country-specific variables' relative explanatory power

increases. Hilscher and Nosbusch's (2010) findings suggest that by lowering a country's volatility in terms of trade, sovereign credit risk would decrease and in the extension so would also borrowing costs.

In the light of these recent findings, we find it interesting and relevant to further assess the strength of terms of trade as an explanatory variable for sovereign credit spreads. Our attempt is therefore to test the level changes and volatility of terms of trade on a different data set. We use CDS spreads instead of bond spreads, have a different time period and use a higher data frequency. This lets us examine the statistical relationship between terms of trade and sovereign risk pricing from a different angle.

Outline

To sort out the basic concepts we begin by providing a theoretical background for sovereign credit risk, CDSs and terms of trade. In order to place our study in an academic context, we then summarize the most important findings on explanatory variables for sovereign credit risk in previous literature. To familiarize the reader with our particular sub-field, we continue by presenting our recently written reference study, the results of which we aim to test in this thesis, more in-depth. Also, to get more flesh to the bones on the most important variable in this thesis, we devote a section to prior findings relating to terms of trade. We then present our two hypotheses around which the study revolves. To clarify how we aim to test these hypotheses, we present the data collected for this purpose as well as the statistical methods used. Next, the empirical findings are presented along with tables from regressions and robustness checks. In data evaluation, before summing up, we run a number of econometric tests on our data to make sure our regressions are valid. To sum up, we conclude with a discussion of the results, potential drawbacks and biases of our paper and suggestions for further research.

Theoretical Background

The central variables in this thesis are CDS spread and terms of trade data, for a set of sovereign countries. Therefore, we here provide a brief introduction to these variables. In this section we also review the basics of sovereign credit risk.

Sovereign credit risk and the determinants of it

Credit risk is the risk of a creditor experiencing the full or partial loss of a claim he or she has. There are two determinants for the expected loss to a creditor; the default arrival intensity and the expected loss due to a default arrival, i.e. the recovery rate (Pan & Singleton, 2008).

$$Expected\ Loss = (1 - Recovery\ Rate) * Probability\ of\ Default$$

The probability of default is the risk that an entity triggers a credit event, e.g. fails to pay interest payments, accumulates too much debt or fails to pay back principal on the debt etc. Recovery risk is the loss the creditor would have in the case of a credit event. Although there is a difference between corporate default and sovereign default, credit events are triggered by similar events for both categories. We cover the differences between corporate and sovereign defaults below. A distinction should be made between sovereign- and country risk, the former meaning lending by governmental institutions such as a governments, central banks etc. The latter being a broader concept that incorporates the ability of a country to enable both its sovereign and non-sovereign actors to repay their debt (Scherrer, 2010).

Lending to a corporation or a sovereign state comes with different rights. When sovereign states lend there is no judicial mechanism that entitles private lenders to take over control of the borrower's assets. At most, another sovereign state or international institution might put political pressure on the defaulter (Eaton & Gersovitz, 1981). The main reason why not more countries repudiate on their debt is a concern for their reputation with lenders. If they default they may be cut off from future borrowing (Grossman & Van Huyck, 1988). According to the ISDA (International Swaps and Derivatives Association) the circumstances that typically trigger payment of CDS contracts on emerging market bonds constitute: (i) a change in coupon rate (ii) a change in principal amount (iii) a postponement of interest or principal payment date, (iv) a change in ranking of priority, and (v) a change in payment of interest or principal to a non-permitted currency (Scherrer, 2010). According to Moody's (2006), the sovereign recovery rate was 55% on an issuer-weighted basis and 29% on volume weighted basis between 1986 and 2006.

Credit Default Swaps

A CDS is in essence an insurance against default. The buyer of the contract pays a periodic premium to the issuer and receives an insurance against the firm or sovereign defaulting on its debt. Should there be a credit event, i.e. a default, the buyer will be compensated for the loss taken. Normally, the buyer of default protection pays a semi-annual premium to the seller. This amount is based on the notional value of the contract and is expressed in basis points (Duffie, 1999). This is what is referred to as the CDS spread.

Settlement in case of a credit event can either take place physically or by cash. In the former, and most common procedure, the CDS buyer delivers the reference security or an equivalent asset to the seller, who has to pay the full notional amount to the insurance buyer. In the latter the CDS buyer

receives the difference between the notional amount and the actual price of the underlying bond (Deutsche Bank, 2004).

As an example of a how a CDS would work we take the 5-year CDS contract for Argentina at the end of June 2007. The CDS spread was 200.4 basis points, which means that an investor would pay 2.004 percent of the insured amount per year. This amount is normally paid semiannually on an actual/360 daycount basis. The investor would continue to pay this until the contract matures or Argentina defaults. In case of a default, the investor pays any outstanding premium and then receives the full face value of the insured amount in exchange for the insured bonds (Longstaff et al., 2007).

The relationship between CDSs and bond spreads

In theory, a bond investor should be able to buy insurance from default of the reference entity by buying a CDS contract. The value change in the CDS will be offset by the change in value of the bond. As the investor is no longer exposed to default risk, it should only earn the risk-free rate of return. In theory, any deviations from this equilibrium should immediately be corrected by investors being able to make arbitrage profits. This relationship has been proven to hold in the long run, however there are several reasons why it may not be so in the shorter run, some of which we describe below (Aktug et al., 2008).

Why CDS instead of bond spreads?

We use the price of a CDS, i.e. its spread, instead of bond spreads to examine changes in sovereign credit risk. Relative to emerging market bonds, CDS contracts are designed with relative simplicity, avoiding complex guarantees or embedded options, which makes them a cleaner estimate of the pricing of sovereign credit risk.

Although CDS contracts are in fact derivatives of bonds, there are a number of reasons to why the valuation of the two may differ. CDSs are contracts, not securities, mitigating liquidity or convenience yield effects that may bias the pricing of bonds. As a contract, there is no upper ceiling to the supply of CDSs, hence if an investor wants to close a position he or she can just enter an opposite position instead and the pressures that may arise in bond markets are not as likely to happen in the CDS market (Longstaff et al., 2005). Furthermore, it has been shown that the CDS market is more liquid than the corporate bond market and that CDS price lead bond price changes (Blanco et al., 2005).

Defining terms of trade

Terms of trade is a measure of the price a country receives for the goods it exports relative to the price it pays for the goods it imports. The ability of a country to sell its goods to a favorable rate

relative to the goods it imports has a significant impact on the ability of the country to generate dollar revenue that can be used to pay down debt in a foreign currency (Bulow & Rogoff, 1989). All else equal, an increase in the terms of trade will make it easier for a country to pay its external debt.

Definitions of terms of trade may vary, therefore we present an example of how the data we use is defined. In Datastream, which is the source of our data, terms of trade for Peru is defined as follows:

"Export Price Index is calculated according to the export price base of the traditional products and the external inflation for the rest of the export. Imports Price Index on the other hand is calculated according to the import price base of food and combustibles and the external inflation for the rest of the imported products. The terms of trade is the index value that represents the relationship between export prices and import prices. It is obtained from the quotient of the index of nominal prices of export and the index of nominal prices of import. An increase or decrease of the index indicates an improvement or decline in the buying capacity of the exports of the country in terms of the imports…"

The difference between terms of trade and real exchange rate

As was seen above, terms of trade is defined as the prices of goods exported divided by the prices of goods imported for a specific country. In contrast, the real exchange rate measures the difference in real price for a similar good bought internationally versus domestically. Thereby, the terms of trade should capture shocks to prices for commodities only if they are exported or imported by a given country. Say that a country is a large net exporter of oil and that there is a negative shock to the price of oil worldwide, while the relative real price of oil within and outside this country remains stable. This could theoretically lead to a decrease in terms of trade for the given country but stable real exchange rate, at least in the short term and, if the country changes its output, also in the long term.

Literature review

We have now examined some of the basic concepts relating to our study of terms of trade and credit risk. We therefore continue by covering the previous literature on global as well as country-specific variables. We also go through the paper by (Hilscher & Nosbusch, 2010) in depth and will henceforth refer to this paper as our reference paper since it contains the results that we are aiming to test. To complete the review of previous findings, we also examine some of the literature relating to the terms of trade variable specifically.

Studies that focus on global and regional factors

Most of the recent literature on the subject of sovereign credit risk has focused on global variables. A paper by Pan & Singleton (2008) shows that the credit spreads for Mexico, Turkey, and Korea have a strong common relationship with the volatility of the U.S. stock market volatility, measured by the VIX index. Furthermore, Longstaff et al. (2007) do a principle component analysis and find that one component explains 30 percent of the variation in credit spreads, and that this component has a 66 percent correlation with changes in the VIX index.

Kamin & von Kleist (1999) look at sovereign bond spreads of emerging countries during the 1990s. They find that credit rating, maturity and currency denomination has a strong explanatory power. Furthermore, they find no linkage between short-term interest rates of industrial countries and emerging countries, as suggested by market participants.

Weigel & Gemmill (2006) find that country-specific variables have a marginal explanatory power on the variability of estimated distance to default for Argentina, Brazil, Mexico and Venezuela. According to this study, regional factors explain 45 percent, global 25 percent and local factors about only 8 percent. Their conclusion is that creditworthiness of the mentioned countries is governed by a small set of factors closely related to regional and U.S. stock markets. The link between spreads and global factors has also been highlighted by García-Herrero & Ortíz (2006).

Remolona et al. (2008) decompose sovereign spreads into an expected loss component and a risk premium component. When analyzing the data they find that the expected loss component is largely driven by country specific macro-economic factors, whereas the risk premium is correlated with regional and global risk aversion measures. The same authors have also shown that the larger part of the spreads is accounted for by the risk premia (Remolona et al., 2007). Herein lies perhaps the key to understanding the puzzle of global versus local factors as explanatory variables for emerging market spreads.

