# Why Do Investors Buy Sovereign Default Insurance?☆

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**Abstract**

We provide empirical evidence of a significant complementarity between the size of a country's debt and the net amount of insurance purchased against default by its government, based on a novel data set of net notional amounts outstanding for single-name sovereign credit default swaps (CDS) from October 2008 to September 2015. Domestic and international debt, the underlying reference obligation for many CDS contracts, reflect different information sets and, together with the size of the economy, explain up to 75% of the cross-country variation in net insured positions. Unlike for CDS spreads, for which a single principal component accounts for 54 percent of the cross-sectional variation, common global factors explain only up to 7 percent of the variation in sovereign CDS net notional amounts outstanding, consistent with findings that net sovereign insurance is driven primarily by country-specific risk. We further pinpoint two economic channels that explain the net trading in sovereign CDS: (a) country-specific credit risk shocks that change banks' capital requirements based on regulatory rating thresholds, and (b) the issuance, but not the announcement, of domestic and international debt. All our findings suggest a strong hedging motive for the use of sovereign CDS.

*Keywords:* Banking Regulation, Basel III, Credit Default Swaps, Credit Risk, OTC, Systemic Risk

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## 1. Introduction

The academic literature on asset pricing is primarily concerned with the determinants of the prices and returns of financial assets. There is, however, significantly less research on what explains asset *trading*, which underlies the price formation process. While this disparity has been noted in the equity market (Wang, 2002; Lo and Wang, 2010), it is even starker in the case of credit default swaps (CDS). Since quantities are as important as prices in determining market equilibrium outcomes, our objective in this paper is to address this imbalance, focusing on the determinants of sovereign CDS *trading*, in contrast to CDS *prices*, i.e., CDS spreads alone.

We focus on sovereign CDS trading, since recent global developments, especially in the European Union (EU) economies have, once again, brought sovereign credit risk to the forefront of global economic policy debates. Sovereign CDS are private, bilateral insurance-type contracts, which offer buyers protection against default by sovereign debtors, and are traded over-the-counter by financial institutions. However, they remain controversial, with strong opinions being expressed at both ends of the spectrum, as to their efficacy and deleterious consequences.[1] More recently, especially since the Eurozone sovereign debt crisis, politicians and policy makers have blamed speculators with "naked" positions in sovereign CDS for rising public borrowing costs.[2] This strong position ultimately led to a ban on naked sovereign CDS positions, initially by Germany, and later, by the EU as a whole.[3] The empirical basis for this argument largely rests on the relationship between government bond yields and sovereign CDS spreads.[4] We believe that the evidence for such a causal link is weak, especially without an understanding of the trad-

[1] Former Federal Reserve Chairman Alan Greenspan argued that "these increasingly complex financial instruments have contributed, especially over the recent stressful period, to the development of a far more flexible, efficient, and hence resilient financial system than existed just a quarter-century ago." (See "Economic Flexibility," Alan Greenspan, Speech given to Her Majesty's Treasury Enterprise Conference, London, January 26, 2004.) In striking contrast, Warren Buffett, the much-acclaimed investor, weighed against derivatives, in general, by describing them as "time bombs, for the parties that deal in them and the economic system" and went on to conclude that "in my view, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal." (See the Berkshire Hathaway Annual Report for 2002.)

[2] See "Call for ban on CDS Speculation" in The Financial Times on March 10, 2010. A "naked" position is an unhedged position, i.e., a purchase of insurance for protection against government default without owning the underlying bonds.

[3] See, for example, the "EU Ban on 'Naked' CDS to Become Permanent" in The Financial Times on October 19, 2011.

[4] See, for example, Portes (2010) and references therein.

ing behavior in the sovereign CDS market. Even with the backdrop of the ban of naked sovereign CDS trading, banking regulations prescribe and encourage the use of sovereign CDS as an efficient vehicle to reduce capital requirements based on sovereign counterparty risk exposures.[5] Overall, sovereign CDS trading remains contentious, under-researched, and fraught with important policy implications. In light of the current regulatory debate around sovereign CDS trading, we aim to improve our understanding of the primary motives for the purchase of insurance in the sovereign debt market, since sovereign CDS may be used for hedging or for speculative purposes.

Although there are reasons to believe that sovereign CDS trading is partially determined by country-specific considerations, it stands to reason that the concentrated oligopolistic structure of the CDS market, and the documented evidence of a tight factor structure in sovereign CDS spreads, may lead to more global determinants of trading. Indeed, the market for CDS trading is heavily concentrated among the major US broker-dealers, with the top 10 counterparties (all broker/dealers) accounting for about 89% of the total protection sold (Giglio, 2014), and reporting dealers maintaining a market share of 71.13% in 2012, according to statistics by the Bank for International Settlements (Augustin, 2014). This has led Longstaff et al. (2011), among many others, to hypothesize a role for US risk factors in explaining the variation in sovereign risk premia and default probabilities. Given this backdrop, our first contribution is to examine the factor structure in CDS traded *quantities* and compare it with that in CDS spreads. Surprisingly, in contrast to the well-known evidence of a strong factor structure in sovereign CDS spreads, we find little evidence of a common factor in the trading of sovereign CDS. Quantitatively, the first (three) principal component(s) is (are) able to explain about 54% (68%) of the common variation in sovereign CDS spread changes, while it (they) can only explain 7% (16%) of the common variation in changes in net notional amounts outstanding. We further discover important market microstructure effects, including mechanical quarterly changes in net notional amounts outstanding on the standard contract roll dates on March 20, June 20, September 20, and December 20 of each year. In addition, some of the variation can be closely linked to the depreciation of the US dollar against a basket of global currencies, given that the

[5] See also AFME et al. (2011).

Derivatives Clearing and Trading Corporation (DTCC) data are reported in USD equivalents.

We further study the cross-sectional and time-series determinants of the net notional amounts outstanding and find an impressive complementarity between total debt and net insured credit risk. We show that domestic and international general government debt, together with the size of an economy (GDP), are sufficient to explain up to 75% of the cross-sectional variation in net quantities of insured sovereign credit risk. The economic magnitudes are also meaningful, as a ten percent increase in total debt outstanding leads to an increase in net notional amount outstanding of 1-2 percent. We explicitly show that both domestic and international debt capture different dimensions of a country's credit risk and are important predictors of net notional amounts outstanding, consistent with the legal differences of sovereign CDS contracts for developed (DM) and emerging market (EM) countries.

In the time-series, the single most important predictors of the weekly percentage changes in net notional amount outstanding are the country's level of credit risk and the volatility in the domestic stock market, which are positively and negatively related, respectively, to net notional amounts of CDS outstanding. This suggests that, at the margin, greater risk leads investors to increase their net positions, while more uncertainty is an incentive to reduce them. Global risk factors add no additional explanatory power to the time-series variation in net quantities, after we control for country-quarter fixed effects, which themselves are significantly related to the dynamics of domestic debt and GDP. This is underscored in country-by-country regressions, which we use to compute local ratios (LR), a proxy for the relative explanatory power of domestic vs. global risk. For each country, we compute the LRs as the ratio of the $R^2$ statistic from a restricted regression with only domestic variables, to that of an unrestricted regression with both domestic and global risk factors. The median and average local ratio is 70%, suggesting that most of the variation in net sovereign CDS exposures is explained by country-specific risk.

Based on the first part of the paper, which characterizes the anatomy of the sovereign CDS market, we postulate three new stylized facts: (i) sovereign CDS quantities (prices) exhibit little (strong) commonality, characterized by low (high) explanatory power of the first principal component; (ii) both domestic and international debt are two key determinants of net and gross notional amounts of CDS outstanding, with international debt being more important, on average; (iii) the dynamics of sovereign CDS trading are better explained by country-specific rather than by global risk factors. Motivated by these findings, we examine two country-specific shocks related to the most important cross-country determinants of CDS trading, in order to tease out the role of economic channels that explain the net positions in the sovereign credit insurance market.

First, we examine shocks to a country's credit risk using changes to a country's credit rating and credit rating outlooks. We examine specifically the *regulatory* rating changes, i.e., those that would lead to a change in bank capital adequacy requirements, according to the standardized framework in the Basel banking regulation of the Bank for International Settlements (BIS). We find that negative shocks to credit rating outlooks are associated with an *increase* in net insured quantities, while a rating downgrade results in a *decrease* of a similar magnitude. A difference-in-differences test comparing the impact of rating and outlook changes on net notional CDS outstanding to that in a matched sample confirms the robustness of our findings. Similarly, rating upgrades are negatively associated with net notional amounts of CDS outstanding, while lagged positive outlook changes are not statistically significant. Overall, these findings point towards a significant hedging motive for the use of sovereign CDS.

Second, due to the significant role of domestic and international debt in explaining the cross-sectional differences in net notional open interest, we investigate the role of the announcement of sovereign debt issuance on sovereign CDS trading. We find that the *issuance* of international debt leads to a significant increase in net CDS positions, and the effect increases in issue size, as a fraction of total debt outstanding. An additional 1% increase in international debt relative to total debt leads to a 0.3% increase in net insured interest. Moreover, these effects are greater if the debt-issuance is short-term, and lower, if a government issues higher quality long-term debt. The *announcement* of government debt issuance does not affect sovereign CDS trading, nor does the issuance of *domestic* debt. Thus, *actual* shocks to the stock of government debt do affect the dynamics of aggregate insurance in the sovereign debt market.

In Section 2 we survey the related literature. In the next section, Section 3, we discuss our data and examine the determinants of the net notional amounts outstanding in the sovereign CDS market, in the cross-section, in the time-series, and country by country. We examine two economic channels of sovereign insurance trading, i.e., the rating and the debt issuance channels in the following section, Section 4,. We conclude in Section 5.

## 2. Literature and Contribution

Oehmke and Zawadowski (2014a) study the determinants of *corporate* CDS trading volume and net open interest and conclude that *corporate* CDS markets emerge as alternative trading venues for hedging and speculation, partially as a result of bond market fragmentation, a prediction made in Oehmke and Zawadowski (2014b). Our research is complementary to their work since we focus on the *sovereign* CDS market and attempt to answer similar questions. There are several characteristics that make sovereign CDS unique and warrant a separate analysis. First, sovereign CDS are the most heavily traded single-name CDS contracts, as they provide a convenient avenue for hedging country risk. Thus, for certain investors such as multinational corporations or large fund managers, CDS spreads (prices) are deemed efficient, real-time metrics, for gauging the credit health of a country. Second, sovereign credit is quite a different asset class from corporate credit, with very different historical default probabilities and recovery rates, especially if judged based on the long-term default rates published by the major rating agencies. Third, sovereign defaults are mostly strategic, which explains the non-existence of a formal sovereign bankruptcy court. Fourth, eligible credit events that trigger insurance payouts differ for sovereign and corporate CDS contracts. Namely, restructuring is a primary determinant of sovereign CDS triggers, while it does not feature in the conventional corporate contract, at least since the inception of the Big Bang protocol in 2009. Fifth, the sovereign bonds underlying CDS contracts are typically more liquid and less fragmented than their corporate counterparts. This can be atributed mainly to the regulatory incentives for banks to hold government bonds in most countries, thus introducing a wedge between sovereign and corporate credit. Finally, sovereign bonds have been the object of massive monetary intervention through quantitative easing (QE) in many countries, with such interventions causing a substantial decline in sovereign bond yields and CDS spreads. Overall, these arguments justify a separate analysis for sovereign CDS trading.

Berg and Streitz (2012) use the sovereign CDS trading data of 57 countries from 2008 to 2010 provided by DTCC to study the dynamics of net notional amounts outstanding and turnover and show that they are related to country-specific characteristics. However, they are silent on the economic channels that may lead to trading in the sovereign CDS market, and are based, unfortunately, on a very short sample period, throwing doubt on the general validity of their findings. In contrast, our sample extends to the year 2015, and hence, we are able to include a plethora of important events in the sovereign credit market that help us pin down economic and regulatory channels underlying sovereign CDS trading, both in the time-series and in the cross-section. A series of recent papers in the literature examines the transaction level data of CDS provided by the DTCC. However, these references focus on questions related to liquidity (Shachar, 2012; Biswas et al., 2015), risk-bearing capacity (Siriwardane, 2014), or counterparty risk (Du et al., 2015), but none of them focuses on the determination of traded *quantities*. More importantly, they all examine *corporate* CDS, and none of them studies *sovereign* CDS, the subject of this paper.

Another feature of our research is that we place the dynamics of sovereign CDS trading in the context of the bank capital requirements, which propose sovereign CDS as hedging vehicles for credit counterparty risk, in particular for sovereign and quasi-sovereign counterparty exposures. These issues are briefly discussed in Bilal and Singh (2012) and Kallestrup et al. (2014), while Lando and Klingler (2015) develop a model that characterizes the impact of the regulatory channel on sovereign CDS *prices*, but not on *quantities*. Our work also relates to the literature that examines the impact of the naked sovereign CDS ban on liquidity (Sambalaibat, 2013; Pu and Zhang, 2012; Duffie, 2010a,b; Criado et al., 2010; Silva et al., 2016).

While we attempt to shed light on the economic channels that may affect trading in the sovereign CDS market, we also relate our work to the rapidly growing literature on the dynamics of sovereign CDS spreads.[6] Pan and Singleton (2008) and Longstaff et al. (2011) focus on the strong co-movement in sovereign credit spreads, and emphasize the importance of global risk factors, mostly US financial market

[6]See Augustin (2014) and Augustin et al. (2014) for related surveys.

variables, for both risk premia and default probabilities.[7] Another strand of the literature stresses a tight relationship between sovereign credit risk and the domestic financial sector (see Acharya et al. (2014) and Gennaioli et al. (2012) among many others). Augustin (2013) emphasizes the time-varying importance of global and local sources of risk for the dynamics of sovereign CDS spreads. While global risk factors have intuitive appeal for the determination of prices through the risk premium channel, it is less clear, ex-ante, if and how common factors should relate to quantities. Hence, improving our understanding of the drivers of variation in *sovereign* trading activity is one of the main goals of this paper.

## 3. The Anatomy of Traded Quantities in the Sovereign CDS Market

We present a novel dataset of weekly traded quantities for single name sovereign CDS contracts for a sample of 60 countries from October 2008 until June 2015, spanning all major geographical regions. The focus is on the *net notional amount outstanding*, which represents the sum of the net protection bought by net buyers (or equivalently net protection sold by net sellers) with respect to any single reference entity. The net notional outstanding generally represents the *maximum* possible transfer of funds between net sellers and net buyers of protection that could be required upon the occurrence of a credit event (as long as there is a non-negative recovery rate on the underlying debt instruments, the net transfer of funds would be lower).[8] Hence, the net notional amount outstanding is considered to be the economically most meaningful measure of aggregate risk transfer as noted by (Oehmke and Zawadowski, 2014a). It also provides a direct indication of the net insured interest, and is therefore analoguous to open interest in futures and options markets, which is the reason why it is our preferred metric to answer the question of why investors buy sovereign default insurance. Other metrics of trading quantities for CDS are gross notional amounts outstanding and market risk transfer activity, which are more closely related to trading volume and, therefore, less appropriate for our research question.

[7]See also Augustin and Tédongap (2016). Anton et al. (2013) argue that commonality in dealer quotes for sovereign CDS spreads is a powerful predictor of cross-sectional CDS return correlations.

[8]Of course, the net notional amount outstanding represents the maximum possible transfer of funds only under the assumption of zero counterparty risk.