Studies that focus on local factors

Early work that looked at Less Developed Countries (LDCs) found that country specific variables have a significant explanatory power for sovereign bond spreads. Edwards (1984) performed a study on publicly guaranteed loans granted to LDCs between 1976 and 1980 and the significant variables found were external debt, international reserves, investments, debt service and current account ratio. Variability of international reserves was included in the study but found to be insignificant. Debt to GNP consistently had a significant impact on a country spreads.

Cantor & Packer (1996) study the determinants and impact of sovereign credit ratings. They find five variables that are correlated to a country's credit rating: per capita income, inflation, external debt level, whether a country is considered developed and if it has defaulted in recent history. Their result also suggests that GDP growth, fiscal balance and current accounts do not explain variations in credit ratings. Finally, they find that credit ratings explain most of the variations in credit spreads, capturing all of the above mentioned variables as well as some unidentified.

Eichengreen & Mody (1998) study spreads on issued bonds of emerging market countries between 1991-96. They find that country-specific variables do not dominate global market sentiment changes in explaining changes in emerging market bond spreads. However, they find significant explanatory power for debt to GNP as well as a dummy for whether a country recently rescheduled its debt. However the findings differ between regions.

Longstaff et al. (2007) look at both global and local variables for determining sovereign credit risk. They include local stock price index movements, exchange rate of the local currency against the dollar and the country's holdings of foreign reserves as explanatory variables. Their result suggests that the stock price index has significant impact on a sovereign's credit risk while the two other variables give conflicting evidence.

Powell & Martínez (2008) strengthen the finding that credit rating, capturing country specific variables as well as rating agency opinions, do have an impact on spread changes. Furthermore, they also look at global variables and find that the factors associated with risk aversions, e.g. the VIX index and the U.S. High Yield are significant but that their liquidity proxy, 10-year U.S. treasury yield, is not. However, they also find that credit ratings capture the explanatory effect of all country-specific variables except GDP growth, which is significant alongside credit ratings. An interesting finding is that global factors matter less than earlier in their sample when determining emerging market credit spreads. Furthermore, they look at daily CDS spread changes and find a highly significant effect of global financial variables on the spread changes.

González-Rozada & Levy Yeyati (2008) also find that the sensitivity of emerging market credit spreads to different variables has changed significantly over time. However, they find that after 2000, the explanatory power of global variables has increased. Specifically, they find that the high yield variable and the 10-year U.S. treasury yield outweigh credit rating as the explanatory power for changes in spreads. Furthermore, they find that credit rating and outlook (of credit ratings) changes respond more to spreads than the other way around. The authors state that country-specific variables to a larger extent drive the exposure to global factors rather than determine spreads

themselves. Their model is however silent to the question of how country specific fundamentals affect spreads over the long-run.

Reinhart et al. (2003) argue that countries that have defaulted in the past are more likely to default in the future. They introduce a concept of "debt intolerance", meaning that certain countries have a lower threshold of debt they can sustain, sometimes as low as 15 to 20 percent to GNP. These levels of "debt intolerance" depend to a large extent on the country's history of default as well as historical levels of inflation.

In sum, the prior research on the importance of local factors provides contradictory evidence. One strand argues that the local factors along with credit ratings based on these local factors are significant drivers of spread. Especially strong factors include debt to GDP ratio, international reserves and local stock price indices. Another, more recent and perhaps stronger, strand argues that it is the global factors that matter and perhaps so to an increasing extent over the last decades. Main global variables include the VIX index, the U.S. default yield, the 10-year U.S. treasury yield and the U.S. stock market. One of the most recent contributions to the ongoing debate is the paper by Hilscher & Nosbusch (2010) where the main finding is that the volatility of terms of trade has a strong impact on bond spreads for a set of emerging market countries. We take this study as our reference study and investigate the results they have achieved.

Reference study and the significance of terms of trade

In this chapter we present the study that we take as a starting point for our investigation into the determinants of sovereign CDS spreads. We refer to this study as our reference study. The paper is by the authors Hilscher & Nosbusch (2010) and they take their starting point in the fact that not many studies have looked at the impact of the volatility of a country's macroeconomic fundamentals on its credit risk. They refer to Merton (1974) and argue that volatility of fundamentals should matter for a sovereign's credit risk, as should levels of fundamentals. Hilscher & Nosbusch (2010) then look at bond spreads for 31 emerging market countries in the period 1994-2007. They find that macroeconomic fundamentals do explain levels of credit risk, especially the volatility and level changes in a country's terms of trade. The result is controlled for global factors as well as other macroeconomic data that is previously known to affect spreads. The main finding is that the volatility of terms of trade has a highly significant and robust impact on bond spreads, both economically and statistically, i.e. the results are significant and show that the additional costs of borrowing that result from deteriorating or volatile terms of trade are large enough to have a meaningful impact on sovereign finances.

The authors express a concern that terms of trade may be correlated with other local or global variables and that there is a risk that the variable is partly endogenous. To handle this issue Hilscher & Nosbusch (2010) construct a country-specific commodity export price index which they use as an instrument for terms of trade. As many of the emerging countries are heavy commodity exporters they look at the major export goods of a country, take the global export price for that good and the exported quantity for each country in order to create an export price index. In order for an instrument to work it needs to be correlated with the potentially endogenous explanatory variable, in this case terms of trade (Woolridge, 2003). Hilscher & Nosbusch (2010) regress terms of trade on the price index and find coefficients significant on a 1 percent level and the R^2 is close to 0.5. Furthermore, the instrument should be exogenous to the variables in the error term, something they argue that commodity prices are with reference to Chen & Rogoff (2003). Their findings are consistent when using the instrument in their regression.

An interesting finding of the Hilscher & Nosbusch (2010) study is that the three country specific variables, volatility of terms of trade, level change in terms of trade and years since last default, all have stronger explanatory power than global factors such as the changes in the VIX index, U.S. default yield spread, the 10-year U.S. treasury yield and the TED spread. In line with previous research, e.g. Edwards (1986) and Eichengreen & Mody (1998) they also find that the debt to GDP and reserves to GDP ratios have a significant explanatory power on the spread levels. However they also note that the two variables may suffer from endogeneity.

Other findings relating to terms of trade

To get an idea of what has previously been found in relation to terms of trade we here summarize a few studies. Hamilton (1983) and Finn (1991) find that terms of trade shocks affect industrial countries' economic activity mainly by raising the relative price of energy. However, shocks in terms of trade have a stronger negative effect on developing countries that are dependent on imported capital goods and that specialize in commodity exports. The stronger effect of terms of trade shocks in developing countries is a motivating factor in examining its effects on sovereign risk pricing (Mendoza, 1995).

Although productivity shocks play an important role, terms of trade shocks have been found to explain roughly half of the variability in GDP. The effect on terms-of trade on net exports has been found to depend on the duration of the shock. Shocks that have limited duration cause net export and savings decline. Permanent changes tend to leave net exports unaffected (Mendoza, 1995).

Mendoza's main findings on the effect of terms of trade are: "1) Terms-of-trade shocks are large, persistent, and weakly procyclical. 2) Net exports-terms of trade correlations are low and positive,

and independent of terms-of-trade autocorrelations. 3) Cycles are larger in [Developing Countries], but all countries have similar variability ratios, autocorrelations, and GDP correlations. 4) Real exchange rate fluctuations are large and procyclical".

Hypotheses

To further clarify the purpose of this thesis, we here present and motivate our hypotheses.

A reexamination of the Hilscher & Nosbusch (2010) findings

The explanatory power of the terms of trade variable was only recently found by the authors of our reference study. However, not much research has been conducted to confirm these findings or to test the extent to which they hold a more universal relevance when it comes to explaining sovereign credit risk changes. There are a number of ways in which the Hilscher & Nosbusch (2010) study can be altered, which leaves the possibility to reexamine their findings. The most important parameters within which they perform their study are the following. First, the study is limited to emerging market countries, i.e. the economies of which are the most likely to be heavily affected by fluctuations in terms of trade due to dependence on commodity export. Second, they use data from J.P. Morgan's emerging market bond spread index as a measurement of credit risk. Third, the data spans over the years 1994 to 2007. Fourth, the variables examined are calculated using annual data.

We reassess the terms of trade variable to see if it holds under circumstances different from those set out by Hilscher & Nosbusch (2010). In other words, we test if change in level and volatility of terms of trade have significant coefficients when regressed against our measure of sovereign credit risk, i.e. CDS spreads. We decided to limit our study to the countries that are included in the Hilscher & Nosbusch (2010) study. This enhances the comparability. However, there are a number of ways in which our sample is different from that of our reference study. First, we use another measure of sovereign credit risk: CDS spreads instead of bond spreads. Second, we look at an overlapping but different time period: 2004-2010 versus 1994-2007. Third, we use higher frequency data: quarterly data as opposed to annual data. These alterations of the test enable us to gather new evidence on the relevance of the terms of trade variable as an explanatory variable for sovereign credit risk, and are summarized in Table 1. Below we present our two hypotheses.

The level of terms of trade

For a country that relies on its commodity exports, the terms of trade should have an impact on the country's ability to generate revenue and pay down debt. An increase in terms of trade means that the goods a country exports become relatively more expensive than the goods it imports. The intuition is straightforward when imagining a country that relies on exports of a single good. If the

world market price of this good appreciates, this will mean that the country will be in a better position to generate more dollar revenue and pay back its dollar-denominated debt. CDS spreads are, according to the theoretical relationship, expected to be equivalent to the bond spread minus the risk-free rate, whereby we would expect the CDS spreads to move in the same way as would bond spreads when a country experiences a shock to terms of trade. We therefore expect to see the same significant results as in our reference study when the level of terms of trade changes.

Hypothesis 1: Increases (decreases) in the level of terms of trade explain decreases (increases) in emerging market sovereign credit risk, as measured by CDS spreads.

The volatility of terms of trade

According to our reference study, the economic rationale behind the volatility of terms of trade affecting spreads is that investors fear large adverse shocks to terms of trade. Thereby they demand a premium for investing in countries where terms of trade have historically been volatile. We could assume that investors assess the volatility of terms of trade by looking back at historical data. Hilscher and Nosbusch (2010) look at volatility in the long run, between ten to six years depending on data availability. We use the same number of observations, i.e. ten, to calculate the volatility of terms of trade, which due to our more frequent observations result in a two and a half year backward-looking window. From this variable, we expect to find that volatility of terms of trade has a significant effect on our dependent variable.

Hypothesis 2: Increases (decreases) in volatility of terms of trade increases (decreases) emerging market sovereign credit risk, as measured by CDS spreads.

Table 1. Summary of the differences between Hilscher & Nosbusch (2010) and our study.

	Hilscher & Nosbusch (2010)	**Our study**
Data frequency	Annually	Quarterly
Credit risk measure	Bond spreads	CDS spreads
Time period	1994-2007	2004-2010

Data

Time-series cross-sectional data is characterized by having repeated observations on fixed units. In our case we use countries as the cross-section. Countries have been chosen first, among the emerging market countries in our reference study by Hilscher & Nosbusch (2010) and second, by the availability of data for the given countries and variables. According to Beck & Katz (1995), the

number of units analyzed would typically range from about 10 to 100, with each unit observed over a relatively long time period of about 20 to 50 years. Our panel has 15 units and 27 time periods, spanning over seven years, 2004-2010. All in all we have a Time-Series Cross-Section of in total 405 possible observations. In Table 2, below, we include summary statistics for our data set.

Table 2. Summary statistics for the main variables split on the cross-section of countries.

Numbers are mean over the period Q1 2004 to Q3 2010 or the closest available date. Mean has been calculated with quarterly observations. The volatility is calculated on quarterly observations using a 2.5-year backward-looking window.

Country	CDS 5y spread end of quarter	% Change CDS 5y end of quarter	Volatility of terms of trade	Terms of trade level	% Change in terms of trade
ARGENTINA	907.0	14.2	4.8	127.8	3.2
CHILE	58.0	12.0	5.9	161.5	11.5
BRAZIL	220.0	1.4	2.4	101.8	3.3
MEXICO	114.9	6.2	3.3	57.2	1.5
PERU	180.8	-0.2	5.2	119.4	6.6
COLOMBIA	214.0	0.3	4.0	110.9	6.8
BULGARIA	144.1	15.0	3.7	100.2	-0.3
HUNGARY	130.5	20.5	1.0	99.3	0.3
POLAND	67.7	17.4	3.2	101.5	1.0
TURKEY	246.7	-0.2	2.1	97.1	-0.6
THAILAND	80.2	8.0	1.3	300.6	0.6
CHINA	52.4	9.9	5.8	98.8	-1.2
KOREA	82.1	9.1	2.5	88.6	-5.9
PAKISTAN	725.7	12.0	6.1	93.2	-4.9
SOUTH AFRICA	123.6	8.4	3.2	105.5	2.9

From Table 2, we can see that there is a very large difference between average spreads for the different countries, ranging from 52 basis points for China to 907 for Argentina. Also, there is a large difference between the average percentage changes in terms of trade, here ranging from Chile's 11.5% average increase versus Korea's 5.9% average decrease.

The terms of trade and the CDS spreads are our main variables. Furthermore, we collect a number of global variables that have been recognized in earlier papers as determinants of CDS spreads, and that are used in Hilscher & Nosbusch (2010).[1] For the complete list of our main, global and control variables, see Table 3.

[1] Compared to our reference study, we exclude the variables: "Years since last default", Debt/GDP and Reserves/GDP. "Years since last default" is not compatible with the percentage change data that we use and we do not find it necessary to include tests where Debt/GDP and Reserves/GDP function as control variables.

Table 3. List of dependent and independent variables used, abbreviations and expected sign. Also, an explanation of how the variables have been calculated is included along with the source of the data.

	Variable	Abbreviation	Expected sign	Explanation	Source
Percentage changes	Sovereign CDS spread	cds_5y_end_of_q_p		5 year contract, last day of quarter	Datastream
	Terms of trade level	tot_1y_p	-	Export price index/import price index. Quarterly observations, one year change	Datastream
	Terms of trade volatility	tot_vol_25y_p	+	2.5-year moving backward-looking window with quarterly observations used with the Excel formula STDEV.S.	Datastream
	U.S. default yield spread	us_default_end_of_q_p	+	Moody's BAA Corporate - Moody's AAA Corporate, last day of quarter	Datastream
	10-year U.S. treasury yield	ten_y_t_bond_end_of_q_p	-	Last day of quarter	Datastream
	TED spread	ted_end_of_q_p	+	3-month U.S. T-Bill (last day of quarter) - 3-month LIBOR (last month of quarter)	Datastream
	VIX index	vix_end_of_q_p	+	CBOE volatility index, last day of quarter	CBOE
Dummy variables	Financial crisis dummy	fincri_dum	+	Starting in the first quarter of 2008	
	Year dummy	yr_*			

Main variables

Data is provided by Thomson Datastream for all variables but the VIX, which is provided by the Chicago Board of Options Exchange (CBOE). For all variables except the terms of trade and the TED spread, we collect daily observations and use the last day of each quarter. For the terms of trade, quarterly observations are collected and used. If the last day of a quarter is not available we use the closest date back in time. We describe the method for the TED spread below. An overview can also be seen above in Table 3.

Credit Default Swaps

We set the quarterly CDS spread to be the mid spread on the last day at the end of each quarter. Hilscher & Nosbusch (2010) use the median daily observation for December each year. Our original data set contains daily senior five year CDS prices from the first quarter 2004[2] to the third quarter 2010 for 15 sovereign emerging market countries, all of which are included by Hilscher & Nosbusch (2010). We have used the five year CDS spread as it is the most liquid maturity and widely used by previous studies. Furthermore, in order to be increase our sample, we have treated the 1st of January 2004 as 31st of December 2003. We measure CDS spreads for Argentina from the second quarter of 2005 as the spreads before show signs of low liquidity and low quality of data.

Furthermore, there is a general concern of endogeneity for these variables, as expressed in previous research (Hilscher & Nosbusch, 2010).

[2] For many countries, CDS contracts were traded since 2001 but the data is only available through the statistics provider Markit, to which we do not have access. It is unfortunate that we cannot make use of data from 2001 since this would increase our sample length. However, as CDS markets grew rapidly in the last decade, liquidity has improved and thus the quality of the 2004 data should be substantially better than for that of 2001.

Terms of trade data

For most countries we have used the pre-specified terms of trade measure, an example of which is shown in the theoretical section on terms of trade, see page 6. For Chile, Bulgaria, Colombia, China and Korea we have computed it manually by dividing the export price index with the import price index, which is in line with the methodology used by the pre-specified indices.

Level of terms of trade - first difference percentage change variable

The first difference percentage change of terms of trade is the Datastream quarterly observation as described above. Our reference study use five year percentage changes in terms of trade. As we use quarterly observations and look at quarterly percentage changes in CDS spreads we will use one year percentage changes in terms of trade.

Volatility in terms of trade - first difference percentage change variable

Our terms of trade volatility variable is measured using the Excel standard deviation function over a period of 10 time series observations. This means that only 1/10 of this variable changes with every new period. Whether we use a longer or shorter window is a trade-off between robustness in the variable and multicollinearity with country dummies.[3] We partially follow our reference study in that we use a rolling backward-looking window of ten observations. As we have quarterly observations versus annually, our window is two and a half year instead of ten years (Hilscher & Nosbusch, 2010).

Global factors and control variables

To capture changes in global risk aversion we use the VIX index. It is published by the CBOE. The CBOE describes the VIX as "a key measure of market expectations of near-term volatility conveyed by S&P 500 stock index option prices. Since its introduction in 1993, the VIX index has been considered by many to be the world's premier barometer of investor sentiment and market volatility."[4]

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[3] The longer our backward looking window, the more static this variable is for each country, over time. If this potentially static level of volatility is different for our different countries, there is a risk that most of the variability of the volatility variable takes place in the cross-section rather than in the time-series. If each country-specific volatility is static across the time series, there will be a large multicollinearity problem between the volatility variable and country dummies. Moreover, the volatility variable will then not be able to adequately explain changes across the time series, but only across the cross-section. The trade-off is that a longer time period makes the estimate of volatility more robust.

[4] http://www.cboe.com/micro/vix/introduction.aspx [accessed 2010-12-06]

The U.S. default yield spread is a further measure of changes in global risk aversion. We include this to ease comparison with our reference study. We define the default yield spread as the difference between middle spreads for corporate bonds with a Moody's rating of AAA and BAA.

In line with Hilscher & Nosbusch (2010), we include the 10-year U.S. treasury yield as a proxy for world interest rates. For the 10-year U.S. treasury yield we have used the middle rate for constant maturities.

The TED spread is widely seen as a proxy for market liquidity and is also used in the reference study. It is calculated as the spread between the 3-month U.S. treasury bill and the 3-month London Interbank Offered Rate (LIBOR). The U.S. treasury bill is measured daily and the LIBOR has been collected with a monthly frequency.

Method

Here we describe and motivate the methods we use to test our hypotheses.

Structural and reduced form models

When modeling credit risk there are two main approaches; the structural model and the reduced form model (Hull & White, 2000). In a structural model debt can be viewed as a short put on the firm's assets. It stipulates that a firm will default once the value of its assets fall below a certain barrier level (Merton, 1974). The advantage of the structural model is that it has intuitive economic interpretations of changes in credit quality from for example increased borrowing. The model relies much on the assumption of complete information (Arora et al., 2005). The main drawback of the structural model is that it has had poor performance in empirical studies, in general underpredicting credit spreads (Jones et al., 1984).

The alternative to the structural model is the reduced form model. This is a model where one writes an endogenous variable in terms of exogenous variables, using an instrumental variable. The reduced form model has been shown to be good for practical applications, however it suffers from a lack of clear economic rationale and is silent on the connection between determinants and the probability of default (Arora et al., 2005).