We manually source the data from the website of the Depository Trust and Clearing Corporation (DTCC), a company specializing in the clearing and settlement of OTC derivatives and other financial instruments. The DTCC commenced the publication of detailed weekly reports on the gross and net notional amounts of CDS trading on October 31, 2008. These weekly reports are based on the information available in the Trade Information Warehouse (TIW), a centralized global trade repository that consolidates trade reporting, post-trade processing, payment calculation, credit event processing, and central settlement. The information is updated every Tuesday after 5 p.m. eastern time. According to the DTCC, the TIW captures more than 95% of the global OTC credit derivatives market. More specifically, the TIW posts weekly gross and net notional amounts outstanding in US dollar equivalents, and the number of traded contracts in aggregate, for the 1,000 most heavily traded reference entities.[9]

Given the focus on sovereign single name contracts, we initially extract an (unbalanced) panel of 64 countries from October 2008 until June 2015, spanning 346 weeks of data. We disregard four countries due to the limited amount of data availability, yielding a total of 20,012 weekly observations for 60 countries, among which 47 countries have continuous information on net notional amounts outstanding throughout the sample period.[10] Figure 1 confirms that our sample of sovereign issuers, which is restricted to those listed among the 1,000 most liquid single-name reference entities, is highly representative of the global sovereign CDS market, as we capture between 92% and 97% of the total sovereign gross notional amount outstanding, at all times throughout our sample period.[11]

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[9] Statistics on traded quantities in credit derivatives involve many different components, such as gross and net notional amounts outstanding, novations/assignments, terminations, and market risk transfer activity, in contrast to trading in exchange-traded derivatives such as equity options, which are adequately summarized by *volume* and *open interest*. We provide a detailed discussion of all these terms in the independent and self-contained appendix A-I.

[10] We exclude Hong Kong, Ecuador, and Morocco, as these countries have only 1, 12, and 35 weeks of data, respectively. Tunisia is dropped from the sample because of sparse debt data, which we need for the analysis. We note that we also eliminate three duplicate entries for Hungary on March 30, 2012, April 6, 2012, and April 13, 2012.

[11] If we also account for sovereign states and state-governed entities, the coverage ratio ranges between 96% and 100%. This suggests that analyses of sovereign entities do not need to correct for censored reporting, in contrast to similar examinations of corporate CDS trading data (Oehmke and Zawadowski, 2014a).

### *3.1. Summary Statistics - Net Notional CDS Outstanding*

The summary statistics, reported in Table 1, underscore substantial cross-sectional and time-series variation for the 60 countries in our sample. We complement this information with detailed country statistics in the Appendix Table A-2. For 47 countries, we have continuous information on weekly net notional amounts outstanding, for a total of 346 weeks, corresponding to approximately 6.4 years of data. Among the other countries, Switzerland and Cyprus have the lowest number of observations with 65 and 177 weeks of data, i.e., a bit more than three years. The average USD equivalent in gross notional amount outstanding is equal to $40.78 billion, ranging from a low of $1.24 billion to a high of $434.85 billion. The most active market is Italy, which leads the list with an average of $308.8 billion, while the country with the lowest average gross notional of $1.41 billion is Switzerland. The standard deviation of the gross notional amount is equal to $54.999 billion, an economically significant number. In comparison, net notional amounts outstanding are significantly smaller than gross notional amounts outstanding, $3.5 billion, on average, representing about 8.70% of the gross notional amounts outstanding, although these numbers range, on average, between 3.20% ($1.13 billion) for Ukraine and 36.17% ($510 million) for Switzerland. Similar to gross notional amounts outstanding, net notional features a significant amount of cross-sectional variation.[12] The distribution is plotted in Figure 2, which also highlights the ranking of the top 10 and 25 countries in the top and lower right, respectively. Net notional amounts are, on average, higher in DM economies, the average of $5.73 billion being about 2.5 times greater than the average in EM economies, i.e., $2.36 billion, despite the fact that the average credit risk is higher in EM economies, as we show in the following subsection.

### *3.2. Other Data*

In addition to sovereign CDS trading data, we collect information on CDS spreads, general government debt statistics, as well as various other country characteristics and macroeconomic fundamentals. We report summary statistics on general government debt from the new quarterly debt data reported by

[12]The two figures in the left panel of Figure 2, which plots the time series of the aggregate, average, and the interquartile range of net notional amount outstanding, further highlight the fluctuations over time.

the Bank for International Settlements (BIS). In light of the large discrepancies in government debt statistics across publicly available data sources, the BIS has built up a new database on general government debt that is relatively homogenous with a broad country coverage. The primary goal of the BIS database is to facilitate cross-country comparisons. We use debt from the general government sector, comprising central, state and local governments, and social security funds. All data are reported in billion USD. Given that the conventional sovereign CDS contract, especially in EM economies, is written on foreign long-term debt, we are careful to distinguish between international ("euro bonds" or foreign denominated bonds) and domestic debt. Thus, we collect data on both international and domestic debt securities as reported by the BIS, as well as on total general government debt.[13] Table 1 (and Table A-2 for statistics at the country level) highlights some remarkable differences across countries in terms of the type of debt they issue. Whereas the U.S. is the most indebted country in terms of total nominal debt ($12.776 trillion), it has only about $3.93 billion of international debt. On the other hand, Estonia is the least indebted country in nominal amounts outstanding ($1.87 billion), with an international component of $1.7 billion. In general, the greater the amount of total debt, the lower the fraction that is international. The cross-sectional ranking and time series evolution of the aggregate debt amounts are further visualized in Figure 3.

In contrast to the belief of many, net notional amounts outstanding represent only a small fraction of the total general government debt outstanding, about 8% on average, while 11% and 2% in EM and DM economies, respectively. To put the net open interest of sovereign credit risk in perspective, we also report the average quarterly debt-to-GDP ratio for each country. The average debt-to-GDP ratio across this globally representative sample is 39%, which is mid-way between the average of 26% in EM and 63% in DM countries, respectively. In contrast, the least indebted countries are Estonia, Dubai, Egypt, and Vietnam, with debt-to-GDP ratios of 1 to 2%, while the two most indebted countries in the

[13]The BIS defines international debt securities as those issued in a market other than the local market of the country in which the borrower resides. Domestic debt securities are defined as debt securities issued in the local market of the country in which the borrower resides, regardless of the currency in which the security is denominated. While international debt is available for all countries, total and domestic debt are not. Hence we fill missing information with annual frequency debt data from the IMF IFS data.

sample are Japan, Lebanon, and Greece, based on average debt-to-GDP ratios of 181%, 142%, and 107%, respectively.

In Table 2 (Table A-3 for country statistics), we provide additional summary statistics (on a quarterly basis) for the various control variables, including CDS spreads, CDS volatility, and CDS liquidity, computed using information from Markit, a leading data provider of CDS spread information. The average level of sovereign CDS spread is 259 basis points (bps) in our sample, while the average spreads range between 335bps and 121bps in EM and DM countries, respectively. CDS volatilities are, on average, slightly higher in DM economies, which is reflective of a period of uncertainty in sovereign CDS spreads, especially given the European debt crisis. The variance of spreads is, on average, 47% in DM economies, and 40% in EM economies, corresponding to volatilities of 63% and 69%. Country average CDS spreads range from just 23 bps for Norway to 17.86% for Greece, which defaulted during our sample period. Regarding CDS liquidity, defined as the number of dealers quoting the spread (Qiu and Yu, 2012), the statistics suggest that the average country CDS is based on the quotes of 6.60 dealers, with a low of 2 and a high of 13 dealers. Other metrics relate to the volatility in a country's stock market, based on information from the MSCI country stock market indices, and to country-specific foreign exchange rate volatility, based on information from Thomson Reuters Datastream. The average quarterly country stock market volatility is approximately 32% (variance of 0.10), while the average quarterly foreign exchange rate volatility is about 14% (variance of 0.02).

The average country in our sample has a foreign exchange reserve of $140 billion, which is larger in EM economies ($160.63 billion) and lower in DM countries ($100.91 billion). As sovereign risk may be tied to the development of financial institutions (Gennaioli et al., 2012), we also control for a country's stock market capitalization, as well as for a country's inflation, both measures being sourced from the World Bank. Inflation is, on average, 3.81%, with a standard deviation of 6.02%. As expected, it is lower in the panel of DM countries, whose average inflation level is 1.49%, while it is 5.06% in less DM countries. Financial markets are substantially more developed in DM economies, as the average stock market capitalization is $2.13 trillion relative to $410 billion in developing economies, with an overall average of $1 trillion. The country statistics in Table A-3 also report each country's average long term foreign debt rating, which we obtain from Fitch Ratings. The average country in our sample has a credit standing equivalent to a A- rating.[14] A detailed description of the data is available in the Appendix Table A-4.

### *3.3. Commonalities and Idiosyncracies in Sovereign CDS Trading*

Given the novelty of our dataset, we begin by examining the factor structure in traded CDS quantities and compare it to that in CDS spreads. It is well documented that sovereign CDS *spreads* co-move significantly over time, as a single factor is typically able to explain as much as 96% of the spread variation at the daily level, and between 60% to 70% at the monthly frequency (Pan and Singleton, 2008; Longstaff et al., 2011; Augustin, 2013). We confirm these findings at the weekly frequency for the 47 countries for which we have a continuous time series of net notional amount outstanding, throughout the sample period, with the results reported in Table 3. Panel A shows that the first principal component of the correlation matrix of changes in average weekly CDS spreads explains about 54% of the total time series variation, a number that increases to roughly 68% for the first three principal components. These numbers increase further if we separate all countries into 30 emerging (EM) and 17 developed (DM) markets, as the first common factor explains 56% and 65% of the variation for the DM and EM sub-samples, respectively.

In contrast to the strong factor structure in CDS spread changes, we find a much weaker factor structure in *quantities*, as can be seen in Panel B of Table 3. Performing the same exercise on the correlation matrix of weekly changes in net notional amounts of CDS outstanding, we find that the first principal component explains only about 10% of the time series variation, and the first five factors explain no more than 25%. There is, however, a stark gap between DM and EM countries. In fact, the magnitude of the explanatory power of the first principal component for changes in net notional is 17% for DM countries.

[14] We classify a country based on the latest available credit rating in a given month by mapping the alphabetical ratings into a numerical scale, such that AAA = 1, AA+ = 2, AA = 3, AA- = 4, ... 17 = CCC, 18 = CC, up to 19 = D (DEFAULT).

For EM economies, instead, the explanatory power of the first factor is substantially lower, i.e. 11.20%.[15]

Importantly, we show that part of the variation explained by the first factor can be associated with the institutional structure of CDS trading and the presence of seasonal patterns in the data.[16] The conventional single-name CDS contract has standardized pre-specified quarterly coupon payment dates. Every three months, the conventional contract will thus expire and a new on-the-run single-name CDS contract will "roll" on to a new standard maturity date. Each calendar year, single-name CDS contracts roll on March 20, June 20, September 20, and December 20. The primary reason for this practice is the desire of market participants to enhance the liquidity of their CDS positions, because the "on-the-run" five-year contract is usually the most liquid. For that reason, we formally check for seasonality in CDS trading by projecting weekly changes in sovereign CDS net notional data for each country $i$, ($\Delta\,\mathrm{NN}_{i,t}$), on country fixed effects, $\gamma_i$, and the dates when the on-the-run contract expires and "rolls" on to a new on-the-run CDS contract. More specifically, we run the following regression:

$$\Delta\,\mathrm{NN}_{i,t} = c + \gamma_i + b_1\,\mathrm{March20Roll} + b_2\,\mathrm{June20Roll} + b_3\,\mathrm{Sep20Roll} + b_4\,\mathrm{Dec20Roll} + \epsilon_{i,t}, \qquad (1)$$

where March20Roll, June20Roll, Sep20Roll, and Dec20Roll refer to the quarterly roll date indicators, which take on the value of one during the week of the roll, and zero otherwise.[17] The results, which are reported in Table 4, clearly attribute an important role to the roll dates, which are all statistically significant at the 1% significance level, and which can explain between 2%-3% of the time series variation, depending on whether we use the full sample of 60 countries, or the sub-sample of 47 countries, for which we have uninterrupted information on net notional amounts outstanding. To get a better appreciation for the institutional factors that drive the common factor structure, we collect the residuals $\epsilon_{i,t}$ from

[15]We emphasize that the DM group is primarily made up of countries from Europe. Thus, we suspect a linkage with the regulatory framework for capital requirements in Europe, where banks used to benefit from an implicit subsidy through zero capital requirements for holdings of sovereign government bonds of Eurozone member countries (Korte and Steffen, 2015).

[16]In fact, the patterns in the time-series of aggregate sovereign CDS net notional amounts outstanding in Figure 2 are suggestive of such seasonal patterns in the data.

[17]In our data, there are seven instances of March and June rolls, and six for September and December.

the regression in equation (1), and perform a principal component analysis on the correlation matrix of their weekly changes. Panel C in Table 3 indicates that the fraction explained by the first common factor is reduced by an amount that is roughly equal to the explanatory power of the roll date indicators in the panel regression with net notional amounts outstanding.

A second important feature of CDS contracts that influences our analysis is that DTCC reports all their information on CDS trading in USD equivalents, even when contracts trade in other currency denominations. For sovereign contracts, not surprisingly, the USD and the EUR are the most common denominations. Indeed, in unreported results, we find that the Friday-to-Friday EUR/USD exchange rate has a negative correlation of -43% with residuals from the regression (1), and stripping the net notional amounts outstanding in each country further off the EUR/USD exchange rate effects reduces the variation explained by the first principal component to 5.88%. These findings have two important implications. From an economic perspective, we document that CDS spreads, which incorporate time-varying risk premia (Pan and Singleton, 2008; Augustin and Tédongap, 2016), contain a tight factor structure with a limited number of common components. On the other hand, economic quantities, in particular net notional amounts of CDS outstanding, have little common variation across countries, as the first principal component explains only about 7% of the time series variation, after we account for institutional mechanisms, such as the quarterly roll dates and the DTCC reporting in USD. From a methodological perspective, the above findings imply that we will need to carefully control for the quarterly roll dates and the EUR/USD exchange rate appreciation in the time series analysis. Failing to do so will result in biased regression coefficients that are difficult to interpret in an economically meaningful way. We end by stating the first stylized fact about sovereign CDS quantities:

- F1: *Sovereign CDS quantities (prices) exhibit little (strong) commonality, characterized by low (high) explanatory power of the first principal component.*

### *3.4. Determinants of Sovereign CDS Trading*

We examine the determinants of sovereign CDS trading in three steps. First, we focus on country-specific characteristics in explaining cross-sectional differences in CDS trading across countries. Second, we examine the role of both country-specific and common factors in explaining the time series variation in the trading of sovereign default insurance. Third, we study each country individually to better gauge the relative importance of domestic and global risk factors in explaining the dynamics of traded quantities.[18]

*3.4.1. Cross-Sectional Determinants of Sovereign CDS Trading*

There is no guidance in the empirical literature as to the determinants of trading in sovereign default insurance. Thus, we need to be careful in selecting the variables for such a regression. To the extent possible, we investigate determinants that are theoretically motivated for trading in *corporate* credit default insurance (Oehmke and Zawadowski, 2014b). We also examine several country-specific characteristics that could potentially explain traded quantities based on economic intuition.

Since we are interested in understanding why and when investors trade sovereign default insurance, the natural starting point is a country's indebtedness. To explain the levels in the net notional amount of CDS outstanding, we use total general government debt as well as total domestic and international debt, which are available from the BIS at a quarterly frequency. We emphasize that it is essential to examine both domestic and international debt, separately, as they may contain different information for net insurance amounts outstanding, due to the contractual features of CDS contracts for developed and emerging economies. While most EM countries sovereign CDS contracts reference foreign debt, domestic debt is the primary debt obligation underlying CDS contracts for DM economies. The correlation matrix (unreported) also shows that both quantities are only weakly correlated, with a Pearson correlation coefficient of 0.004, and thus it is important to control for both the total and international components of debt. Given our objective of studying the levels of net notional CDS outstanding, we also need to control for the size of each economy, which we do by including a country's gross domestic product (GDP). We specify the following benchmark panel regression:

$$\ln(\text{NN})_{i,t} = c + b_1 \ln(\text{Domestic Debt})_{i,t} + b_2 \ln(\text{Int Debt})_{i,t} + b_3 \ln(\text{GDP})_{i,t} + \epsilon_{i,t}, \tag{2}$$

[18] Note that we treat Dubai and Abu Dhabi as separate reference entities, even though they are separate Emirates within the United Arab Emirates and their debts are reported separately.

where all net notional amounts are aggregated at a quarterly frequency. We use a natural logarithmic transformation to improve the distributional behavior of the sample and to be able to interpret regression coefficients as elasticities.[19] We report all results in Table 5, with standard errors that are clustered by country. In unreported results, we verify that all results are robust for double clustering by country and quarter.