As we are interested in pure economic relationships and are not seeking to predict spreads or defaults we find that the structural form suits our study better. The reduced form model is very good when handling a potential endogeneity problem. Hilscher & Nosbusch (2010) use a reduced form regression to test for endogeneity in their terms of trade variable. They conclude that their instrument, a commodity price index, gives the same significant result as the terms of trade variable.

We take their results at face value, i.e. since we use the same set of countries and also look at terms of trade data, we take their test of endogeneity as valid also in our study. Thus, we allow ourselves to focus on the structural form regressions.

Regression analysis

A multiple regression analysis is used to test our hypotheses. This has been done by most prior studies on the subject, for example Hilscher & Nosbusch(2010), Cantor & Packer (1996) and Martinez & Powell (2008). Since the length of the time-series as well as the number of countries in the cross-section in our study is limited we can draw the benefits of a panel data analysis. In other words, the use of panel data allows us to draw statistical conclusions about the relationship between variables even if we do not have enough observations to make either a cross-sectional or a time-series analysis. One of the benefits is that it is possible to account for heterogeneity for individual cross-sections. It enables us to sort out if there are some cross-section specific variables (i.e. country specific) with problematic distribution properties and that are not be included in the regression (Jakovlev, 2007).

Regression equations

As with all panel data, there are two letters in the subscript of our regressions: *i* and *t*, where the former stands for sovereign and the latter for time-period. Thus, y_{it} denotes the CDS variable observations for sovereign *i* at time *t*. β is the slope coefficient of the explanatory variable and x_{it} denotes the explanatory variable observation of sovereign *i* and time period *t*.

$$y_{it} = \propto + \beta x_{it} + u_{it}$$

u_{it} is the error term. With panel regressions this error term can be divided into two parts. Both parts capture effects that are not included in the explanatory variables of the regression. The first, μ_i accounts for the individual-specific effects that are constant over time. The other, ε_{it}, can be thought of as the normal disturbance term, that captures both cross-section and time variations.

$$u_{it} = \mu_i + \varepsilon_{it}$$

Stationarity tests

In order for our results to be valid, we need to find that our data is stationary. Stationarity means that the joint probability distribution of a time series must remain unchanged throughout the series. This property is desired of a time series data for results to be trustworthy. We must be careful when handling data so that the time series is not highly persistent (strongly dependent), in which case the often necessary assumptions of “the law of large numbers” and the central limit theorem do not hold (Woolridge, 2003). We perform a number of statistical tests to asses our data and constrain our

regressions to stationary data. More can be read about the tests we perform in the section "Data evaluation tests" on page 25. [5]

Fixed effects model

To come to terms with possible country heterogeneity we use a fixed effects (unobserved effects) model. Dummy variables help us take away biases to β that are a result of fixed effects. For example, there might be sovereign specific factors that have an individual effect on the dependent variable for each sovereign and therefore give rise to a trend in the cross-section of the data. Unless we add dummy variables for each country, this false trend might be picked up by the β of our explanatory variables.

Global variables

In order to make our results more robust, we run regressions using different sets of explanatory variables and global variables. In all regressions, we include the first difference percentage change in the terms of trade level and volatility variable. See Table 3 for a complete list of the variables we use, including abbreviations and descriptions of how each variable is calculated.

Main regression equation

We perform a number of regressions where we vary the independent variables. The regressions are numbered and what variables are included can be seen in the regression tables. Due to results from the stationarity tests (page 25), we drop our levels data and limit the study to first difference data. Thus, we regress all variables described above in the form of first difference percentage change data, including the level of volatility and the level of terms of trade. Our reference study uses levels data for most of the variables in their regressions whereas we use first difference data. First difference data is more likely to only account for events taking place within our time window, whereas levels might have other data integrated in the sample, especially as our time window is fairly short. Our regression equation follows here:

Equation 1: $$\boldsymbol{cds}\_\Delta\%_{it} = \propto + \boldsymbol{tot}\_\Delta\%_{it} + \boldsymbol{tot\_vol}\_\Delta\%_{it} + \boldsymbol{global\_variables}\_\Delta\%_{t} + \boldsymbol{u_{it}}$$

[5] When conducting these tests we find that the levels data, i.e. the data on absolute CDS spreads, has a unit root and is non-stationary. This means that we cannot run tests using levels data but have to confine our analysis to data on first difference percentage changes, which are found to be non-stationary.

Empirical Findings

Descriptive statistics

Table 4. Descriptive statistics of the change variables. All variables except % change in terms of trade are expressed in decimals, whereas % change in terms of trade is expressed in whole percentages.

Code	mean	max	min	sd	skewness	kurtosis	N
% change in CDS	0.089	2.844	-0.615	0.470	2.031	9.063	389
% change in terms of trade	1.779	41.623	-27.839	9.875	0.587	4.983	389
% change in volatility of terms of trade	0.040	1.981	-0.529	0.200	4.757	39.269	375
% change in 10-year U.S. treasury yield	-0.007	0.303	-0.416	0.149	-0.327	3.501	405
% change in VIX index	0.038	0.964	-0.403	0.266	1.721	6.936	405
% change in U.S. default yield	0.029	0.810	-0.412	0.245	1.030	5.054	405
% change in TED spread	0.154	2.273	-0.639	0.731	1.653	5.153	405

Table 4 contains descriptive statistics for our regression variables. The mean of the CDS percentage change variable shows that CDS spreads are on average increasing throughout our sample period. We interpret this as a result of the financial crisis that took part in the latter half of the sample period. The average quarterly change in the VIX index is positive throughout our sample. The only variable that does not have a positive average change is the U.S. 10-year treasury yield, something that could be explained by a flight to quality during the financial crisis and general interest rate drop that we have seen.

Looking at the skewness and kurtosis, see Table 12, of our variables we conclude that the data is mostly leptokurtic, i.e. has higher peaks around the mean and thicker tails compared to normal distributions. This is something that is not unusual with financial data (Jakovlev, 2007).

Further description of the data can be found in the section on data evaluation tests on page 25.

Regression results

We now look at the outcome of our tests. The main regressions show that we cannot confirm any of our two hypotheses. That is, our measure of terms of trade and volatility do not have any significant explanatory power on emerging market CDS spreads after we control for global factors. In Table 5 below, we present the main results more in depth. Also, further tests that confirm these findings are conducted in the robustness section.

Table 5. Main regression, regression of percentage changes in CDS spreads

Country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (5) denote different regressions that we run and what variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Whole sample, all countries, percentage	(1)	(2)	(3)	(4)	(5)
Country variables					
% Change in terms of trade (tot_1y_p)	-0.00680***	-0.00611**	-0.00351*	-0.00206	-0.00173
	(-3.54)	(-3.28)	(-2.06)	(-1.24)	(-1.00)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.209**	0.187*	0.0218	-0.0594	-0.0542
	(2.67)	(2.41)	(0.27)	(-0.65)	(-0.61)
Global variables					
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-1.232***	-1.092***	-0.135	-0.202	-0.211
	(-5.64)	(-4.95)	(-0.89)	(-1.08)	(-1.09)
% Change in TED spread (ted_end_of_q_p)	0.0798**	-0.0267	0.0231	0.0550	0.0558
	(2.58)	(-0.60)	(0.51)	(1.43)	(1.47)
% Change in VIX index (vix_end_of_q_p)		0.439***	0.00909	-0.0876	-0.0945
		(3.90)	(0.07)	(-0.70)	(-0.77)
% Change in default yield spread (us_default_end_of_q_p)			1.077***	0.918***	0.912***
			(7.74)	(5.19)	(5.19)
Control variables					
Year dummies				x	x
Country dummies					x
Number of observations	359	359	359	359	359
R^2 overall	0.233	0.261	0.393	0.453	0.474

The results from the first set of regressions can be seen in Table 5. The main variables are included in all regressions. For regression (1), we only include the change in 10-year U.S. treasury yield and the TED-spread among the global variables and achieve significant results for both the percentage change in terms of trade level and volatility on a 0.1 and 1 percent level respectively. The 10-year U.S. treasury yield is also significant on a 0.1 percent level and the TED spread on a 1 percent level, whereas the R^2 of the regression is at 0.23. As we add the change in the VIX index the explanatory power of the model increases. This new variable shows significance on strong level, and it takes away the significance of the TED-spread variable. But most importantly, it decreases the significance of the two main variables. When we add one more global variable, the U.S. default yield spread, the R^2 increases markedly, from 0.26 to 0.39, and the significance of the percentage change in the volatility of terms of trade vanishes. The significance of the change in terms of trade level is also greatly reduced, however still significant. Finally, in regression (4), when we control for fixed year effects, the significance of both the main variables disappears, the R^2 increases to 0.45 and the U.S. default yield spread is still strongly significant. In regression (5) we also check for fixed country effects, however the effect only marginally changes the coefficient and significance of the variables, hence we exclude this check in regressions below.

There see two clear outcomes from these tests. The first one is regarding the significance of our two main variables. We see that the variables are significant when regressed with two of our global explanatory variables. However, as we improve our model by adding other global variables and increasing the explanatory power of the model, the two terms of trade variables loose in significance. In other words, terms of trade level and volatility can to some extent help explain variance in CDS spreads for our set of countries and time period. However, the relationship is weak and is dominated by the relationship between CDS spreads and global variables.

The second outcome concerns the global variables, where we can see that they all show signs of a relationship with the CDS spreads. But when we add the U.S. default yield spread the significance of all other global variables disappears. Thus the outcome is that these emerging market sovereign CDS spreads are highly dependent on the U.S. default yield spread and that it dominates all our other variables in explanatory power.

Robustness

Since our result is fairly straightforward, we now focus on strengthening it by performing new tests and robustness checks.

Splitting the sample into regions

To strengthen the robustness of our findings, we analyze the correlation between the CDS spreads for our cross-section of countries, see Table 6 below. We also look at the correlation between countries' terms of trade changes, seen in Table 7.

Table 6. Percentage change in CDS spread correlation matrix between countries. Correlation in-between and between Latin American countries and Asian countries highlighted in boxes.