The univariate regression in column (1) indicates a statistically significant and economically meaningful relationship between the quarterly net notional sovereign CDS amount outstanding and the total amount of general government debt, which individually accounts for 27% of the cross-sectional differences in net notional outstanding (*without* time fixed effects). A 10% increase in total debt is associated with a 1.5% increase in net notional amount outstanding. In other words, greater total debt implies more insured interest. This seemingly weak statistical significance masks the rich information separately provided by domestic and international debt. In columns (2) and (3), we separately compare the impact of domestic and international general government debt, which is the debt referenced by the standard emerging market sovereign CDS contract. Both measures are statistically significant, and the economic magnitude of the coefficients on international and domestic debt suggest that a 10% increase for each leads to a 0.5% to 0.6% increase in net notional. Together, these two variables explain 34% of the cross-sectional dispersion in net insured interest. Column (4), which controls for the size of the economy, using the GDP, illustrates that domestic debt partially proxies for the size of the economy, as the coefficient for domestic debt is reduced, while that for international debt hardly changes in magnitude. The coefficient for GDP is positive and statistically significant with a magnitude of 0.496. Together, these three variables explain as much as 66% of the cross-country dispersion in net notional amount outstanding. Adding time-fixed effects to account for the influence of observable (and unobservable) common macroeconomic and financial factors does only marginally change the regression fit in terms of adjusted $R^2$, which becomes 67%, but the coefficients are not significantly altered.

[19] We transform each variable $x$ into variable $y = \ln(1 + x)$, given the existence of countries with zero international debt or foreign exchange rate reserves.

We emphasize the strong fit of this model by reporting a plot of the predicted versus the actual net notional quantities in Figure 4, based on a cross-sectional regression that uses time-series averages, and we report the estimates in column (4). This graph delivers a strong message in the sense that, after controlling for the size of an economy, both domestic and international debt alone, i.e., country leverage, can explain about three quarters ($adj.R^2 = 75.2\%$) of the cross-country dispersion in net notional amount of CDS outstanding. We emphasize that only the U.S. is a slight outlier on this graph, given its significant amount of debt compared to the world economy, and the dominant position of US banks that do not benefit from hedging their US Treasury bond positions. In unreported regressions, we show that allowing for a separate U.S. intercept increases the adjusted $R^2$ to 80%. In column (7), we examine whether the relationship between net open interest and both domestic and international debt is different between developed and emerging economies. Our results suggest that there is no structural difference between the two groups of countries.

In Table 6, we examine additional risk factors that may explain cross-sectional differences in net notional amounts of CDS outstanding. We conjecture that trading in sovereign default insurance is intimately linked to a country's financial health and its default risk. We include each country's level of foreign exchange rate reserves, measured in billion USD, indicating its foreign asset holdings, and CDS spread, as a direct measure of the sovereign's credit risk. To capture potential non-linearities, and, motivated by the importance of volatility in structural credit risk models, we also include a proxy for country-specific credit risk volatility, computed as the quarterly sum of the daily squared percentage changes in CDS spreads. In addition, since market participation may depend on the underlying liquidity of the CDS market (Oehmke and Zawadowski, 2014b; Sambalaibat, 2013), we proxy for it by using CDS depth, i.e., the number of dealer quotes used in the computation of the mid-market spread (Qiu and Yu, 2012).

A sovereign's financial health may also be influenced by future risk contingencies. The European sovereign debt crisis has highlighted the fragility of public balance sheets following the bailouts of domestic banks (Acharya et al., 2014). The crisis has also focused attention on the intricate relationship between the financial health of governments and that of their financial sectors (Gennaioli et al., 2012). In addition, investors may possibly use sovereign default insurance as a “proxy hedge” for country equity risk exposure, or to speculate using a less capital-intensive synthetic exposure than simply a position in the sovereign debt. We therefore include a country’s stock market capitalization using information from the World Bank. We also include the domestic stock market return volatility, computed as the sum of daily squared stock market returns over the quarter, using the MSCI total return country indices as a source. Finally, we control for the level of a country’s inflation, as well as the volatility of the exchange rate relative to the USD, given that sovereign distress episodes are positively correlated with a depreciation of the local currency (Reinhart and Rogoff, 2008).

In column (1), we add the aggregate amount of foreign exchange reserves, since the greater the buffer of a country, the lower the need to hedge a country’s default risk. However, the coefficient is statistically insignificant. Column (2) further controls for CDS spreads, CDS volatility and CDS liquidity. CDS liquidity is highly significant and positively correlated with the net notional amount of CDS outstanding. The coefficient of 0.902 translates into a 15% increase in net insured interest for a 20% increase in liquidity. Given that the average country’s CDS is quoted by six to seven broker dealers, this implies that net insured interest is, on average, almost ten percent higher if a country gets covered by one additional dealer. This regression, nevertheless, does not address the endogeneity issue: a country may be covered by more dealers and, therefore, more liquid, because it has a greater net notional amount of CDS outstanding. Countries with more credit risk, on average, have higher net notional amounts of CDS outstanding, as suggested by the positive coefficient on CDS Spread. Similarly, higher credit risk volatility suggests more net insured interest in sovereign credit risk. These variables are, however, not statistically significant, in line with Darrell Duffie’s testimony that highlighted a weak relationship between the level of CDS spreads and net sovereign insurance purchased (Duffie, 2010a).

In column (3), we emphasize a positive and significant relationship between a country’s stock market capitalization. The coefficient implies a 3%-4% higher net insured interest for countries in which the stock market capitalization is 10% larger. Due to the high correlation between GDP and market capitalization, we only include one of these variables at a time. In column (4), we introduce additional market-based risk factors, such as the country-specific equity and foreign exchange rate volatility, and the level of inflation. None of these variables are significant. Importantly, the debt coefficients change little in magnitude. and there is little improvement in explanatory power beyond a parsimonious specification with only domestic and international, and a country's GDP. Overall, these regressions yield adjusted $R^2$s of up to 80%. Based on these observations, we formulate a second stylized fact about sovereign CDS trading:

- F2: *Both domestic and international debt are two key determinants of net notional amounts of CDS outstanding, with international debt being more important, on average.*

*3.4.2. Time-Series Determinants*

After an examination of the cross-sectional relationship between changes in the net notional amount of sovereign CDS outstanding and country-specific characteristics, we now proceed to an examination of the time-series determinants of sovereign CDS trading. We project weekly percentage changes in the sovereign CDS net notional amounts outstanding on a set of country-specific and common risk factors, together with country fixed effects, and indicator variables for the roll dates on March 20, June 20, September 20, and December 20 of each year. In addition, we also account for residual global and regional influences.

With respect to domestic risk factors, we use the same variables that we relied on in the analysis of the cross-sectional variation in net and gross notional amounts of CDS outstanding, but we absorb the quarterly country variation of lower frequency variables using country-quarter fixed effects (debt, GDP, reserves). Thus, we use weekly percentage changes in the countries' credit risk, CDS volatility and liquidity, country- specific stock market returns and their volatilities, as well as their foreign exchange rate returns and volatilities, relative to the USD.

We use several common risk factors to capture the global equity, credit, foreign exchange, and interest rate risk environment. In particular, we use the US dollar factor, the weekly value-weighted return on all NYSE, AMEX and NASDAQ stocks from CRSP in excess of the weekly-Treasury-bill return from

Ibbotson Associates, the weekly changes in investment-grade and high-yield spreads, defined as the differences between the Bank of America/Merrill Lynch US BBB and AAA corporate bond yields, and between the BB and BBB yields, respectively, and the weekly changes in the 5-year constant maturity Treasury spread.[20] In addition, we proxy global hedging demand and risk aversion/bearing capacity by the weekly changes in the CBOE VIX implied volatility index, based on S&P500 option prices. Global funding illiquidity is measured using the weekly changes in the TED spread. Finally, we proxy global risk premia by the monthly percentage changes in the cyclically adjusted price-earnings ratio of the S&P500 index.

Finally, we attempt to capture any residual influence and spillover effects through global and regional CDS spreads. The global (regional) CDS spread for each country is defined as the average sovereign CDS spread of all other countries in the world (region). We then use only the true residual component of the spread by projecting that global CDS (regional) spread on all other explanatory variables, both global and country-specific, and then using the residual as the global (regional) spread. We group all countries into four regions, i.e., Europe, Middle East and Africa, Asia-Pacific, and Americas.

The weekly panel regression results with standard errors clustered at the country level are reported in Panel A of Table 7. A key observation to be made here is that global variables add little explanatory power in explaining the time-series dynamics of net notional amounts of sovereign CDS outstanding. The adjusted $R^2$s attain a maximum of 3.1 percent, while this explanatory power is already obtained with just country-specific risk factors in column (3). This is very consistent with the findings of a weak factor structure among CDS traded quantities, which we have previously emphasized. It is, nevertheless surprising, in light of the important evidence on the role of global risk factors in explaining sovereign CDS *prices*. This seems to suggest that common factors help explain CDS spreads because they embed time-varying risk premia that compensate investors for non-diversifiable risk exposures. On the other hand, the evidence suggests that economic quantities are primarily determined by country-specific risks.

[20]The dollar factor represents an average exchange rate against the USD rate of a large basket of countries (Lustig et al., 2011).

The most important domestic risk factors that explain the time-series variation in the net notional amount outstanding are the the volatility of a country's stock market return and the level of a country's credit risk. Increases in stock market volatility are associated with decreases in net notional amounts outstanding. A ten percent increase in the domestic stock market volatility leads to an approximate decrease of 2.4%-3.6% in the net notional amount outstanding.[21] Changes in country credit risk are also significant predictors of changes in net notional amounts outstanding, although the economic magnitude is weaker, as a ten percent increase in a country's spread is associated with an increase of approximately 0.1% in net notional amounts outstanding. These findings suggest that there is more insurance outstanding when the level of risk increases, but less when there is more uncertainty about the performance of the real economy. While all other country-specific risk factors have the expected signs, they are not significant. A positive stock market and foreign exchange return, as well as greater credit risk and foreign exchange uncertainty, all are negatively associated with net notional amounts outstanding, while CDS liquidity bears a positive relationship with net open interest.

All outstanding CDS positions are reported by DTCC in USD equivalents, which could lead to mechanical valuation effects in the trade repositories. We therefore include in all our time-series regressions a global US dollar factor, which captures the average appreciation of the dollar relative to all other countries. This variable is significant and negatively related to the net notional amounts outstanding, confirming that stronger individual foreign currencies relative to the USD (i.e., a lower US dollar factor) lead to higher USD equivalent amounts of foreign currency CDS contracts. Importantly, apart from the investment-grade bond spread, a proxy for the global credit cycle, no other global variables contains significant information for the dynamics of net notional amounts of CDS outstanding. More importantly, even the significance of the investment-grade bond spread disappears, if we control for country-quarter fixed effects in column (7) of Table 7, while the level of credit risk and country stock market volatility

[21] In unreported regressions, we find that domestic stock market volatility is *positively* associated with the *gross* notional amounts of CDS outstanding. This is highly suggestive of the fact that investors exit the market when uncertainty increases, by entering into new contracts, thereby increasing the gross notional amount outstanding, but taking offsetting positions to reduce the net notional amount outstanding.

remain significant at the 10% level, despite this restrictive regression. This suggests that the time variation in net open interest is primarily attributable to country-specific quarterly variation, and that global risk factors do not help in explaining the within-quarter changes in the net notional amount at the country level. We examine the economic content of the quarter-time fixed effects in Panel B of Table 7 by regressing these fixed effects on quarterly changes in the domestic and international general government debt, as well as quarterly percentage changes in GDP. Both domestic debt and GDP are significantly related to the within-country quarterly variation in net notional amounts if CDS outstanding, which underscores that a country's leverage and size explain not only the cross-sectional variation, but also the dynamics of net sovereign CDS positions.

Overall, these findings are suggest that country-specific risk factors paint a more detailed picture about the dynamics of sovereign CDS trading, and that aggregate financial and macroeconomic fundamentals provide little information for the dynamics of net amounts of CDS outstanding. While it may be intuitive to think that the trading of insurance is primarily linked to country-specific idiosyncratic risks, this is not at all obvious ex ante, for two primary reasons. First, trading in CDS contracts is heavily concentrated among the large U.S. broker-dealers acting as the main trading facilitators (Giglio, 2014; Siriwardane, 2014). Hence, since these broker-dealers represent the main operators in this market, it is plausible that traded quantities are influenced by aggregate risk aversion and global risk factors specific to them. Second, there is a large literature documenting a significant influence of global risk factors on sovereign CDS spreads, and that U.S. financial risk is better in explaining sovereign default probabilities (Longstaff et al., 2011). The latter argument, especially, may suggest that sovereign insurance quantities are also likely to be better explained by the same global risk factors. We further examine these findings through country by country regressions in the following sub-section.

### *3.4.3. Country Regressions*

We have provided evidence that the dynamics of sovereign insurance quantities are primarily determined by country-specific risk factors. To better gauge the relative importance of local vs. global risk, we now analyze country-specific effects and run the time series regressions separately for each country.

For each sovereign, we compute the local ratio, defined as the ratio of the $R^2$ from a restricted regression with only the country-specific risk factors to the $R^2$ from the full regression, after having stripped out the mechanical valuation effects associated with the USD exchange rate.[22] This ratio is a proxy measure for the fraction of the explained variation that is captured by country-specific factors *relative* to global risk factors. The histograms for the $R^2$ from the restricted and full regressions, as well for the local ratios, reported in Figure 5, suggest that, even though there is some cross-sectional variation in local ratios, for most countries, the greatest fraction of the explained variation comes from domestic risk. The average and median local ratio statistics are 70%, while the 25th percentile is 64%. This is surprising, especially as the sovereign CDS market is strongly concentrated, with the large broker-dealers acting as the main trading facilitators, as pointed out earlier (Giglio, 2014; Siriwardane, 2014). These results lead us to formulate a third stylized fact about sovereign CDS trading:

- F3: *The dynamics of sovereign CDS trading are better explained by country-specific rather than by global risk factors*

Even though domestic risks represent the dominant fraction of the explained variation, there is still a substantial amount of time-series variation that is left unexplained. In order to better understand the underlying sources of trading, we therefore explore more granular evidence on two economic channels that are suggested by the previous analysis. First, given the tight relationship between net notional amounts of CDS outstanding and both country-specific credit risk and stock market volatility, we will examine the impact of unexpected shocks to domestic credit risk on sovereign CDS quantities. Namely, we study the impact of sovereign credit rating and credit outlook changes. Second, we have shown that greater sovereign debt outstanding leads to more net notional amounts of CDS outstanding. Hence, we exploit the heterogeneity in the timing and intensity of bond issuance by different governments to relate CDS trading to the dynamics of general government debt.

[22] While we acknowledge that there may also be some economic fluctuations due to foreign exchange effects, the mechanical effects are of first order.

## 4. Economic Channels of Sovereign CDS Trading

In the second part of this paper, we examine two specific channels that may explain the dynamics of net open interest in the sovereign CDS market. Our investigations are motivated by the finding that sovereign leverage is the most important predictor of cross-country differences in net notional amounts outstanding.

### *4.1. Shocks to Credit Risk*

Country-specific leverage and size are the most important determinants of the cross-sectional variation of net notional amounts of CDS outstanding, and there is little evidence in support of common factors in the time-series variation. We, therefore, conjecture that shocks to a country's credit risk, in the form of changes to a country's credit rating and credit rating outlooks, may lead to changes in the total quantity of insured credit risk. In particular, we investigate the *regulatory rating channel* by focusing on rating changes that would result in a change in capital requirements for holding the underlying government debt, according to the standardized approach in the Basel regulatory framework for bank capital.[23] If sovereign CDS are primarily hedging vehicles, then only credit rating changes that cross a threshold should affect sovereign CDS trading, due to adjustments in the hedging demand. This leads us to formulate the first testable hypothesis.

- H1: *There is more (less) sovereign insured interest, i.e., net notional amount outstanding, when there is a credit rating downgrade (upgrade).*

In line with the standardized approach for credit risk capital charges in the Basel framework, we define the indicator variable $Upgrade$ to take the value one during the week a country's credit rating changes from (i) below B- to B- or higher, (ii) below BBB- to BBB- or higher, (iii) below A- to A- or higher, (v) below AA- to AA- or higher, and zero otherwise. We define the indicator variable *Downgrade* to take the

[23] In the Basel II framework, for the standardized approach, the risk weights associated with sovereign credit ratings are 0% for AAA to AA-, 20% for A+ to A-, 50% for BBB+ to BBB-, 100% for BB+ to B-, 150% for ratings below B-, and 100% unrated countries.

value one during the week a country's credit rating changes from (i) B- or higher to below B-, (ii) BBB- or higher to below BBB-, (iii) A- or higher to below A-, (iv) AA- or higher to below AA-, zero otherwise. In addition, we examine credit rating outlook changes and define *Pos* Δ *Outlook* as an indicator variable that is equal to one, if the rating outlook changes from negative to neutral, from negative to positive outlook, or from neutral to positive, and zero otherwise. *Neg* Δ *Outlook* is an indicator variable that is equal to one, if the rating outlook changes from positive to neutral, from neutral to negative, or from positive to negative, and zero, otherwise. The focus is again on those outlook changes that are consistent with regulatory thresholds, resulting in effective changes in capital requirements if the outlook materialized. We examine the contemporaneous and lagged credit rating (outlook) and the changes in these variables. According to this definition, the sample contains 27 downgrades, 15 upgrades, 15 negative outlook changes, and 8 positive outlook changes. We specify the following empirical model for weekly percentage changes in net notional amount of CDS outstanding:

$$\Delta NN_{i,t+1} = a + \sum_{k=0}^{1} b_k^1 (Pos\ \Delta\ Outlook)_{t-k} + \sum_{k=0}^{1} c_k^1 (Neg\ \Delta\ Outlook)_{t-k} + \sum_{k=0}^{1} d_k^1 (Upgrade)_{t-k} + \sum_{k=0}^{1} e_k^1 (Downgrade)_{t-k} + \delta X_{i,t} + \gamma Y_t + \alpha_i + \xi_t + \varepsilon_{i,t}, \quad (3)$$

where $X_{i,t}$ and $Y_t$ define the vectors of country-specific and common global control variables, respectively, and $\alpha_i$ and $\xi_t$ define the country and monthly time fixed effects. Table 8 documents our findings, using standard errors clustered at the country level. The first column indicates a statistically significant and negative relationship between changes in net notional amounts of CDS outstanding and regulatory credit rating downgrades. On average, a downgrade reduces the net quantity of insured credit risk by two percent. The coefficient of the upgrade variable is also significantly negative, with a magnitude of 2.8 percent. Contemporaneous outlook changes are not significant. Column (2) augments the model with lagged variables. Interestingly, the lagged coefficient for negative outlook changes is *positive* and statistically significant, and of the same magnitude as the contemporaneous impact from downgrades. On the other hand, lagged positive outlook changes are not significant. This is highly suggestive that sovereign

CDS are used for hedging purposes. A negative credit rating outlook increases the need to hedge existing credit risk exposures. Once a sovereign gets downgraded to a category that requires higher regulatory capital, investors, at the margin, dispose of the debt, which reduces the hedging need, implying a reduction in net notional positions. Similarly, following an upgrade, there is a reduction in regulatory capital requirements, but there is no need to hedge, if the positive outlook change is announced with a lag. Columns (3) and (4) show that this effect is robust, and that the magnitude of the coefficients does not change in a meaningful way, when we control for country-specific and common risk factors.

We point out that we achieve statistical significance despite a limited number of 27 downgrades and 15 negative outlook changes. We compare this in column (7) with the larger sample of *all* ratings (outlooks) and their changes, and not just those associated with a change in regulatory capital requirements, which generates a total of 79 downgrades, 40 upgrades, 42 negative watch lists, and 25 positive watch lists. Using this "richer" alternative of rating changes yields much weaker statistical significance in our regression framework, and, more importantly, a lower economic magnitude. The coefficients on lagged outlook changes and downgrades reduce by 50 percent. In column (8), we reexamine the effect of rating actions on the dynamics of net notional amounts of CDS outstanding, using all actions that do not result in changes in regulatory capital requirements. All coefficients become insignificant, except for lagged rating downgrades, but the economic magnitude of the coefficient is only 0.005, i.e., very small.

We also examine the impact of fallen angels (investment-grade to junk downgrades) and knighted devils (junk to investment-grade upgrades), but such specifications are not significant. Thus, it is truly the regulatory rating channel that is responsible for increasing net notional amounts of CDS outstanding in the presence of negative credit rating outlook changes, followed by a reduction of two percent if the country gets subsequently downgraded. This raises a particular question relating to other research. Korte and Steffen (2015) discuss the "zero-risk subsidy" relating to the dispensation that banks are not required to hold any regulatory capital against their holdings of domestic currency denominated bonds. Thus, we should observe a stronger effect for the group of non-EU members, who do not get the EU reprieve on regulatory capital requirements. In unreported regressions, we do confirm that the impact of downgrades on net notional amounts outstanding is stronger for non-EU countries, as the magnitude of the coefficient increases to 0.032, and it is statistically significant. On the other hand, it is not significant for EU-member countries, for which CDS contracts do not offer such a regulatory concession.[24] While these findings confirm the hedging motive, we cannot rule out the possibility that the lack of significance for EU-member countries may be due to a lack of statistical power, given the more modest subsample size.

In column (5), we repeat the analysis for weekly percentage changes in *gross* notional amounts outstanding. Similar to the regression for net notional amount outstanding, a negative credit rating outlook change in the previous week increases gross notional mounts of CDS outstanding. Nevertheless, contemporaneous downgrades do not affect changes in gross sovereign CDS positions. This is reassuring for the interpretation of the hedging motive we propose. Gross notional amounts outstanding contain CDS contract novations and assignments, which are part of CDS trading volume, i.e., market risk transfer activity. Thus, downgrades reduce the net economic quantities of sovereign insured interest, but not the gross positions. Overall, these results are more in line with the view that sovereign CDS are used for hedging, rather than for speculative purposes.

To assure ourselves of the robustness of our results, we compare the impact of lagged negative outlook changes and contemporaneous rating downgrades in the sample of treated countries to that in a matched control sample. Column 6 reports results for a matched sample, where we match with replacement countries from the same geographical region, using the first best match based on the Mahalanobis distance between the vector of observed covariates across treated and non-treated countries. The match is based on the CDS spread level, the credit rating, and the ratio of net notional to debt outstanding in the quarter immediately preceding the rating or outlook action.[25] Table 9, which reports summary statistics for the treatment and matched control samples, confirms the quality of the match. The summary statistics be-

[24]These results have important policy signficance, in view of the current discussions in the Eurozone to require differential risk weighting of intra-country and intra-zone sovereign debt.

[25]We closely follow Abadie and Imbens (2011) for the matching procedure. We alternatively matched using only the CDS spread level and the credit rating, and using the the CDS spread level, the credit rating, and total debt to GDP. All results remain unchanged.

tween the treated and matched samples are statistically indistinguishable for the match based on negative outlook changes (Panel B), despite the limited number of countries available for the matching procedure. Debt-to-GDP is statistically different in both samples, if we match ahead of the rating downgrades, although the last two columns in Panel A highlight that this difference is due to the impact of Greece, whose debt levels got swollen during the Eurozone sovereign debt crisis. The matching is coarser for the CDS spread level and the nominal amount of gross notional CDS outstanding, as these statistics are significantly different in both subsamples. Appendix Table A-5 provides a detailed list of the itemized matches for each event.

The findings in column (6) confirm that the documented effect of rating actions and lagged negative outlook changes is not due to a common factor that jointly affects the treated and matched control groups. The coefficients for downgrades and outlook changes are insignificant. The difference-in-differences estimators, i.e., the average treatment effects, reported at the bottom of the table, are statistically significant at the 5% level, and of roughly equal economic magnitude to the average treatment effect on the treated. This mitigates endogeneity concerns and points towards a robust impact of regulatory rating actions on net notional amounts of CDS outstanding.

### *4.2. Government bond issuance and the debt channel*

In the first part of the paper, we showed that domestic and international government debt are two primary determinants of the cross-sectional dispersion in net notional amounts of CDS outstanding, as they jointly explain up to 75% of the cross-sectional variation together with the size of the economy. Thus, we explore whether shocks to a country's debt stock significantly impact the net economic quantities of CDS outstanding. We examine both the timing of the announcement of a debt issue and the actual issuance date. If CDS are really used for hedging purposes, then we should observe an increase in net notional amounts outstanding following a debt issue, but not following an announcement. In addition, given that the underlying debt instrument for emerging markets sovereign CDS contracts is foreign denominated debt, we expect to see greater effects for international debt issues in those countries. We thus postulate a second hypothesis.

- H2: *Net notional amounts of CDS outstanding increase following the issuance of international government debt.*

We manually download the information on debt issuance and the announcement dates from Bloomberg. We use all sovereign bond issuances with maturities above one year, as short-term bills are often mechanical debt roll-overs, e.g., in the United States. We classify a bond issuance as international if the Bloomberg description contains the terms "International Bond," "International," or "Foreign Bond," or if it is denominated in a currency other than the home/local currency of the issuer. Otherwise, we classify each event as a domestic bond issuance. We manually verify all bond prospectuses for accuracy.[26]

In total, we have 558 international bond issuances and 2,461 domestic bond issuances. For each event, we have both the announcement and the effective issuance date. As our dependent variables is measured at a weekly frequency, we aggregate several bond issues of the same country within the same week and compute the average issuance weighted by the size of the debt issue. The average value-weighted maturity for international issues is 10.8 years, and ranges from a minimum of two years to a maximum of 100 years (Mexico). The average value-weighted maturity for domestic issues is 8.7 years, slightly lower, and ranges from a minimum of two years to a maximum of 53 years. The average international bond issue by a country corresponds to about 2.5% of its total outstanding debt, while the average domestic bond issue corresponds to about 1.7% of its total outstanding debt. To test our hypothesis, we examine the following regression specification:

$$\begin{aligned}\ln(NN_{i,t+1}/NN_{i,t}) = a + [b^1 + b^2(D\_Issue_{1b}(\%)) + b^3 T_1 + b^4(T_1 \cdot D\_Issue_{1b}(\%))](I_1)_{t-k} \\ + \delta X_{i,t} + \gamma Y_t + \alpha_i + \varepsilon_{i,t},\end{aligned} \tag{4}$$

where $I_1$ is an indicator variable that takes on the value one, in the week of a debt issue, $D\_Issue_{1b}(\%)$ is the amount of issued debt as a fraction of total outstanding debt, $T_1$ denotes the value-weighted average

[26]Note that Saudi Arabia and Estonia did not issue any bonds during the sample period. In fact, Saudi Arabia, like China, has never issued an international bond, thus far, although it is reported to be exploring this possibility.

maturity of the debt issuance, $X_{i,t}$ and $Y_t$ are the vector of country-specific and global control variables we used earlier. We use country fixed effects in all regressions and cluster all standard errors by country.

All results are reported In Table 10 for net notional amounts of CDS outstanding. A first important take-away is that actual debt issuance dates are related to changes in net notional amounts outstanding, but not the announcement dates of debt issues. This is demonstrated by the insignificance of the coefficients reported below the dashed line, which correspond to the announcements effects. Thus, it is truly an increase in outstanding debt amounts that matter for sovereign CDS trading, and not just the announcement of it. In addition, we show, in unreported regressions, that none of the coefficients for domestic debt issuances are significant, which is why we omit the reporting due to space constraints. The findings otherwise suggest that the greater the amount of international debt issued as a fraction of total outstanding debt, the greater the increase in net notional amounts outstanding. A one percent increase in debt issuance is associated with 0.3% increase in net insured interest. This finding is consistent with the cross-sectional regressions that show a strong complementarity between CDS open interest and debt. The regression coefficients in columns (6) and (7), which separate the results for emerging and developed economies, have similar magnitudes, but the coefficient is not significant for emerging economies, which is likely due to a lack of power.[27] The coefficient on the maturity coefficient, interacted with the size of the issuance amount, is negative and significant, but the magnitude of the coefficient is much smaller than for the the amount of debt issued. Thus, while the average effect of debt issuance on net notional amounts of CDS is positive, it is greater for the issuance of riskier short-term debt.

Column (8) reports the results for a similar regression using one specific component of gross notional amounts of CDS outstanding, i.e., new trades. This specification strongly confirms the previous findings. When international debt gets issued, there is an increase in the initiation of new trades, and the effect is stronger for short-term debt issues.

[27] In fact, in unreported results, we show that the effect is statistically significant at the 1% level for gross notional amounts outstanding.

## 5. Conclusion

Sovereign credit default swaps (CDS) remain a controversial, under-researched topic, especially with regard to trading activity. We believe that the results of this research provide a valuable perspective on the size and dynamics of the sovereign CDS market. This is particularly relevant in light of current regulatory discussions around the naked CDS ban, and the Basel capital requirements of the BIS that prescribe sovereign CDS as hedging tools against sovereign and quasi-sovereign counterparty risk. Overall, our findings provide evidence for a strong hedging motive in the sovereign CDS market.

An examination of net traded quantities in the sovereign credit insurance market reveals that the size and trading are primarily determined by country-specific risk factors, rather than by aggregate common financial risk. Domestic and international general government debt, together with the size of the economy, are jointly able to explain up to 75% of the cross-sectional differences in net economic insured interest. This points towards a significant complementarity between debt and associated insurance positions. We pinpoint two economic channels that explain the dynamics of net open interest. Negative shocks to credit rating outlooks increase net insured interest, while subsequent downgrades that result in an increase in regulatory capital lower net positions by an equal amount. Debt issuance dates are also shocks that increase net amounts of sovereign CDS outstanding, and these effects are more pronounced for greater issue sizes and shorter bond maturities. All our findings point towards a large number of investors using sovereign CDS as hedging vehicles, at the margin. These findings need to be considered for regulatory policy design, as they cast some doubt on the validity of allegations that speculators drive up sovereign borrowing costs by buying naked insurance on sovereign default.

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**Fig. 1. DTCC Sovereign Coverage Ratio.** This figure shows how much of the overall single name sovereign CDS trading volume is accounted for by the sovereign reference entities listed among the 1,000 most heavily traded reference entities in the DTCC Trade Information Warehouse over the time period November 2008 to September 2015. The observation frequency is weekly. The lines indicate the fraction of the total sovereign CDS trading volume of the sovereign reference entities in the top 1,000 list. *All Sovereigns* refers to sovereign countries, sovereign states and state bodies. *Sovereign Countries* refers to sovereign countries only. Source: DTCC.

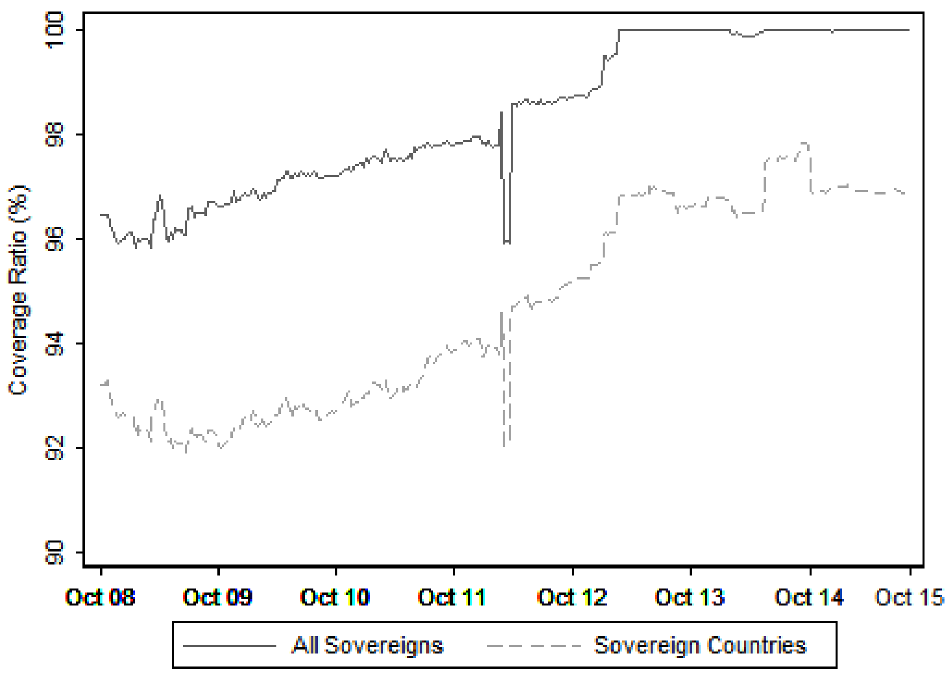

**Fig. 2. CDS Net Notional Amounts Outstanding.** This figure reports total and average net notional amounts of CDS outstanding in billion USD equivalents. The top left panel of the figure presents the total weekly sovereign CDS net notional outstanding. The bottom left panel presents the average weekly sovereign CDS net notional outstanding. The shaded area represents the inter-quartile range. The right panel reports country averages of net notional amounts of CDS outstanding in billion USD equivalents. The top right panel displays the cross section of the average net notional outstanding in the full sample of countries. The box, in the top right panel, reports the 10 countries with the highest average CDS net notional outstanding during our sample period. The bottom right panel displays the cross section of the average net notional outstanding in the 25 countries with the highest average CDS net notional outstanding during our sample period. The sample period is October 2008 to September 2015. Source: DTCC.