Whole Period	argent~a	chile	brazil	mexico	peru	colombia	bulgaria	hungary	poland	turkey	thailand	china	korea	pakistan	southa~a
argentina	1.	0.54	0.68	0.74	0.63	0.61	0.56	0.59	0.8	0.36	0.49	0.6	0.57	0.54	0.53
chile	0.54	1.	0.92	0.83	0.66	0.87	0.78	0.83	0.83	0.63	0.7	0.86	0.9	0.51	0.86
brazil	0.68	0.92	1.	0.88	0.74	0.93	0.75	0.81	0.86	0.65	0.71	0.84	0.85	0.55	0.81
mexico	0.74	0.83	0.88	1.	0.73	0.9	0.83	0.9	0.94	0.68	0.76	0.88	0.87	0.48	0.88
peru	0.63	0.66	0.74	0.73	1.	0.69	0.67	0.69	0.69	0.25	0.61	0.57	0.67	0.45	0.55
colombia	0.61	0.87	0.93	0.9	0.69	1.	0.73	0.8	0.81	0.75	0.66	0.83	0.79	0.49	0.87
bulgaria	0.56	0.78	0.75	0.83	0.67	0.73	1.	0.84	0.84	0.54	0.68	0.79	0.9	0.44	0.84
hungary	0.59	0.83	0.81	0.9	0.69	0.8	0.84	1.	0.92	0.66	0.81	0.93	0.83	0.29	0.92
poland	0.8	0.83	0.86	0.94	0.69	0.81	0.84	0.92	1.	0.61	0.71	0.89	0.83	0.41	0.87
turkey	0.36	0.63	0.65	0.68	0.25	0.75	0.54	0.66	0.61	1.	0.62	0.72	0.57	0.35	0.83
thailand	0.49	0.7	0.71	0.76	0.61	0.66	0.68	0.81	0.71	0.62	1.	0.82	0.79	0.3	0.76
china	0.6	0.86	0.84	0.88	0.57	0.83	0.79	0.93	0.89	0.72	0.82	1.	0.84	0.39	0.94
korea	0.57	0.9	0.85	0.87	0.67	0.79	0.9	0.83	0.83	0.57	0.79	0.84	1.	0.54	0.83
pakistan	0.54	0.51	0.55	0.48	0.45	0.49	0.44	0.29	0.41	0.35	0.3	0.39	0.54	1.	0.4
southafrica	0.53	0.86	0.81	0.88	0.55	0.87	0.84	0.92	0.87	0.83	0.76	0.94	0.83	0.4	1.

Table 7. Terms of trade percentage change correlation matrix between countries. Correlation in-between and between Latin American countries and Asian countries highlighted in boxes.

Whole Period	argent~a	chile	brazil	mexico	peru	colombia	bulgaria	hungary	poland	turkey	thailand	china	korea	pakistan	southa~a
argentina	1.	0.13	0.43	0.77	0.15	0.8	0.34	-0.39	-0.58	-0.14	-0.8	-0.67	-0.68	-0.64	-0.26
chile	0.13	1.	0.31	0.41	0.95	-0.14	0.61	0.41	0.1	-0.13	-0.31	-0.2	-0.22	-0.17	0.29
brazil	0.43	0.31	1.	0.58	0.52	0.42	0.78	-0.22	-0.38	-0.65	-0.46	-0.81	-0.7	-0.64	-0.59
mexico	0.77	0.41	0.58	1.	0.48	0.68	0.69	-0.27	-0.55	-0.27	-0.92	-0.87	-0.92	-0.84	-0.48
peru	0.15	0.95	0.52	0.48	1.	-0.11	0.75	0.37	0.11	-0.26	-0.35	-0.39	-0.35	-0.28	0.07
colombia	0.8	-0.14	0.42	0.68	-0.11	1.	0.28	-0.65	-0.83	-0.31	-0.76	-0.66	-0.74	-0.74	-0.5
bulgaria	0.34	0.61	0.78	0.69	0.75	0.28	1.	0.08	-0.19	-0.56	-0.63	-0.77	-0.7	-0.67	-0.54
hungary	-0.39	0.41	-0.22	-0.27	0.37	-0.65	0.08	1.	0.85	0.44	0.29	0.31	0.51	0.53	0.37
poland	-0.58	0.1	-0.38	-0.55	0.11	-0.83	-0.19	0.85	1.	0.47	0.55	0.47	0.7	0.69	0.38
turkey	-0.14	-0.13	-0.65	-0.27	-0.26	-0.31	-0.56	0.44	0.47	1.	0.35	0.48	0.55	0.46	0.47
thailand	-0.8	-0.31	-0.46	-0.92	-0.35	-0.76	-0.63	0.29	0.55	0.35	1.	0.8	0.86	0.8	0.46
china	-0.67	-0.2	-0.81	-0.87	-0.39	-0.66	-0.77	0.31	0.47	0.48	0.8	1.	0.92	0.89	0.73
korea	-0.68	-0.22	-0.7	-0.92	-0.35	-0.74	-0.7	0.51	0.7	0.55	0.86	0.92	1.	0.92	0.69
pakistan	-0.64	-0.17	-0.64	-0.84	-0.28	-0.74	-0.67	0.53	0.69	0.46	0.8	0.89	0.92	1.	0.64
southafrica	-0.26	0.29	-0.59	-0.48	0.07	-0.5	-0.54	0.37	0.38	0.47	0.46	0.73	0.69	0.64	1.

The correlation matrix in Table 6 shows that CDS spreads are positively correlated across our cross-section of countries. However, when we examine the pair wise correlations between change in terms of trade, Table 7, we notice that terms of trade changes within two regional subgroups, Latin America (Argentina, Chile, Brazil, Mexico, Peru and Colombia) and Asia (Thailand, China, Korea and Pakistan) are negatively correlated between each other, see box with dotted line in Table 7. Also, within these groups terms of trade changes are positively correlated, see boxes with solid line. This indicates that the two regions are subgroups within our sample for which the CDS spreads co-vary but terms of trade data does not. Furthermore, the results these regions provide give us suitable subsections for robustness tests. Hence, in order to examine the possibility that these two regions give different results, we run regressions on the two subsamples.

As can be seen in Table 8, below, results do not change materially when we split the sample into regions. None of the terms of trade variables are significant when global variables are included. R^2 of the regressions is at 0.43 for Latin America and 0.58 for Asia.

Table 8. Robustness regression, regional subset over whole period

Sample limited to and split up between Latin American and Asian countries. Regressions on CDS spreads by fundamentals and global variables using quarterly percentage change. Country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (3) denote regressions containing only Latin American countries, (4) to (6) denote regressions including only Asian countries. What variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Regions, whole sample, percentage	Latin America			Asia		
	(1)	(2)	(3)	(4)	(5)	(6)
Country variables						
% Change in terms of trade (tot_1y_p)	-0.00520*	-0.00278	-0.00102	-0.00665	-0.00257	-0.00328
	(-2.22)	(-1.37)	(-0.47)	(-1.76)	(-0.73)	(-0.87)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.229**	0.0739	0.0405	0.434***	0.200	0.0908
	(2.99)	(0.81)	(0.37)	(3.88)	(1.64)	(0.62)
Global variables						
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-0.950*	0.107	0.159	-0.880***	-0.233	-0.369
	(-2.50)	(0.42)	(0.50)	(-3.47)	(-0.98)	(-1.26)
% Change in TED spread (ted_end_of_q_p)	0.0669	0.0355	0.0511	0.141*	0.0269	0.0544
	(1.62)	(0.66)	(1.07)	(2.19)	(0.30)	(0.71)
% Change in VIX index (vix_end_of_q_p)		-0.150	-0.202		0.313	0.197
		(-0.77)	(-1.02)		(1.36)	(0.95)
% Change in default yield spread (us_default_end_of_q_p)		1.132***	1.036***		0.671***	0.364
		(4.47)	(3.42)		(4.65)	(1.62)
Control variables						
Year dummies			x			x
Number of observations	153	153	153	84	84	84
R^2 overall	0.177	0.385	0.434	0.342	0.459	0.580

Splitting the sample into two time periods

Having split up the data across the cross-section of countries, we also want to test for the possibility that there are subsections in the time series that impact the result. Considering that our investigation spans over the recent financial crisis, it is natural to divide the data into two subsections along the time dimension; one for the period before and one for the period during and after the financial crisis. We also include regressions with the division into the regions described above. When examining the regressions of splitting our sample into time subsections, we get the same picture as previously, seen in Appendix 4 and 5. We still do not find significance for the terms of trade variables and the U.S. default yield spread is the most significant variable.

Including lags, country dummies and excluding outliers and non-stationary series

We continue to perform a couple of further robustness test. To test for delayed effects of terms of trade we include one and two periods of lags on our main variables. We add country dummies to exclude any country specific fixed effects. Our findings are robust to this change as seen in the Appendix 6. To reduce the possibility that our selection of countries is biased, we also create two new sets of cross-sectional data by first excluding the countries whose data could not be confirmed to be stationary by the Dickey Fuller test. The countries excluded are Chile, Brazil, Thailand, Pakistan

and Mexico. Then we exclude the countries for which we have manually calculated the terms of trade data from the export price index and import price index, namely, Chile, Bulgaria, Colombia, China and Korea. The results from these tests further confirm the finding that neither percentage change nor volatility of terms of trade show significance in relation to the global variables, see Appendix 7. Also, we still find that the U.S. default yield spread is highly significant and dominates the other variables in terms of explanatory power. Lastly, we have changed how we calculate the volatility of terms of trade by changing the backward-looking window to five and ten years. We also run the regressions with a five-year change in the level of terms of trade. We also run the regression including the lagged percentage change in CDS spreads as an explanatory variable. These regressions are completely in line with our main results and come to no new findings, tables are not included.

Data evaluation tests

In order for our regression results to be valid we need to evaluate our data to identify potential econometrical issues such as non-stationary, heteroskedasticity, non-normal data distribution, multicollinearity and serial correlation in the error terms.