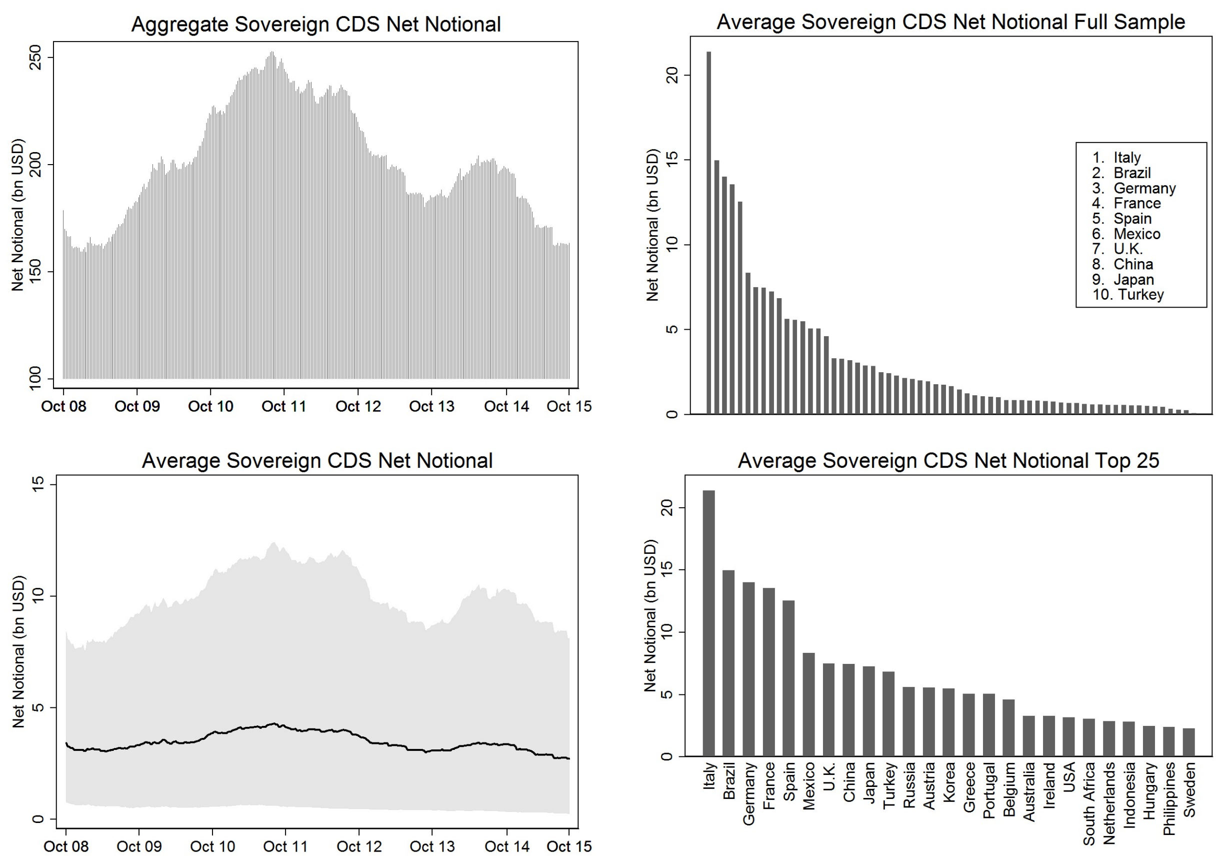

**Fig. 3. International General Government Debt.** The top left (right) panel of the figure presents the aggregate quarterly international (total, i.e., domestic and international) general government debt outstanding in billion USD. The dotted line in the top figures represents the share of the aggregate (international or total, respectively) debt outstanding represented by the debt of the 20 OECD countries. The bottom left (right) panel presents the average quarterly international (total, i.e., domestic and international) general government debt outstanding in billion USD for each country in our sample. The legend of the bottom figures lists the top ten countries by international (total) debt outstanding. The sample period is the second quarter 2008 to the second quarter 2015. Source: Bank for International Settlements (BIS).

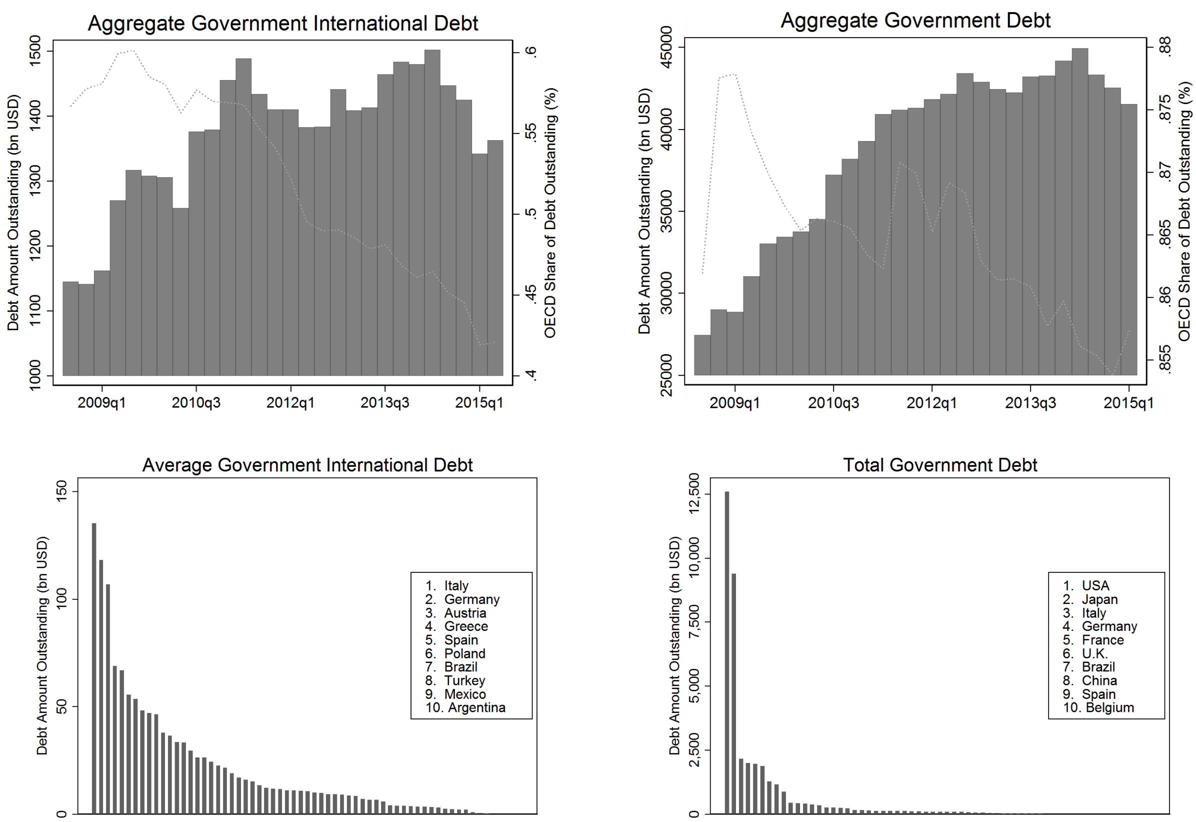

**Fig. 4. Predicted vs. Actual Net Notional Amount of CDS Outstanding.** This figure plots the predicted net notional amount of CDS outstanding against the actual net notional amount of CDS outstanding using the empirical model

$$\ln(\hat{NN})_i = 5.89 + 0.021 \ln(\text{Domestic Debt})_i + 0.083 \ln(\text{Int Debt})_i + 0.498 \ln(\text{GDP})_i \qquad R^2 = 0.75,$$

controlling for total domestic general government debt, total international general government debt, GDP, using a cross-sectional regression based on time-series averages of weekly values. The sample period is the second quarter 2008 to the second quarter 2015. Source: Bank for International Settlements (BIS).

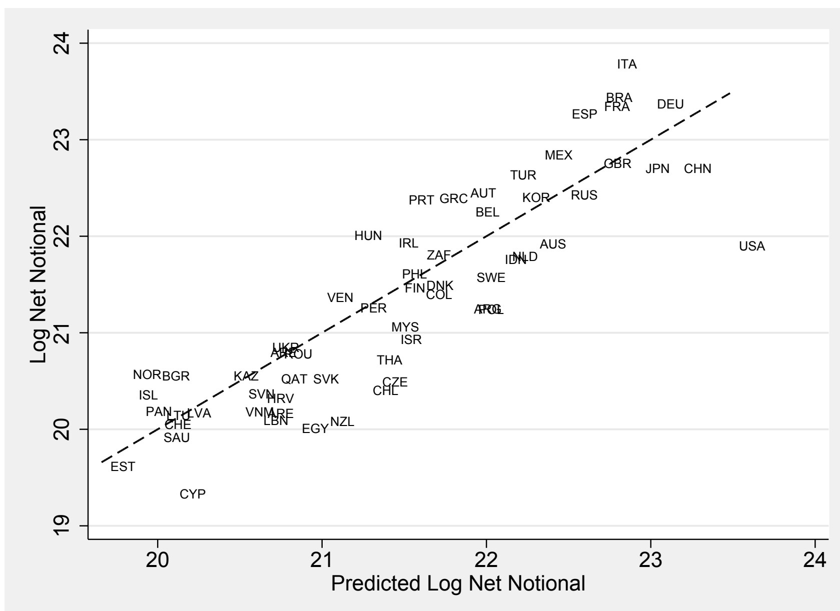

**Fig. 5. Local Ratio Histograms**. The top left panel of the figure presents the distribution of $R^2$s from the country by country restricted time-series regression of percentage changes in net notional amounts of sovereign CDS outstanding on local risk factors only (*Local R-square*). The middle panel reports the distribution of $R^2$s for the full time series regression including both domestic and global risk factors (*Global R-square*). The bottom panel reports the distribution of the local ratios, which are defined as the ratio of the $R^2$ from the restricted regression of percentage changes in changes in noet notional amounts of CDS outstanding to that from the unrestricted regression on both local and global variables (*Local Ratio*). The sample period is the second quarter 2008 to the second quarter 2015.

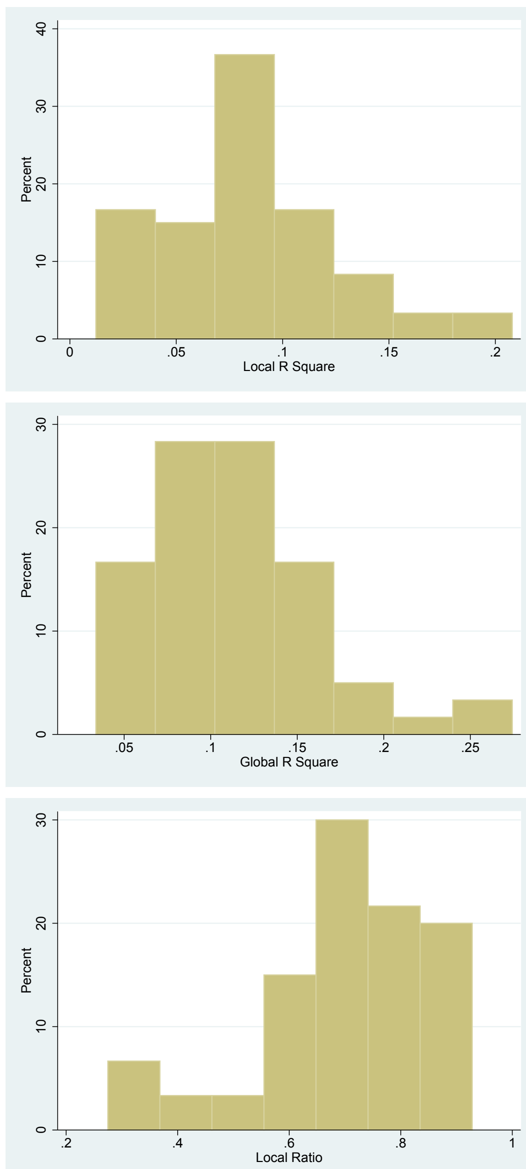

**Table 1**

**Descriptive Statistics.** The table reports summary statistics on CDS trading for the 60 sovereign reference entities included in the 1000 most heavily traded contracts, constituting our sample. We report the mean, standard deviation, minimum, maximum, 25th, 50th, and 75th percentiles of end-of-quarter values. Gross and net notional refer to the combined values for CDS contracts of all maturities, and are measured in billions of US dollars. GDP is the country's gross domestic product, and debt refers to the total amount of domestic and international debt outstanding, both variables are measured in billions of dollars. Quantities in currencies other than US dollars were converted to the latter, using the prevailing foreign exchange rate. We report statistics for the ratio of net notional to debt outstanding and the ratio of debt outstanding to GDP. CDS spread is measured in percentage points and it refers to a contract with a maturity of five years. The sample period extends from the fourth quarter of 2008 to the second quarter of 2015. The number of observations is reported under the "N"-titled columns. CDS contract data are obtained from Markit and DTCC, GDP and debt data are obtained from the Bank of International Settlements (BIS).

| Panel A: All Countries | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
| Gross Notional | 1474 | 40.78 | 54.99 | 1.21 | 8.20 | 19.47 | 51.96 | 434.85 |
| Net Notional | 1474 | 3.55 | 4.61 | 0.08 | 0.72 | 1.72 | 4.22 | 27.05 |
| Debt | 1474 | 687.75 | 2117.58 | 0.00 | 16.95 | 100.81 | 285.32 | 15613.88 |
| International Debt | 1474 | 23.32 | 29.44 | 0.00 | 3.95 | 12.06 | 30.66 | 153.02 |
| Domestic Debt | 1474 | 664.43 | 2117.26 | 0.00 | 6.51 | 85.36 | 228.64 | 15610.02 |
| GDP | 1474 | 1076.48 | 2427.27 | 12.82 | 167.99 | 286.43 | 853.81 | 18124.73 |
| Net Notional/Debt | 1450 | 0.08 | 0.22 | 0.00 | 0.01 | 0.02 | 0.05 | 2.93 |
| Debt/GDP | 1474 | 0.39 | 0.35 | 0.00 | 0.14 | 0.33 | 0.53 | 2.09 |
| **Panel B: Emerging Countries** | | | | | | | | |
| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
| Gross Notional | 954 | 32.77 | 38.48 | 1.21 | 7.22 | 16.82 | 44.21 | 180.00 |
| Net Notional | 954 | 2.36 | 3.17 | 0.08 | 0.62 | 1.06 | 2.32 | 18.62 |
| Debt | 954 | 141.57 | 288.21 | 0.00 | 8.69 | 35.88 | 120.72 | 1686.31 |
| International Debt | 954 | 17.54 | 19.17 | 0.00 | 3.83 | 10.18 | 26.47 | 109.46 |
| Domestic Debt | 954 | 124.03 | 281.18 | 0.00 | 0.00 | 25.20 | 101.24 | 1670.88 |
| GDP | 954 | 588.23 | 1341.60 | 19.53 | 97.80 | 205.79 | 461.65 | 11211.93 |
| Net Notional/Debt | 930 | 0.11 | 0.26 | 0.00 | 0.02 | 0.03 | 0.07 | 2.93 |
| Debt/GDP | 954 | 0.26 | 0.27 | 0.00 | 0.07 | 0.23 | 0.37 | 1.51 |
| **Panel C: Developed Countries** | | | | | | | | |
| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
| Gross Notional | 520 | 55.47 | 74.36 | 1.34 | 11.99 | 27.11 | 64.47 | 434.85 |
| Net Notional | 520 | 5.73 | 5.87 | 0.38 | 1.74 | 3.36 | 8.17 | 27.05 |
| Debt | 520 | 1689.79 | 3319.61 | 4.91 | 126.59 | 287.57 | 1859.49 | 15613.88 |
| International Debt | 520 | 33.93 | 40.14 | 0.00 | 4.33 | 18.11 | 42.61 | 153.02 |
| Domestic Debt | 520 | 1655.86 | 3325.06 | 2.72 | 108.75 | 199.56 | 1791.80 | 15610.02 |
| GDP | 520 | 1972.22 | 3489.16 | 12.82 | 268.28 | 528.72 | 2318.78 | 18124.73 |
| Net Notional/Debt | 520 | 0.02 | 0.02 | 0.00 | 0.01 | 0.01 | 0.02 | 0.22 |
| Debt/GDP | 520 | 0.63 | 0.35 | 0.11 | 0.41 | 0.57 | 0.78 | 2.09 |