Stationarity

For non-stationary data, unexpected changes may be sticky, i.e. have a non-declining effect on the variables over time. If our data is non-stationary, results from such a regression may be useless and regressions spurious (Woolridge, 2003). We use the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS) as well as the augmented Dickey Fuller (ADF) test to test for stationarity (Kwiatkowski et al., 1992; Woolridge, 2003).

Table 9. Overview over KPSS test and ADF test hypotheses

	H0	**H1**
KPSS test	Stationary	Non-stationary
ADF test	Non-stationary	Stationary

In the KPSS test, the null hypothesis is that the data is stationary, see Table 9 for an overview. To determine the optimal lags to include, we follow the Schwert criterion, resulting in a lag of 2 for all countries and variables (Kwiatkowski et al., 1992).

In the ADF test, the null hypothesis is that the data is non-stationary, see overview in Table 9. To determine the optimal number of lags, we chose the number of lags that minimize the Bayesian information criteria. The maximum number of lags is a trade-off between number of observations

and strength of the test (Woolridge, 2003). Woolridge (2003) recommends one or two lags for annual data. As we have quarterly data but relatively few observations, we therefore set the maximum number of lags to 2 quarters. Number of lags used can be seen in Table 11.

If the series proves to have a unit-root, we can try to adjust it by creating new variables from the first difference of the original variables, which normally decreases the non-stationary properties of the data (Woolridge, 2003).

We report the results in Appendix 1 for the log of our three main variables, CDS spread, volatility of terms of trade and the absolute value of the terms of trade. For the CDS spread variable, all countries have non-stationary time series. All except Turkey have non-stationary terms of trade volatility and only Colombia and China show stationary data for terms of trade absolute level. As the results point to non-stationarity for all three variables, we drop the log level data and proceed to testing the first difference percentage change. We first perform a KPSS test to assess whether the first difference percentage change data has any unit root. Then we run the ADF test to see if we can reject non-stationarity. Results from the two tests are presented below.

Table 10. Results from the KPSS test on the first difference percentage data. The null hypothesis is that the data is stationary. Critical values are reported. We cannot reject the null hypothesis for any country or variable for all three lags. Maximum number of lags calculated using the Schwert criteria, resulting in 2 lags for all variables. * denotes rejection at a 1% significance level; ** at 5%; * at 10%.**

Country	% change in CDS spreads			% change in volatility of terms of trade			% change in terms of trade		
	Lags			Lags			Lags		
	0	1	2	0	1	2	0	1	2
ARGENTINA	0.126	0.109	0.111	0.175	0.138	0.133	0.185	0.131	0.119
CHILE	0.130	0.118	0.109	0.121	0.134	0.156	0.514**	0.279	0.210
BRAZIL	0.088	0.083	0.092	0.386*	0.366*	0.300	0.397*	0.250	0.208
MEXICO	0.105	0.104	0.111	0.182	0.184	0.176	0.243	0.147	0.127
PERU	0.138	0.123	0.132	0.152	0.119	0.133	0.370*	0.202	0.151
COLOMBIA	0.096	0.097	0.102	0.195	0.179	0.179	0.446*	0.308	0.282
BULGARIA	0.329	0.245	0.219	0.071	0.072	0.095	0.192	0.122	0.107
HUNGARY	0.188	0.169	0.162	0.307	0.366*	0.369*	0.352*	0.217	0.182
POLAND	0.238	0.204	0.205	0.131	0.160	0.174	0.190	0.120	0.099
TURKEY	0.091	0.099	0.119	0.035	0.048	0.056	0.109	0.068	0.061
THAILAND	0.128	0.112	0.105	0.169	0.185	0.149	0.248	0.143	0.118
CHINA	0.190	0.168	0.157	0.087	0.100	0.122	0.198	0.118	0.101
KOREA	0.284	0.191	0.162	0.130	0.111	0.116	0.295	0.171	0.138
PAKISTAN	0.167	0.136	0.138	0.453*	0.373*	0.342	0.461*	0.301	0.251
SOUTH AFRICA	0.172	0.148	0.140	0.142	0.138	0.130	0.313	0.211	0.173

Table 10 shows that when using the percentage change data, we cannot reject the null hypothesis of stationarity. This means that either the data is now closer to stationarity or we do not have enough data to reject the null hypothesis of stationarity. For further proof, we also perform an ADF test, seen in Table 11. By comparing the two, we can see that the KPSS test and the ADF give in general

the same results. Countries for which we cannot reject non-stationarity in one or more variable are: Mexico, Chile, Brazil, Thailand and Pakistan. As general test results indicate stationarity, we treat these countries as stationary in our main regressions, however we also exclude them in order to test the robustness of our results.

Table 11. Augmented Dickey Fuller test on first difference percentage data. Null hypothesis is non-stationarity. Optimal number of lags calculated using the Bayesian Information Criteria with two maximal lags.

Country	% change in CDS 5y Spread		% change in volatility of terms of trade		% change in terms of trade	
	Optimal lags	P-value	Optimal lags	P-value	Optimal lags	P-value
ARGENTINA	0	0.006***	0	0.005***	2	0.089*
CHILE	1	0.038**	0	0.000***	2	0.423
BRAZIL	1	0.000***	0	0.000***	2	0.179
MEXICO	2	0.261	0	0.000***	2	0.010***
PERU	0	0.001***	0	0.004***	2	0.074*
COLOMBIA	0	0.000***	0	0.000***	2	0.055*
BULGARIA	0	0.011**	0	0.000***	2	0.026**
HUNGARY	0	0.000***	0	0.000***	2	0.045**
POLAND	0	0.001***	0	0.000***	2	0.012**
TURKEY	0	0.000***	0	0.000***	2	0.001***
THAILAND	0	0.001***	0	0.000***	2	0.163
CHINA	0	0.001***	0	0.009***	2	0.003***
KOREA	0	0.068*	0	0.001***	2	0.012**
PAKISTAN	0	0.007***	0	0.006***	2	0.427
SOUTH AFRICA	0	0.001***	0	0.000***	2	0.031**

Due to our finding that levels data is non-stationary, we would run the risk of achieving biased results if we used it. Thus, we drop all levels data and only focus on first difference, percentage change data. We note that this is in line with most previous research on CDS spreads (Longstaff et al., 2007; Pan & Singleton, 2008).

Heteroskedasticity

We suspect that the volatilities of our time-varying observations are not constant. One property of our CDS data could be that it is conditionally heteroskedastic. That is, if we have periods of high and low volatility that correspond to cycles in the financial markets. But since our sample only spans over seven years and not over a whole business cycle, it is hard to examine the long term properties of the data. Generally, heteroskedasticity does not cause a bias in the estimators of the betas but may reduce reliability of t-statistics (Woolridge, 2003). We alleviate this problem by using percentage changes and *robust* regressions.

Normality

To test for normality we perform the Shapiro-Wilks test, which determines if we can reject the null hypothesis that our data is normally distributed.

$$H0: data\ is\ normally\ distributed$$

$$H1: data\ is\ not\ normally\ distributed$$

Table 12. Shapiro-Wilks test for normality. Null hypothesis is normal distribution. The test shows that we can reject normal distribution for all variables.

Variable	Obs	W	V	z	Prob>z
% change in CDS	389	0.83347	44.716	9.031	0
% change in terms of trade	389	0.95261	12.725	6.045	0
% change in volatility of terms of trade	375	0.60574	102.45	10.982	0
% change in VIX index	405	0.82446	48.866	9.259	0
% change in U.S. default yield	405	0.90742	25.773	7.736	0
% change in 10-year U.S. treasury yield	405	0.9713	7.99	4.948	0
% change in TED spread	405	0.80188	55.153	9.547	0

The test rejects the null hypothesis of normal distribution for all variables, seen in Table 12. This is a breach of the underlying distribution assumptions of the regressions. However, given that we have more than 30 observations we rely on the central limit theorem, as we can argue that our data is stationary from the results above. We are, however, aware that our t-statistics and P-values will be approximations of their true values due to this.

Multicollinearity

In order to reduce the problem of multicollinearity, i.e. that we have too correlated variables and too large variance of our estimated coefficients, we create a correlation matrix where we look at each pair wise correlation, see Appendix 2 (Woolridge, 2003). Once we have identified variables that correlate to a large degree, we run regressions where each of the previously explanatory variables function as dependent variables. This way we can see which variable has the strongest relationship with our other explanatory variables.

The correlation matrix shows that there is around 70 percent correlation between the TED spread and the VIX index and also between U.S. default yield spread and the 10-year U.S. treasury yield. The U.S. default index has a correlation of 0.54 with the VIX index and 0.62 with the CDS spread. The 10-year U.S. treasury yield and the TED spread have a low correlation of -0.27.

When regressing exogenous variables on other exogenous variables, we do not include highly correlated variables as explanatory ones as these regression may themselves suffer from multicollinearity. From Appendix 3, we see that the terms of trade variables do not seem to be well explained by the other variables. As the 10-year U.S. treasury yield and the U.S. default yield have a lower relationship with the other variables than the TED spread and the VIX index, we use these two variables in our first regression.

Even though there is considerable correlation between some of our variables, we do not find the correlation to be large enough to motivate complete removal of the variables. Also, the different economic rationales for including our variables motivate inclusion. Thus, we also add all the remaining variables and run regressions using all the variables at the same time.

Serial correlation in residuals

A potential problem would be serial correlated error terms. This could lead to biased estimators and potentially invalidate our findings. We have conducted a Durbin-Watson test, modified by Baltagi & Wu (1999). We cannot reject the null hypothesis of no serial correlation in the error terms; hence serial correlation in the residuals does affect our results.

Discussion of results

The empirical results section shows us that we can accept none of our two hypotheses. In other words, neither the change in level and nor in volatility of terms of trade show significant explanatory power on CDS spreads, when controlled for global factors. On the other hand, the U.S. default yield spread shows strong significance in nearly all our regressions, which is consistent with a trend in the literature to emphasize the explanatory power of global variables. Regarding our main variables, we find three possible explanations for why our results differ so markedly from those of our reference study, i.e. why we do not find any significance for the terms of trade variables. These are all discussed below:

First, as previously stated, Hilscher & Nosbusch (2010) present the hypothesis that local variables are more significant at lower frequencies and global variables are more significant at higher frequencies. This is a potential contributory factor. Potentially, as one lowers the frequency of observations one may reduce the level of noise in the CDS data and thus get a cleaner measure of the impact from large scale shifts in terms of trade. However, it is difficult to evaluate if lower frequency would change the result since CDS markets for sovereign countries still do not have a long enough history to provide a sufficient amount of yearly observations.

Second, we have also discussed the impact of the differences between our two samples, i.e. that we use a smaller number of countries and a partially different time-period (see page 12, Table 1). On the basis of our thorough robustness checks and the fact that the countries in our study are an excerpt from the Hilscher & Nosbusch (2010) study, we argue that the cross-sectional dimension should not be the driver of differing results. In contrast, the difference in time period may have an impact.

González-Rozada & Levy Yeyati (2008) found that the importance of global variables has increased since 2000. Potentially, the strong development in some of these emerging markets in the last years might have decreased their sensitivity to trade price shocks and thus changed the drivers of default risk for these countries. Our data starts from 2004, thus we cannot fully test this hypothesis. However, when we perform separate robustness tests of the period that overlaps with our reference study, 2004-2007, our original results are maintained. We do not know what the outcome would have been if our reference study would have tested the overlapping period separately, but we believe that the difference in time period is one plausible explanation for the discrepancy in our results compared to the reference study.

Third, another differing factor is the use of CDS data instead of bond data. In theory, there should be an arbitrage relationship between CDS and bond spreads, which if it holds would mean that we should get identical results regardless of which instrument we look at. This has been tested and results indicate that although deviations may appear in the short run, the relationship holds in the long run. Given that we use quarterly data, there should be time for prices to adjust from one observation to another and thus we do not believe that there should be any great discrepancies from using CDS data instead of bond data.

To sum up, our results point in the opposite direction of the results of Hilscher & Nosbusch (2010). The most probable reasons for this is that we look at a later time period and at higher frequency data. Indeed, the validity of terms of trade as an explanatory variable for CDS spreads decreases as a result of our findings.

Conclusion and suggestions for further research

In this thesis we question the explanatory power of terms of trade on CDS spreads. We find that there is indeed a covariance between the two variables, which can be seen in our multiple regressions, but only if the number and strength of global variables is limited. When we include more global variables we find that they and especially the U.S. default yield spread dominate in terms of explanatory power. Our main conclusion is therefore that terms of trade do not add explanatory power to CDS spreads when global variables are present and should therefore not be

thought of as a determinant of CDS spreads. There is a substantial amount of literature that supports the finding that global variables are more important in determining country spreads than local factors generally, and a few studies that highlight the role of the U.S. default spread specifically. Thus, one could argue that our findings are more in line with previous literature than is our reference study and also that our results question the universal validity of the theory that terms of trade is a driver of sovereign credit spreads.

Despite our results, we ask ourselves why so many authors find that local macroeconomic factors have so little explanatory power on sovereign credit risk. In fact, it must ultimately be the local or possibly regional macroeconomic conditions, policies and decisions that govern why a global crisis make some countries default and others not. In this context, we find a proposition by González-Rozada & Levy Yeyati (2008), specifically interesting. They argue that local variables increase or decrease the sensitivity of a country to global variables, rather than affect the pricing of risk directly. Building on this hypothesis, a further research path could be to examine if terms of trade has an impact on emerging sovereigns' exposure to global factors.[6] In such a study, we would not expect to see direct linkages between local variables and country risk pricing. Instead, we suggest focusing on how local variables, such as terms of trade, affect the magnitude of emerging country spread reactions to changes in global variables, such as the U.S. default yield spread. If successful, such a research path could further our understanding of how local and global variables co-interact to form the spreads that are so important for the ability of emerging market sovereigns to borrow and in the end determine their ability to finance development.

Potential drawbacks

To increase the transparency of our paper we here raise issues that may cause biases in our results and that are potential drawbacks.

First is the question of data quality. For terms of trade data, we have used the data provided by national banks or governments to Thomson Datastream. We are aware that the definition of terms of trade may vary. Export price indices and import price indices contain both a basket of goods as well as their respective prices. Therefore, we cannot be confident that terms of trade data for these

[6] Specifically, one could test if countries with a high sensitivity to global factors over time also have a high average level of volatility of terms of trade compared to peer countries. We propose estimating the betas for global variables in a country specific time-series regression (first pass). We would then do a cross-sectional regression where volatility of terms of trade is the independent variable and the beta for the global variables is the dependent variable (second pass).

countries is comparable neither in the cross-section nor in the time dimension. Furthermore, we do not have access to the methods used to compute these indices and therefore cannot control that they are calculated in an unbiased way. The data collected originates from national banks or statistical offices of our respective countries. Any distortions to the way terms of trade has been calculated could potentially disentangle its true relationship with the CDS spreads. However, we believe that it is the best available quarterly data and that it should suffice for the purpose at hand.

A drawback of this paper is that the data we use spans over a relatively short time period and contains a relatively small number of countries. This affects the universal validity of our results and makes the paper more sensitive to country specific conditions and to events that took place during our investigation time period, for example the recent financial crisis. We have tried to control for possible substantial effects of this drawback by identifying subgroups and conducting individual regressions on these subgroups.

There is a possible bias in our selection of countries as we have included countries on the basis of data availability. As data availability is not random but rather an increasing effect of the development of a country, our data sample may suffer from a bias towards more developed emerging countries.

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Appendix

Appendix 1. KPSS test for absolute levels data. The null hypothesis is that the data is stationary. Critical values are reported. * denotes rejection at a 1% significance level; ** at 5%; * at 10%.**

Country	Log of CDS spread			Log of volatility of terms of trade			Log of terms of trade level		
	Lags			Lags			Lags		
	0	1	2	0	1	2	0	1	2
ARGENTINA	0.219***	0.127*	0.099	0.418***	0.232***	0.173**	0.155**	0.108	0.098
CHILE	0.311***	0.176**	0.133*	0.158**	0.104	0.088	0.368***	0.204**	0.151**
BRAZIL	0.424***	0.241***	0.180**	0.546***	0.300***	0.218***	0.128*	0.086	0.075
MEXICO	0.330***	0.185**	0.139*	0.501***	0.278***	0.203**	0.212**	0.129*	0.110
PERU	0.290***	0.174**	0.137*	0.294***	0.175**	0.144*	0.402***	0.215**	0.156**
COLOMBIA	0.366***	0.209**	0.157**	0.363***	0.211**	0.162**	0.114	0.084	0.088
BULGARIA	0.387***	0.218***	0.163**	0.271***	0.168**	0.140*	0.124*	0.084	0.076
HUNGARY	0.217***	0.129*	0.102	0.355***	0.219***	0.173**	0.143*	0.089	0.076
POLAND	0.345***	0.198**	0.151**	0.506***	0.293***	0.218***	0.132*	0.094	0.081
TURKEY	0.220***	0.142*	0.116	0.085	0.066	0.060	0.189**	0.121*	0.108
THAILAND	0.217***	0.125*	0.096	0.294***	0.167**	0.124*	0.252***	0.151**	0.127*
CHINA	0.342***	0.190**	0.141*	0.124*	0.096	0.098	0.112	0.068	0.060
KOREA	0.341***	0.185**	0.136*	0.210**	0.136*	0.120*	0.386***	0.218***	0.168**
PAKISTAN	0.245***	0.142*	0.109	0.430***	0.246***	0.185**	0.172**	0.116	0.109
SOUTH AFRICA	0.307***	0.174**	0.133*	0.499***	0.275***	0.197**	0.158**	0.123*	0.117

Appendix 2. Matrices of pairwise correlation between percentage change variables.

	% change in CDS	% change in terms of trade	% change in volatility of terms of trade	% change in VIX index	% change in U.S. default yield	% change in 10-year U.S. treasury yield	% change in TED spread
% change in CDS	1	-0.1657	0.1125	0.356	0.6211	-0.4395	0.2298
% change in terms of trade	-0.1657	1	0.0237	-0.0841	-0.1559	0.057	-0.0339
% change in volatility of terms of trade	0.1125	0.0237	1	0.0113	0.1829	-0.0903	-0.0626
% change in VIX index	0.356	-0.0841	0.0113	1	0.5364	-0.3664	0.7177
% change in U.S. default yield	0.6211	-0.1559	0.1829	0.5364	1	-0.6725	0.3125
% change in 10-year U.S. treasury yield	-0.4395	0.057	-0.0903	-0.3664	-0.6725	1	-0.2725
% change in TED spread	0.2298	-0.0339	-0.0626	0.7177	0.3125	-0.2725	1

Appendix 3. Auxiliary regression between change variables.

Regressions show explanatory power of each variable for each other. Columns with the heading (1) to (6) denote regressions, what variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Auxiliary regression	% Change in terms of trade	% Change om volatility of terms of trade	% Change in 10-year U.S. treasury yield	% Change in TED spread	% Change in VIX index	% Change in default yield spread
	(1)	(2)	(3)	(4)	(5)	(6)
Country variables						
% Change in terms of trade (tot_1y_p)		0.00127	0.000467	0.00119	0.000108	-0.00279*
		(1.09)	(0.57)	(0.34)	(0.08)	(-2.48)
% Change in volatility of terms of trade (tot_vol_25y_p)	3.193		-0.0653	-0.437**	-0.111	0.211*
	(0.96)		(-1.09)	(-2.97)	(-1.63)	(2.53)
Global variables						
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-4.507	0.0555		-0.462	-0.0344	
	(-1.03)	(0.71)		(-1.60)	(-0.40)	
% Change in TED spread (ted_end_of_q_p)	0.278	-0.0304*	-0.00518			-0.0369*
	(0.37)	(-2.14)	(-0.48)			(-2.08)
% Change in VIX index (vix_end_of_q_p)	-0.355	-0.0198	-0.192***			0.563***
	(-0.12)	(-0.29)	(-5.87)			(12.82)
% Change in default yield spread (us_default_end_of_q_p)	-8.277**	0.215*		0.819***	0.576***	
	(-2.88)	(2.25)		(3.73)	(8.06)	
Number of observations	375	375	375	375	375	375
R^2 overall	0.0303	0.0534	0.139	0.120	0.294	0.336

Appendix 4. Robustness regression, time period restricted to before the crisis.