**Table 2**

**Descriptive Statistics.** The table reports summary statistics at the quarterly frequency for the explanatory variables used in the cross-sectional analysis of the net notional amounts of CDS outstanding for the 60 sovereign reference entities included in the 1000 most heavily traded contracts, constituting our sample. We report the mean, standard deviation, minimum, maximum, 25th, 50th, and 75th percentiles of end-of-quarter values. $\sigma^2_{CDS}$ is the variance of weekly relative changes in CDS spreads, CDS liquidity refers to the average weekly depth of the CDS spread quotes from Markit, $\sigma^2_{FX}$ is the variance of weekly exchange rate returns. Reserves represent the country's foreign exchange reserves in billion USD. Inflation is the change in GDP deflator. Market capitalization is the total size of the country's stock market, measured in trillions of dollars, while $\sigma^2_{MKT}$ is the weekly return variance of the country's stock index. $\sigma^2_{CDS}$, $\sigma^2_{FX}$, and $\sigma^2_{MKT}$ have been multiplied by 100 to ease interpretation. The sample period extends from the fourth quarter of 2008 to the second quarter of 2015. The World Bank does not report data for all countries in every quarter, thus the number of observations for Inflation and Market Capitalization is below the total number of data points available. The number of observations is reported under the "N"-titled columns. CDS contract data are obtained from Markit, inflation and market capitalization data are obtained from the World Bank. Reserves data are obtained from the Bank of International Settlements (BIS). FX data are obtained from Datastream.

Panel A: All Countries

| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
|---|---|---|---|---|---|---|---|---|
| CDS Spread | 1471 | 2.59 | 5.58 | 0.13 | 0.74 | 1.29 | 2.55 | 112.65 |
| $\sigma^2_{CDS}$ | 1470 | 0.42 | 0.49 | 0.00 | 0.12 | 0.27 | 0.56 | 6.67 |
| CDS Liquidity | 1471 | 6.60 | 1.86 | 2.04 | 5.17 | 6.64 | 7.83 | 12.75 |
| $\sigma^2_{FX}$ | 1471 | 0.02 | 0.11 | 0.00 | 0.00 | 0.01 | 0.03 | 3.41 |
| Reserves | 1474 | 139.56 | 445.35 | 0.13 | 13.51 | 37.41 | 74.53 | 4010.83 |
| Inflation | 1413 | 3.80 | 6.02 | -24.22 | 0.88 | 2.06 | 5.26 | 45.94 |
| Market Capitalization | 1055 | 1.01 | 3.05 | 0.00 | 0.07 | 0.22 | 0.79 | 26.33 |
| $\sigma^2_{MKT}$ | 1471 | 0.10 | 0.16 | 0.00 | 0.02 | 0.05 | 0.11 | 1.59 |

Panel B: Emerging Countries

| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
|---|---|---|---|---|---|---|---|---|
| CDS Spread | 952 | 3.35 | 6.71 | 0.47 | 1.07 | 1.63 | 3.19 | 112.65 |
| $\sigma^2_{CDS}$ | 952 | 0.39 | 0.49 | 0.00 | 0.12 | 0.26 | 0.51 | 6.67 |
| CDS Liquidity | 952 | 6.83 | 1.98 | 2.04 | 5.25 | 6.89 | 8.11 | 12.75 |
| $\sigma^2_{FX}$ | 952 | 0.03 | 0.13 | 0.00 | 0.00 | 0.01 | 0.02 | 3.41 |
| Reserves | 954 | 160.63 | 521.31 | 0.13 | 13.85 | 36.23 | 92.91 | 4010.83 |
| Inflation | 913 | 5.06 | 7.04 | -24.22 | 1.29 | 3.54 | 6.98 | 45.94 |
| Market Capitalization | 687 | 0.41 | 0.80 | 0.00 | 0.03 | 0.18 | 0.41 | 6.00 |
| $\sigma^2_{MKT}$ | 952 | 0.11 | 0.16 | 0.00 | 0.02 | 0.05 | 0.12 | 1.27 |

Panel C: Developed Countries

| Variable | N | Mean | STD | Min | 25th Pct | Median | 95th Pct | Max |
|---|---|---|---|---|---|---|---|---|
| CDS Spread | 519 | 1.21 | 1.65 | 0.13 | 0.38 | 0.65 | 1.30 | 12.84 |
| $\sigma^2_{CDS}$ | 518 | 0.47 | 0.49 | 0.01 | 0.13 | 0.30 | 0.64 | 4.51 |
| CDS Liquidity | 519 | 6.20 | 1.55 | 2.68 | 5.08 | 6.38 | 7.31 | 9.98 |
| $\sigma^2_{FX}$ | 519 | 0.02 | 0.03 | 0.00 | 0.01 | 0.01 | 0.03 | 0.51 |
| Reserves | 520 | 100.91 | 248.15 | 0.80 | 12.34 | 43.86 | 66.06 | 1258.17 |
| Inflation | 500 | 1.49 | 1.86 | -5.20 | 0.67 | 1.46 | 2.06 | 11.39 |
| Market Capitalization | 368 | 2.13 | 4.85 | 0.04 | 0.16 | 0.59 | 1.48 | 26.33 |
| $\sigma^2_{MKT}$ | 519 | 0.09 | 0.14 | 0.00 | 0.03 | 0.05 | 0.09 | 1.59 |

**Table 3**
**Principal Component Analysis.** The table reports summary statistics for the principal component analysis of the correlation matrix of weekly sovereign CDS spread changes (Panel A), the correlation matrix of weekly changes of net (Panel B) notional CDS outstanding, and the correlation matrix of weekly changes of net notional CDS outstanding that has been corrected for seasonality effects due to the quarterly on-the-run roll effects on March 20, June 20, September 20, and December 20 (Panel C). The correlation matrices are based on the 47 countries for which we have continuous information on CDS net notional with 349 weeks of data. The sample period is October 31, 2008 to July 3, 2015. Source: DTCC and Markit.

| | Full Sample | | Developed | | Emerging | |
|---|---|---|---|---|---|---|
| Principal Component | Percent Explained | Total | Percent Explained | Total | Percent Explained | Total |
| Panel A<br>Δ *Spread* | | | | | | |
| First | 53.65 | 53.65 | 56.33 | 56.33 | 64.53 | 64.53 |
| Second | 10.43 | 64.09 | 10.83 | 67.16 | 7.22 | 71.75 |
| Third | 4.27 | 68.36 | 6.01 | 73.17 | 4.62 | 76.37 |
| Fourth | 3.56 | 71.92 | 5.06 | 78.24 | 3.99 | 80.36 |
| Fifth | 2.90 | 74.81 | 4.31 | 82.54 | 2.80 | 83.16 |
| Panel B<br>Δ *Net Notional* | | | | | | |
| First | 9.51 | 9.51 | 17.35 | 17.35 | 11.20 | 11.20 |
| Second | 4.91 | 14.42 | 9.04 | 26.40 | 5.73 | 16.92 |
| Third | 4.14 | 18.56 | 7.59 | 33.98 | 5.32 | 22.25 |
| Fourth | 3.52 | 22.08 | 7.11 | 41.10 | 4.86 | 27.10 |
| Fifth | 3.33 | 25.41 | 6.17 | 47.27 | 4.58 | 31.68 |
| Panel C<br>Δ *Net Notional De-Seasonalized* | | | | | | |
| First | 6.69 | 6.69 | 15.25 | 15.25 | 8.00 | 8.00 |
| Second | 4.85 | 11.55 | 9.39 | 24.64 | 5.84 | 13.84 |
| Third | 4.28 | 15.82 | 7.63 | 32.27 | 5.54 | 19.38 |

**Table 4**

**Sovereign CDS Net Notional Amount Seasonality Regression.** This table reports the estimated coefficients from the seasonality panel regression for weekly percentage changes of sovereign CDS net notional amounts outstanding, which are projected on the dates when the on-the-run contract expires and "rolls over" to a new on-the-run CDS contract. The CDS roll indicator for each of the quarterly roll dates takes on the value of one during the week of the roll, and zero otherwise. Each calendar year, single-name CDS roll on March 20, June 20, September 20, and December 20. Source: DTCC.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Δ NN % | Δ NN % | Δ NN % | Δ NN % |
| Mar20Roll | -2.084*** | -2.084*** | -2.283*** | -2.283*** |
| | (0.176) | (0.176) | (0.193) | (0.193) |
| Jun20Roll | -2.410*** | -2.410*** | -2.525*** | -2.525*** |
| | (0.176) | (0.176) | (0.193) | (0.193) |
| Sep20Roll | -1.422*** | -1.423*** | -1.471*** | -1.471*** |
| | (0.189) | (0.189) | (0.208) | (0.208) |
| Dec20Roll | -1.781*** | -1.780*** | -1.981*** | -1.981*** |
| | (0.177) | (0.177) | (0.193) | (0.193) |
| Constant | 0.112*** | 0.113*** | 0.123*** | 0.123*** |
| | (0.032) | (0.025) | (0.034) | (0.028) |
| Observations | 20,650 | 20,650 | 16,779 | 16,779 |
| R-squared | 0.0218 | 0.0220 | 0.0218 | 0.0260 |
| Fixed Effect | No | Yes | No | Yes |
| # Sovereigns | 61 | 61 | 47 | 47 |

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

**Table 5**

**Cross-Sectional Determinants of CDS Net Notional Amounts.** This table reports the estimated coefficients from the panel regression analysis aimed at investigating the determinants of cross-sectional differences in net notional amounts outstanding in sovereign CDS contracts. All information is aggregated at a quarterly frequency. We regress quarterly levels of sovereign CDS net notional amounts on a set of country-specific variables and time fixed effects. The explanatory variables are total, domestic, and international general government debt outstanding in billion USD, and gross domestic product (GDP). All variables have been log-transformed to allow the interpretation of the parameters as elasticities. *Developed* is an indicator variable that takes on the value one for developed countries (according to the OECD classification), and zero otherwise. We report the adjusted $R^2$ of the regression. For specifications 1 to 5, and 7, the standard errors are clustered by country with the corresponding t-statistics reported in parentheses. Specifications 5 and 7 feature quarterly time fixed effects. Specification 6 reports the results for the cross-sectional regression based on time-series country averages. In specification 7, we include an interaction term between both domestic and international debt and the developed countries indicator variable. $^{*}$, $^{**}$, and $^{***}$ refer to statistical significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Total Debt | 0.152$^{*}$ | | | | | | |
| | (1.82) | | | | | | |
| Domestic Debt | | 0.055$^{***}$ | 0.051$^{***}$ | 0.017$^{**}$ | 0.017$^{**}$ | 0.020$^{***}$ | -0.068 |
| | | (7.03) | (6.74) | (2.51) | (2.48) | (3.21) | (-0.64) |
| International Debt | | | 0.062$^{***}$ | 0.060$^{***}$ | 0.060$^{***}$ | 0.083$^{***}$ | 0.080$^{***}$ |
| | | | (2.76) | (3.47) | (3.54) | (6.99) | (4.28) |
| GDP | | | | 0.496$^{***}$ | 0.499$^{***}$ | 0.498$^{***}$ | 0.522$^{***}$ |
| | | | | (7.09) | (7.05) | (7.10) | (9.08) |
| DD·Emerging | | | | | | | 0.080 |
| | | | | | | | (0.75) |
| ID·Emerging | | | | | | | -0.031 |
| | | | | | | | (-1.00) |
| Emerging | | | | | | | -1.637 |
| | | | | | | | (-0.60) |
| Constant | 17.573$^{***}$ | 20.218$^{***}$ | 18.942$^{***}$ | 16.789$^{***}$ | 16.880$^{***}$ | 5.887$^{***}$ | 18.634$^{***}$ |
| | (8.36) | (142.66) | (32.27) | (31.97) | (31.73) | (3.24) | (7.29) |
| Time FE | No | No | No | No | Yes | No | Yes |
| Cluster | Country | Country | Country | Country | Country | None | Country |
| Obs. | 1474 | 1474 | 1474 | 1474 | 1474 | 60 | 1474 |
| Countries | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| adj. $R^2$ | 0.265 | 0.259 | 0.339 | 0.662 | 0.673 | 0.752 | 0.687 |

**Table 6**

**Cross-Sectional Determinants of CDS Net Notional Amounts.** This table reports the estimated coefficients from the panel regression analysis aimed at investigating the determinants of cross-sectional differences in net notional amounts outstanding in sovereign CDS contracts. All information is aggregated at a quarterly frequency. We regress quarterly levels of sovereign CDS net notional amounts on a set of country-specific variables and time fixed effects. The explanatory variables are domestic and international general government debt outstanding in billion USD, gross domestic product (GDP), reserves in foreign currencies, CDS Spreads, the variance of weekly relative changes in the CDS Spread ($\sigma^2_{CDS}$), the liquidity of the CDS market, the country's stock market capitalization, the variance of weekly relative changes in the country's stock index ($\sigma^2_{MKT}$), inflation, and the variance of changes in the FX rate against the US Dollar ($\sigma^2_{FX}$). All variables have been log-transformed to allow the interpretation of the parameters as elasticities. We report the adjusted $R^2$ of the regression. All specifications feature quarterly time fixed effects, the standard errors are clustered by country with the corresponding t-statistics reported in parentheses. $^{*}$, $^{**}$, and $^{***}$ refer to statistical significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Domestic Debt | 0.016** | 0.018*** | 0.021** | 0.014** |
| | (2.31) | (2.90) | (2.60) | (2.08) |
| International Debt | 0.056*** | 0.038*** | 0.039** | 0.036*** |
| | (3.46) | (3.03) | (2.07) | (2.93) |
| GDP | 0.573*** | 0.577*** | | 0.590*** |
| | (4.94) | (5.95) | | (5.88) |
| FX Reserves | -0.084 | -0.115** | -0.096 | -0.114** |
| | (-1.30) | (-2.30) | (-1.60) | (-2.34) |
| CDS Spread | | 0.081 | 0.068 | 0.109 |
| | | (1.10) | (0.66) | (1.61) |
| $\sigma^2_{CDS}$ | | 0.044 | 0.189*** | 0.026 |
| | | (1.14) | (3.72) | (0.62) |
| CDS Liquidity | | 0.902*** | 1.044*** | 0.915*** |
| | | (3.52) | (3.85) | (3.12) |
| Market Capitalization | | | 0.366*** | |
| | | | (4.33) | |
| $\sigma^2_{MKT}$ | | | | 0.035 |
| | | | | (0.81) |
| Inflation | | | | -0.012 |
| | | | | (-1.34) |
| $\sigma^2_{FX}$ | | | | 0.012 |
| | | | | (0.58) |
| Constant | 16.826*** | 15.244*** | 19.000*** | 15.430*** |
| | (31.54) | (30.34) | (25.38) | (26.02) |
| Time FE | Yes | Yes | Yes | Yes |
| Cluster | Country | Country | Country | Country |
| Obs. | 1474 | 1470 | 1051 | 1407 |
| Countries | 60 | 60 | 60 | 60 |
| adj. $R^2$ | 0.681 | 0.732 | 0.585 | 0.738 |