Sample including whole cross-section and split up between Latin American and Asian countries and limited to the period before the financial crisis. Country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (2) denote regressions with all countries included, (3) to (5) denote regressions with only Latin American countries and (6) to (8) show regressions with only Asia included. What variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Before crisis, percentage	All countries		Latin America			Asia		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country variables								
% Change in terms of trade (tot_1y_p)	-0.00489	-0.00208	-0.000940	0.00208	0.00216	-0.00355	0.00274	0.000285
	(-1.51)	(-0.74)	(-0.23)	(0.56)	(0.62)	(-0.37)	(0.37)	(0.04)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.259**	0.00920	0.202	0.0328	0.0204	0.212	0.118	0.201
	(3.22)	(0.11)	(1.84)	(0.29)	(0.16)	(0.74)	(0.69)	(0.98)
Global variables								
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	0.0789	0.965*	0.847	1.532*	1.790**	-0.529	0.252	0.379
	(0.23)	(2.45)	(1.62)	(2.47)	(3.23)	(-1.02)	(0.51)	(0.81)
% Change in TED spread (ted_end_of_q_p)	0.149***	0.277***	0.134**	0.229**	0.252**	0.137	0.191	0.207
	(3.52)	(4.81)	(2.62)	(3.12)	(3.20)	(1.43)	(1.85)	(1.71)
% Change in VIX index (vix_end_of_q_p)		0.746*		-0.0330	-0.0603		0.811**	0.732
		(2.34)		(-0.11)	(-0.15)		(3.12)	(1.70)
% Change in default yield spread (us_default_end_of_q_p)		1.432***		1.182**	1.551***		0.805*	1.001*
		(4.28)		(2.80)	(3.44)		(2.15)	(2.27)
Control variables								
Year dummies		x			x			x
Number of observations	202	202	87	87	87	44	44	44
R^2 overall	0.0856	0.321	0.102	0.275	0.340	0.143	0.470	0.494

Appendix 5. Robustness regression, time period restricted to during and after the crisis.

Sample including whole cross-section and split up between Latin American and Asian countries and limited to the period during and after the financial crisis. Country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (2) denote regressions with all countries included, (3) to (5) denote regressions with only Latin American countries and (6) to (8) show regressions with only Asia included. What variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

During and after crisis, percentage	All countries		Latin America			Asia		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country variables								
% Change in terms of trade (tot_1y_p)	-0.00698**	-0.00124	-0.00596*	-0.000216	0.000507	-0.00802	-0.00606	-0.00343
	(-2.99)	(-0.62)	(-2.25)	(-0.08)	-0.17	(-1.60)	(-1.15)	(-0.74)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.0721	-0.218	0.178	-0.00559	-0.0251	0.436**	0.0552	0.0812
	-0.58	(-1.58)	-1.52	(-0.04)	(-0.17)	-3.08	-0.22	-0.36
Global variables								
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-1.552***	-0.519**	-1.407***	-0.0276	-0.294	-0.882**	-0.082	-0.654
	(-6.35)	(-2.59)	(-3.35)	(-0.14)	(-0.92)	(-2.82)	(-0.30)	(-1.81)
% Change in TED spread (ted_end_of_q_p)	0.0609	-0.112	0.0556	-0.286**	-0.207*	0.162	-0.154	0.0715
	-1.36	(-1.64)	-0.86	(-2.87)	(-2.12)	-1.72	(-0.83)	-0.41
% Change in VIX index (vix_end_of_q_p)	0	0.198	0	0.441	0.317	0	0.514	0.161
	0	-1.23	0	-1.86	-1.29	0	-1.29	-0.49
% Change in default yield spread (us_default_end_of_q_p)	0	0.915***	0	1.227***	1.020**	0	0.854**	0.199
	0	-4.17	0	-3.92	-2.73	0	-3.16	-0.6
Control variables								
Year dummies		x			x			x
Number of observations	157	157	66	66	66	40	40	40
R^2 overall	0.365	0.577	0.358	0.595	0.607	0.425	0.534	0.619

Appendix 6. Robustness regressions including lag-variables.

Robustness regressions including lag-variables, country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (5) show regressions, what variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Robustness regressions with one and two lags in main variables	(1)	(2)	(3)	(4)	(5)
Country variables					
% Change in terms of trade (tot_1y_p)	-0.00663	-0.00481	-0.00225	-0.00115	-0.000612
	(-1.73)	(-1.23)	(-0.69)	(-0.36)	(-0.17)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.212**	0.186*	0.0247	-0.0715	-0.0572
	(2.63)	(2.36)	(0.30)	(-0.78)	(-0.65)
Lagged country variables					
% Change in terms of trade with one lag (lag_tot_1y_p)	0.000934	-0.00107	-0.00151	-0.00131	-0.00180
	(0.14)	(-0.16)	(-0.28)	(-0.25)	(-0.33)
% Change in terms of trade with two lags (lag_2_tot_1y_p)	-0.000643	0.000191	0.000914	0.00199	0.00297
	(-0.15)	(0.04)	(0.27)	(0.58)	(0.80)
% Change in volatility of terms of trade with one lag (lag_tot_vol_25y_p)	-0.00306	-0.0414	-0.0261	-0.108	-0.0984
	(-0.03)	(-0.49)	(-0.34)	(-1.24)	(-1.09)
% Change in volatility of terms of trade with two lag (lag_2_tot_vol_25y_p)	-0.0348	-0.0155	0.0346	-0.0891	-0.0760
	(-0.47)	(-0.21)	(0.51)	(-1.68)	(-1.25)
Global variables					
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-1.212***	-1.090***	-0.109	-0.174	-0.179
	(-5.36)	(-4.78)	(-0.70)	(-0.91)	(-0.91)
% Change in TED spread (ted_end_of_q_p)	0.0833**	-0.0219	0.0303	0.0605	0.0605
	(2.62)	(-0.49)	(0.66)	(1.55)	(1.57)
% Change in VIX index (vix_end_of_q_p)		0.431***	-0.000525	-0.108	-0.113
		(3.76)	(-0.00)	(-0.84)	(-0.89)
% Change in default yield spread (us_default_end_of_q_p)			1.088***	0.960***	0.955***
			(7.60)	(5.28)	(5.27)
Control variables					
Year dummies				x	x
Country dummies					x
Number of observations	351	351	351	351	351
R^2 overall	0.237	0.264	0.400	0.463	0.482

Appendix 7. Robustness regression excluding certain country series.

Data set modified to exclude non-stationary countries and countries with terms of trade variables that are manually calculated. Country specific terms of trade variables, global variables, country- and year-dummies regressed on CDS spreads using quarterly percentage change data. Columns with the heading (1) to (6) show regressions, what variables we included can be understood from the left hand side. Absence of data means that a variable is not included. t-statistics (reported in parentheses) are calculated using standard errors which are robust * denotes significant at 0.1%; ** significant at 1%; * significant at 5%.**

Robustness regressions, certain countries excluded	Non stationary data series excluded					Countries with manually calculated terms of trade excluded				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Country variables										
% Change in terms of trade (tot_1y_p)	-0.00724**	-0.00676**	-0.00421*	-0.00400	-0.00317	-0.00970***	-0.00895***	-0.00566*	-0.00400	-0.00336
	(-3.15)	(-3.05)	(-1.99)	(-1.89)	(-1.39)	(-3.76)	(-3.55)	(-2.28)	(-1.62)	(-1.32)
% Change in volatility of terms of trade (tot_vol_25y_p)	0.191	0.167	0.000803	-0.0813	-0.0746	0.100	0.0806	-0.0924	-0.190	-0.176
	(1.72)	(1.48)	(0.01)	(-0.58)	(-0.55)	(0.84)	(0.67)	(-0.73)	(-1.44)	(-1.34)
Global variables										
% Change in 10-year U.S. treasury yield (ten_y_t_bond_end_of_q_p)	-1.528***	-1.381***	-0.307	-0.474*	-0.490*	-1.270***	-1.150***	-0.176	-0.260	-0.278
	(-5.12)	(-4.54)	(-1.78)	(-2.24)	(-2.24)	(-4.21)	(-3.74)	(-0.94)	(-1.13)	(-1.16)
% Change in TED spread (ted_end_of_q_p)	0.0555	-0.0528	0.00637	0.0486	0.0492	0.0637	-0.0263	0.0253	0.0569	0.0568
	(1.36)	(-0.88)	(0.10)	(0.98)	(1.02)	(1.59)	(-0.51)	(0.49)	(1.30)	(1.32)
% Change in VIX index (vix_end_of_q_p)		0.438**	-0.0242	-0.133	-0.142		0.381**	-0.0477	-0.136	-0.142
		(2.95)	(-0.14)	(-0.81)	(-0.89)		(2.86)	(-0.29)	(-0.85)	(-0.90)
% Change in default yield spread (us_default_end_of_q_p)			1.168***	0.984***	0.975***			1.072***	0.907***	0.897***
			(6.53)	(4.36)	(4.39)			(5.73)	(3.92)	(3.90)
Control variables										
Year dummies				x	x				x	x
Country dummies					x					x
Number of observations	232	232	232	232	232	242	242	242	242	242
R^2 overall	0.267	0.291	0.425	0.490	0.513	0.229	0.250	0.378	0.438	0.462