**Table 7**

**Time-Series Determinants of CDS Net Notional Amounts.** This table reports the estimated coefficients from the panel regression analysis aimed at investigating the time-series determinants of net notional amounts of CDS contracts. At a weekly frequency, we regress percentage changes in the level of sovereign CDS net notional amounts outstanding on a set of country specific and global variables. Specifications (1) to (6) include country fixed effects, while Specification (7) includes country-quarter fixed effects. The explanatory variables include returns to the US dollar currency portfolio (*US Dollar*), and local variables such as changes to the sovereign's CDS spread (*CDS*), changes in the square of CDS percentage changes ($CDS^2$), changes in CDS liquidity (*CDS Liquidity*), return to the country's equity market orthogonalized to returns in the US equity market ($Equity^{\perp}$), changes in square unadjusted equity market return ($Equity^2$), changes in the FX rate (*FX*), changes in the square FX rate ($FX^2$ ). Global variables include changes in global and regioanl CDS orthogonalized to the following macro variables: return of the US stock market (*UsRet*), changes in the PE ratio (*PE Ratio*), changes in the VIX (*VIX*), changes in the TED spread (*TED*), changes in the difference between the BBB credit spread and the AAA credit spread (*BBB-AAA*), changes in the difference between the BB credit spread and the BBB credit spread (*BBB-AAA*, *BB-BBB*), and the 5-year constant maturity treasury spread (*5y CMT*). All macro variables are also included as regressors. All changes are percentage changes. Dummies for four yearly roll-over dates are included but not reported. Panel B reports the coefficients from the regression of the country-quarter fixed effects on domestic debt, international debt, and GDP. We report the adjusted $R^2$ of the regression. For all specifications, standard errors are clustered by country. $^{*}$, $^{**}$, and $^{***}$ refer to statistical significance at the 10%, 5%, and 1% level, respectively.

| Panel A: Time Series Regression | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| US Dollar | -0.275*** | -0.287*** | -0.248*** | -0.247*** | -0.239*** | -0.239*** | -0.229*** |
| CDS | | 0.007 | 0.008* | 0.009* | 0.012** | 0.014** | 0.011* |
| $CDS^2$ | | -0.036 | -0.013 | -0.014 | -0.012 | -0.009 | -0.027 |
| CDS Liquidity | | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| $Equity^{\perp}$ | | | -0.002 | -0.002 | -0.005 | -0.004 | -0.004 |
| $Equity^2$ | | | -0.358*** | -0.358*** | -0.339*** | -0.343*** | -0.239* |
| FX | | | -0.038 | -0.038 | -0.039 | -0.040 | -0.030 |
| $FX^2$ | | | -0.627 | -0.627 | -0.624 | -0.600 | -0.742 |
| Global $CDS^{\perp}$ | | | | -0.002 | -0.003 | -0.001 | 0.001 |
| Regional $CDS^{\perp}$ | | | | 0.000 | -0.003 | -0.004 | -0.009 |
| UsRet | | | | | -0.012 | -0.006 | -0.013 |
| PE Ratio | | | | | 0.011 | 0.007 | -0.011 |
| VIX | | | | | -0.004 | -0.003 | -0.005 |
| TED | | | | | -0.006 | -0.006 | -0.007* |
| BBB-AAA | | | | | | -0.020*** | -0.004 |
| BB-BBB | | | | | | -0.001 | -0.002 |
| 5y CMT | | | | | | -0.003 | -0.001 |
| Roll Dummies | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| FE | C | C | C | C | C | C | CQ |
| Cluster | Country | Country | Country | Country | Country | Country | Country |
| Observations | 19735 | 19725 | 19725 | 19725 | 19725 | 19725 | 19725 |
| Adjusted $R^2$ | 0.030 | 0.030 | 0.031 | 0.031 | 0.031 | 0.031 | 0.031 |
| Panel B: Country Quarter Fixed Effects Determinants | | | | | | | |
| Domestic Debt | | | | | | | 0.005** |
| International Debt | | | | | | | 0.000 |
| GDP | | | | | | | 0.018*** |
| Adjusted $R^2$ | | | | | | | 0.009 |
| N | | | | | | | 1414 |

**Table 8**

**Credit Risk Channel.** This table reports the regression results from the weekly percentage changes of net (columns 1 to 4) and gross (column 5) notional amounts of sovereign CDS outstanding on credit risk shocks due to contemporaneous and lagged credit rating and credit rating outlook changes. We define the indicator variable *Upgrade* that takes on the value one during the week a country's credit rating rating changes from (i) below B- to B- or higher, (ii) below BBB- to BBB- or higher, (iii) below A- to A- or higher, (v) below AA- to AA- or higher, and zero otherwise. We define the indicator variable *Downgrade* that takes on the value one during the week a country's credit rating rating changes from (i) B- or higher to below B-, (ii) BBB- or higher to below BBB-, (iii) A- or higher to below A-, (iv) AA- or higher to below AA-, zero otherwise. *Pos* Δ *Outlook* is an indicator variable that is equal to one if the rating outlook changes from negative to neutral, *or* from negative to positive outlook, *or* from neutral to positive, and zero otherwise. *Neg* Δ *Outlook* is an indicator variable that is equal to one if the rating outlook changes from positive to neutral, *or* from neutral to negative, *or* from positive to negative, and zero otherwise. Column 6 reports results for a matched sample, where we match with replacement countries from the same geographical region using the first best match based on the Mahalanobis distance between the vector of observed covariates across treated and non-treated countries. The match is based on the CDS spread level, the credit rating, and the ratio of net notional to debt outstanding in the quarter immediately preceding the rating or outlook action. Column 7 adjusts the definition of rating and outlook changes to account for all credit rating and outlook changes, as opposed to those that result in changes of regulatory capital requirements according to the Basel II Standardized framework. Column 8 uses all rating and outlook changes that do not result in a change of regulatory capital requirements. We use all country-specific and common global control variables as defined in Part I of the manuscript. All regressions include roll dummies that are equal to one in the week of the conventional roll dates, and monthly time fixed effects. Standard errors are clustered at the country level.

| VARIABLES | (1)<br>Δ NN % | (2)<br>Δ NN % | (3)<br>Δ NN % | Regulatory Ratings<br>(4)<br>Δ NN % | Regulatory Ratings<br>(5)<br>Δ GN % | Matched Sample<br>(6)<br>Δ NN % | All Ratings<br>(7)<br>Δ NN % | Non-Reg Ratings<br>(8)<br>Δ NN % |
|---|---|---|---|---|---|---|---|---|
| Pos Δ Outlook | -0.020* | -0.020* | -0.020* | -0.020* | -0.002 | -0.020* | -0.011 | -0.008 |
| | (0.011) | (0.011) | (0.011) | (0.011) | (0.008) | (0.011) | (0.008) | (0.010) |
| Neg Δ Outlook | -0.004 | -0.004 | -0.003 | -0.005 | 0.004 | -0.004 | 0.001 | 0.003 |
| | (0.010) | (0.010) | (0.010) | (0.010) | (0.005) | (0.008) | (0.006) | (0.008) |
| Upgrade | -0.028** | -0.028** | -0.028** | -0.028** | 0.013 | -0.028** | -0.004 | 0.006 |
| | (0.014) | (0.014) | (0.014) | (0.014) | (0.012) | (0.014) | (0.008) | (0.007) |
| Downgrade | -0.020** | -0.021** | -0.021** | -0.021** | 0.002 | -0.004 | -0.009* | -0.002 |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.002) | (0.003) | (0.005) | (0.004) |
| Lag Pos Δ Outlook | | 0.004 | 0.004 | 0.004 | -0.008 | 0.004 | 0.003 | 0.002 |
| | | (0.009) | (0.010) | (0.010) | (0.011) | (0.010) | (0.004) | (0.005) |
| Lag Neg Δ Outlook | | 0.023** | 0.023** | 0.022** | 0.017*** | 0.002 | 0.009** | 0.001 |
| | | (0.009) | (0.009) | (0.009) | (0.005) | (0.006) | (0.004) | (0.006) |
| Lag Upgrade | | -0.003 | -0.003 | -0.003 | 0.000 | -0.003 | -0.004 | -0.001 |
| | | (0.007) | (0.007) | (0.007) | (0.003) | (0.007) | (0.004) | (0.004) |
| Lag Downgrade | | -0.001 | -0.000 | -0.000 | -0.014 | -0.003 | 0.003 | 0.005* |
| | | (0.005) | (0.005) | (0.005) | (0.009) | (0.005) | (0.003) | (0.003) |
| Constant | -0.009* | 0.004 | 0.003 | 0.003 | 0.008*** | 0.003 | 0.003 | 0.003 |
| | (0.005) | (0.004) | (0.004) | (0.004) | (0.003) | (0.004) | (0.005) | (0.004) |
| Observations | 20,069 | 20,008 | 20,008 | 19,962 | 19,962 | 19,962 | 19,962 | 19,962 |
| R-squared | 0.052 | 0.052 | 0.053 | 0.054 | 0.102 | 0.054 | 0.054 | 0.053 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Roll Dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Global Controls | No | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Local Controls | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Time FE (Monhtly) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sovereigns | 61 | 61 | 61 | 61 | 61 | 61 | 61 | 61 |
| Diff Coeff. Downgrade (4) & (6) | | | | | | -0.017** | | |
| Diff Coeff. Lag Neg Δ Outlook (4) & (6) | | | | | | 0.02** | | |

*** p<0.01, ** p<0.05, * p<0.1

**Table 9**

**Credit Risk Channel - Summary Statistics Treatment and Matched Samples.** This table reports summary statistics for treatment and matched control samples from the tests that examine the impact of credit risk shocks on CDS trading. We match with replacement countries from the same geographical region using the first best match based on the Mahalanobis distance between the vector of observed covariates across treated and non-treated countries. The match is based on the CDS spread level, the credit rating, and the ratio of net notional to debt outstanding in the quarter immediately preceding the rating or outlook action. We perform a match for downgrades (Panel A) and lagged negative rating outlook changes (Panel B). In the statistics, we report the average and either the standard deviation or the range, as well as a t-test for the differences in means. The last two rows in Panel A report the t-test for the differences in means excluding Greece. The reported variables are the number of countries (# Sovereigns), the CDS spread level (CDS), the credit rating by FitchRatings (Rating), the net notional amount of CDS outstanding as a fraction of total public debt outstanding (Net Notional), the gross notional amount of CDS outstanding as a fraction of total public debt outstanding (Gross Notional), and the total amount of debt outstanding as a fraction of GDP (Debt/GDP).

| | Actual | | Matched | | Difference | | | |
|---|---|---|---|---|---|---|---|---|
| | | Std. Dev. | | Std. Dev. | | | Ex Greece | |
| | Mean | Range | Mean | Range | Diff | t-stat | Diff | t-stat |
| Panel A | | | | | | | | |
| *Downgrade* | | | | | | | | |
| Sovereigns | 19 | | 16 | | | | | |
| CDS | 71.50 | 59.45 | 48.39 | 27.94 | 23.11 | 6.17*** | 16.87 | 4.60*** |
| Rating | BBB | [B- AA] | BBB | [B- AA] | -0.09 | 0.30 | -0.55 | 1.83* |
| NN/Debt | 12.23 | 41.67 | 4.48 | 6.93 | 7.76 | 3.21*** | 9.80 | 3.73*** |
| GS/Debt | 82.43 | 205.64 | 49.36 | 63.42 | 33.07 | 2.69*** | 46.10 | 3.47*** |
| Net Notional | 4.97 | [0.23 21.40] | 5.83 | [0.17 22.24] | -0.86 | 1.75* | 0.04 | 1.76* |
| Gross Notional | 61.46 | [1.61 411.65] | 82.75 | [1.54 425.59] | -21.29 | 2.73*** | -19.91 | 2.35** |
| Debt/GDP | 0.65 | 0.42 | 0.56 | 0.24 | 0.09 | 3.26*** | 0.01 | 0.25 |
| CDS Vol | 0.82 | 1.56 | 0.51 | 0.75 | 0.31 | 3.10*** | 0.29 | 2.77*** |
| CDS Liq | 6.41 | 1.72 | 7.03 | 1.62 | -0.62 | 4.63*** | -0.32 | 2.34** |
| Equity Ret | -0.40 | 3.67 | -0.33 | 4.21 | -0.07 | 0.23 | 0.02 | 0.06 |
| Equity Vol | 0.23 | 1.82 | 0.15 | 0.28 | 0.08 | 0.74 | 0.07 | 0.61 |
| Panel B | | | | | | | | |
| Neg $\Delta$ Outlook | | | | | | | | |
| Sovereigns | 13 | | 12 | | | | | |
| CDS | 42.07 | 26.83 | 41.26 | 27.20 | 0.81 | 0.29 | | |
| Rating | BBB- | [B AA] | BBB- | [B- AA+] | -0.14 | 0.41 | | |
| NN/Debt | 2.74 | 3.95 | 2.84 | 2.12 | 1.51 | 2.47** | | |
| GS/Debt | 34.05 | 47.78 | 34.74 | 30.13 | 10.35 | 2.56** | | |
| Net Notional | 0.45 | [0.24 14.33] | 2.21 | [0.21 10.16] | 0.52 | 1.65 | | |
| Gross Notional | 34.05 | [1.85 128.78] | 29.87 | [1.65 136.44] | 4.17 | 1.12 | | |
| Debt/GDP | 0.45 | 0.32 | 0.42 | 0.23 | 0.02 | 0.79 | | |
| CDS Vol | 0.70 | 1.47 | 0.54 | 0.85 | 0.16 | 1.30 | | |
| CDS Liq | 0.27 | 1.80 | 6.72 | 1.73 | -0.01 | 0.05 | | |
| Equity Ret | 0.00 | 5.26 | 0.13 | 5.44 | -0.24 | 0.43 | | |
| Equity Vol | 0.00 | 0.60 | 0.25 | 0.47 | 0.02 | 0.41 | | |

**Table 10**

**International Debt Issuance Channel - Net Notional CDS Outstanding.** This table reports the regression results from the weekly percentage changes of net notional amounts of sovereign CDS outstanding on the announcement of debt issuance and debt issuance dates. We define the indicator variable *ID Iss* (*IDAnn*) that takes on the value one during the week of an international debt issue (gets announced), and zero otherwise. *ID Maturity Iss* defines the value-weighted average maturity of an international debt issuance. *ID Amount % Iss* defines the size of the international debt issue as a fraction of total outstanding debt. We use all country-specific and common global control variables as defined in Part I of the manuscript. All regressions include roll dummies that are equal to one in the week of the conventional roll dates. Standard errors are clustered at the country level. Column (6) restricts the sample to developed economies, while column (7) restricts the sample to emerging economies. Column (8) uses new trades as the dependent variable.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | Δ NN % | Δ NN % | Δ NN % | Δ NN % | Δ NN % | Δ NN % | Δ NN % | New Trades |
| ID Iss | 0.007** | 0.003 | 0.002 | 0.002 | 0.002 | 0.004 | -0.002 | 0.001 |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.004) | (0.005) | (0.004) |
| ID Maturity Iss | -0.000* | -0.000* | -0.000 | -0.000 | -0.000 | -0.000** | 0.000 | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| ID Amount % Iss | | 0.120 | 0.258* | 0.257* | 0.261* | 0.358 | 0.296* | 0.213** |
| | | (0.118) | (0.150) | (0.151) | (0.151) | (0.216) | (0.167) | (0.086) |
| ID Mat x Amount Iss | | | -0.013* | -0.013* | -0.013* | -0.022 | -0.017** | -0.021*** |
| | | | (0.007) | (0.007) | (0.007) | (0.019) | (0.008) | (0.008) |
| ID Announ | -0.003 | -0.003 | -0.003 | -0.003 | -0.003 | -0.001 | -0.006* | 0.000 |
| | (0.002) | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.003) | (0.005) |
| ID Maturity Iss | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.000 | 0.000* | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| ID Amount % Iss | | 0.020 | -0.005 | -0.007 | -0.006 | -0.049 | 0.029 | 0.295** |
| | | (0.055) | (0.079) | (0.079) | (0.079) | (0.329) | (0.078) | (0.131) |
| ID Mat x Amount Ann | | | 0.002 | 0.003 | 0.003 | 0.007 | -0.000 | -0.031*** |
| | | | (0.007) | (0.007) | (0.007) | (0.028) | (0.007) | (0.012) |
| Constant | 0.009*** | 0.009*** | 0.009*** | 0.009*** | 0.009*** | 0.009*** | 0.003*** | 0.023*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Observations | 19,424 | 19,424 | 19,424 | 19,375 | 19,139 | 6,673 | 12,466 | 10,584 |
| R-squared | 0.032 | 0.033 | 0.033 | 0.037 | 0.038 | 0.056 | 0.035 | 0.087 |
| Country Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Roll Dummy | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Global Controls | No | No | No | Yes | Yes | Yes | Yes | Yes |
| Local Controls | No | No | No | No | Yes | Yes | Yes | Yes |
| Sovereigns | 61 | 61 | 61 | 61 | 61 | 21 | 40 | 61 |

*** p<0.01, ** p<0.05, * p<0.1

# Internet Appendix

## Why Do Investors Buy Sovereign Default Insurance?

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### A-I. A Law of Motion for CDS Trading Volumes

Statistics on traded quantities in credit derivatives involve many different components, such as gross and net notional amounts outstanding, novations/assignments, terminations, and market risk transfer activity, in contrast to trading in exchange-traded derivatives such as equity options, which are adequately summarized by *volume* and *open interest*,. While some of these terms are widely known among market professionals, it is not entirely clear how they are related to each other. Further, the exact definitions of these terms, which are essential for the analysis of the trading data, are generally lacking. This section briefly describes and illustrates each of these components, made available in the Trade Information Warehouse ("TIW") of the Depository Trust and Clearing Corporation (DTCC), with a more detailed discussion provided in the appendix section A-II. We also develop a simple accounting identity to reconcile and relate these different terms with one another.

For credit default swaps, the *gross notional amount outstanding*, $G$, refers to the par amount of credit protection bought or sold, across multiple agreements for the same name and maturity, and is used as the underlying reference amount to derive the insurance premium payments and the recovery amounts in the event of a default. In other words, the gross notional amount represents the *cumulative* total of past transactions. The *net notional amount outstanding*, $N$, with respect to any single reference entity and maturity is the sum of the net protection bought by net buyers (or equivalently net protection sold by net sellers).[1] The difference between gross and net notional amount outstanding is best illustrated by adapting the examples from Oehmke and Zawadowski (2014a), for our purpose here. Suppose, for example, that counterparty A has purchased \$20 million in gross notional CDS outstanding from counterparty B. Panel A in Table A-1 shows that, in this scenario, both gross and net notional outstanding are equal to \$20

[1] The clearing platforms of the Chicago Mercantile Exchange (CME) and the New York Stock Exchange (NYSE) for OTC derivatives use the term *open interest*, defined as the sum of the net notional amount outstanding per contract, which is thus consistent with the net notional amount outstanding, reported by DTCC.

million. If, in addition to buying \$20 million from counterparty B, counterparty A also sells \$20 million to counterparty C, while B sells \$20 million to A and C buys \$20 million from A, then the total gross notional amount outstanding is equal to \$40 million, while the total net notional amount outstanding is only equal to \$20 million, as is depicted in Panel B of Table A-1. Finally, we show in Panel C that, if the previous scenario is slightly amended with counterparty C also selling \$20 million to B, then the total gross amount outstanding inflates to \$60 million, while the net notional amount outstanding shrinks to \$0 million. The net notional position generally represents the *maximum* possible transfer of funds between net sellers and net buyers of protection that could be required upon the occurrence of a credit event (as long as there is a non-negative recovery rate on the underlying debt instruments, the net transfer of funds would be lower).[2] Hence, the net notional amount outstanding is often considered to be the economically more meaningful measure (Oehmke and Zawadowski, 2014a). These simple examples illustrate that the net notional amount outstanding can never be greater than the gross notional amount outstanding, and that it is proportional to gross notional amount outstanding by a factor, $0 \leq \alpha \leq 1$, such that

$$N_t = \alpha_t G_t, \tag{A-1}$$

which allows us to define a measure of trading intensity $\gamma_t = 1/\alpha_t$, with $0 \leq \alpha \leq 1$, representing a summary statistic of trading activity.

The gross notional amount outstanding may be affected by the practice of *novation*, which is also sometimes called *assignment*. Novation, which may be partial, refers to the process by which one counterparty (transferor) agrees to transfer to a third party (transferee) its obligations under an existing transaction they have with another counterparty (remaining party). DTCC states that, since an assignment transaction is the transfer of a pre-existing TIW position to another party, it does not affect the gross notional amounts or the number of contracts. Thus, although not explicitly explained by DTCC, there should be no effect on *aggregate* net notional amounts outstanding either.[3] Duffie et al. (2011) provide a simple example of novation, which we adapt in Panels D.1 and D.2 of Table A-1. Suppose that counterparty A buys \$20 million from counterparty B (such that B sells \$20 million to A). The gross and net notional are both \$20 million. If B wants to exit its trade position with A and agrees to pass on the position to C, then B (the step-out party) assigns the trade to C (the step-in party). Counterparty A needs to be informed and consent to the novation. A new trade relationship exists between A and C, but the gross and net notional amounts outstanding remain unchanged.

Participants in the CDS market may also unwind their contracts in the TIW by entering into a contract

[2] Of course, the net notional amount outstanding represents the maximum possible transfer of funds only under the assumption of zero counterparty risk.

[3] It goes without saying that there would be, however, an effect on individual counterparty net notional amounts outstanding.

*termination*, which is often called a *cancellation*, $C$. This could potentially be done through *portfolio compression*, which is the process by which two counterparties maintain the same risk profile, but reduce the number of contracts and gross notional amounts outstanding held by participants. Dongyoup (2011) and Duffie et al. (2011) provide examples of portfolio compression, which we also depict in Panels E.1 and E.2 of Table A-1. In this example, counterparty A bought \$5 million from counterparty C and sold \$10 million to counterparty B. B bought \$10 million from A and sold \$10 million to C. Finally, C bought \$10 million from B and sold \$5 million to A. The total gross and net notional amounts outstanding reported by DTCC would then be \$25 million and \$5 million, respectively (Panel E.1). If the regulators call for a trade compression for reasons of credit risk mitigation, then the trade compression process would, for example, reduce the gross notional amount outstanding from \$25 million to \$5 million, while the net notional amount outstanding would remain unchanged, as is illustrated in Panel E.2. This would effectively happen by terminating the two trades B has with A and C, while replacing the trades between A and C with a new transaction that preserves the previous risk profile between these two counterparties.

Gross and net notional amounts outstanding can also be affected through termination or upon reaching maturity. Thus, *matured contracts*, $M$, arise when contracts have reached their scheduled termination date. A similar effect on gross and net notional amount outstanding arises through *exits*, $E$, which arise when bilateral counterparties mutually agree to remove contracts from the TIW. We illustrate this in Panel F of Table A-1. Consider the example in Panel B, in which A has bought (sold to) \$20 million from B (C), B has sold \$20 million to C, and C has bought \$20 million from A, resulting in a total gross (net) notional amount outstanding of \$40 (\$20) million. Suppose that the \$20 million C bought from A were purchased in three separate transactions on 5 year CDS contracts: \$10 million were bought at $t-5$, \$5 million were bought at $t-2$, and another \$5 million were bought at $t-1$. In this case, even though there is no contemporaneous transaction at time $t$, the gross notional amount outstanding shrinks to \$30 million, while the net notional amount outstanding remains flat at \$20 million. The illustration of a trade exit would be identical. Finally, gross notional amounts outstanding may also be altered by *backloads*, $B$, which refers to previously registered and non-electronically confirmed trades that the TIW registers at a later date than when the contract was actually signed. Thus, to summarize, gross notional outstanding is increasing in new transactions ($T$) and backloads, and decreasing in matured contracts, compressions and exits. The net notional amount outstanding may be increasing or decreasing in new transactions, increasing in backloads and decreasing in matured contracts and compressions. Novations should, in principle, have no effect on the *aggregate* gross and net notional amounts outstanding. We characterize this law of motion for CDS trading, in terms of the change in the gross notional amount outstanding, as follows:

$$G_{t+1} = G_t + T_{t+1} - M_{t+1} - C_{t+1} - E_{t+1} + \sum_{j=1}^{J} B_{t-j}, \tag{A-2}$$

where the new transactions, $T$, are contemporaneous trades that effectively transfer risks between counterparties.[4] DTCC also refers to *market risk transfer activity*, a quantity that we will subsequently refer to as *volume*, $V$. Volume relates to all activities that result in risk transfer between two counterparties and, therefore, changes the composition of risk across counterparties, but not necessarily in the aggregate. As such, it includes new trades, terminations, and assignments, but excludes portfolio compressions and matured transactions.[5]

## A-II. CDS Trading Terminology

### *A-II.A. Gross Notional CDS Outstanding*

According to the Derivatives Consulting Group Glossary, *Gross* refers to "A derivative or asset position expressed without netting bought and sold trades," and *Notional Amount* refers to "The amount of principal underlying the derivative contract, to which interest rates are applied in order to calculate periodic payment obligations."[6] In other words, for credit default swaps, notional amount refers to the par amount of credit protection bought or sold, equivalent to debt or bond amounts, and is used to derive the premium payment calculations for each payment period and the recovery amounts in the event of a default. The Depository Trust & Clearing Corporation's ("DTCC") Trade Information Warehouse ("Warehouse") reports aggregate gross notional amounts outstanding on a weekly basis. According to their definition, "*Gross Notional Values are the sum of CDS contracts bought (or equivalently sold) for all Warehouse contracts* in aggregate, by sector or for single reference entities displayed. Aggregate gross notional value and contract data provided are calculated on a per-trade basis. For example, a transaction of \$10 million notional between buyer and seller of protection is reported as one contract and \$10 million gross notional, as opposed to two contracts worth \$20 million. It is interesting to note that according to ISDA interpretations, "notional amount most certainly overstates the level of new activity because it represents a cumulative total of past transactions, many of which were used by dealers to make their daily

[4]To be precise, total reductions in the gross notional amount outstanding are also affected by *post-trade event* (PTE) in-flight, referring to transactions that become uncertain (but were certain in the previous week) after a PTE like an assignment or a novation. Similarly, total increases in gross notional are affected by PTE completed, i.e., uncertain transactions that become certain after a PTE. Thus, PTE completed (PTE in-flight) needs to be added to (subtracted from) equation (1) to completely reconcile DTCC's summary statistics. We abstract here from these components for simplicity.

[5]A slightly different definition of volume is used by the clearing platforms of the Chicago Mercantile Exchange (CME) and the New York Stock Exchange (NYSE) for OTC derivatives. They define volume as the sum of the notional amounts for trades where both the buyer and seller agree to clearing the transaction.

[6]http://www.isda.org/c_and_a/oper_commit-dcg-glossary.html#g

adjustments to their risk positions."[7] In addition, they state that "given the increasing awareness that notional amount outstanding is not a useful measure of risk, there are efforts to provide more meaningful data." Also, the Bank for International Settlements ("BIS") reports that "[gross notional] amounts are generally not those truly at risk."[8]

Note that gross notional amount outstanding should not be confused with *gross (positive and negative) market values*, which are reported by the Bank for International Settlements (BIS). According to the BIS, "*gross market values are defined as the sums of the absolute values of all open contracts with either positive or negative replacement values evaluated at market prices prevailing on the reporting date*." Thus, the gross positive market value of a dealer's outstanding contracts is the sum of the replacement values of all contracts that are in a current gain position to the reporter at current market prices (and therefore, if they were settled immediately, would represent claims on counterparties). The gross negative market value is the sum of the values of all contracts that have a negative value on the reporting date (i.e., those that are in a current loss position and therefore, if they were settled immediately, would represent liabilities of the dealer to its counterparties). The term "gross" indicates that contracts with positive and negative replacement values with the same counterparty are not netted.

Finally, the BIS also reports statistics on *gross credit exposures and liabilities*. According to the BIS, "*gross credit exposure represents the gross value of contracts that have a positive market value after taking account of legally enforceable bilateral netting agreements*." Similarly, liabilities arising from OTC derivatives contracts represent the gross value of contracts that have a negative market value taking account of legally enforceable bilateral netting agreements.

*A-II.B. Net Notional CDS outstanding*

One section of the 2002 ISDA Master Agreement allows counterparties to proceed to the netting of payments. Payment netting takes place during the normal business of a solvent firm, and involves combining offsetting cash flow obligations between two parties on a given day in a given currency into a single net payable or receivable.[9] Another form of netting guided buy Section 6 of the Master Agreement is close-out netting, which applies to transactions between a defaulting firm and a non-defaulting firm. Close-out netting refers to a process involving termination of obligations under a contract with a defaulting party and subsequent combining of positive and negative replacement values into a single net payable or receivable. Hence, the DTCC reports, in addition to gross notional amounts outstanding, net notional amounts outstanding of CDS. Following their definition, "*net notional values with respect to any single reference entity is the sum of the net protection bought by net buyers (or equivalently net protection sold*

[7] http://www.isdacdsmarketplace.com/market_statistics/understanding_notional_amount
[8] http://www.bis.org/publ/otc_hy1111.pdf
[9] http://www.isda.org/researchnotes/pdf/Netting-ISDAResearchNotes-1-2010.pdf

*by net sellers)*. The aggregate net notional data provided is calculated based on counterparty family. A counterparty family will typically include all of the accounts of a particular asset manager or corporate affiliates rolled up to the holding company level. Aggregate net notional data reported is the sum of net protection bought (or equivalently sold) across all counterparty families.[10] Given that net notional positions generally represent the maximum possible net funds transfers between net sellers of protection and net buyers of protection that could be required upon the occurrence of a credit event relating to particular reference entities (actual net funds transfers are dependent on the recovery rate for the underlying bonds or other debt instruments), net notional is often considered to be an economically more meaningful measure (Oehmke and Zawadowski, 2014a).

### *A-II.C. Novation/Assignment*

If a counterparty would like to reduce its credit exposure towards an individual reference entity, she would usually enter a new trade by doing the same trade in the opposite direction, thereby offsetting its exposure. In contrast to exchange traded derivatives, for which the sale of the contract would effectively erase the deal from the trading book, in the presence of OTC derivative transactions, both deals stay "alive" until expiration of the contracts. Although this would reduce the *net* credit exposure, it doesn't reduce counterparty risk. There is however a procedure, which allows to completely eliminate transactions from the trading book. Such a procedure is called *Novation* or, equivalently, *Assignment*. Following the Derivatives Consulting Group Gloassary, an Assignement or Novation refers to "*the process by which one counterparty (transferor) agrees to transfer to a third party (transferee) its obligations under an existing transaction they have with another counterparty (remaining party)*." Thus, the transferee is *stepping in*, and the transferor is *stepping out*. It refers to the process by which one of the original parties exits a transaction, and instead of terminating, a third party steps in upon identical terms and assumes the rights and obligations of the party that is stepping out.

Contractually, the *2004 ISDA Novation Definitions* are intended to facilitate the documentation of the novation of transactions under the ISDA Master Agreement and the *2005 ISDA Novation Protocol* provides an outline of the duties of each of the parties to a novation when completing a novation pursuant to the terms of the 2005 ISDA Novation Protocol. The *August 2010 Additional Provisions for Consent to, and Confirmation of, Transfer by Novation of OTC Derivative Transactions* were prepared to facilitate the launch of the Consent (i.e., Confirmation project) for Credit Derivatives Transactions. They are designed for incorporation into the documentation governing use of a Novation Consent Platform to set out the legal effect of a novation consent request processed through that platform. It is intended to apply to users of the relevant platform via the users' agreement to be governed by the platform's rules, and to ensure that

[10] http://www.dtcc.com/downloads/products/derivserv/tiw_data_explanation.pdf

consistent legal provisions apply to novation consent requests processed through different platforms.[11]

DTCC states that *since an assignment transaction is the transfer of a pre-existing Warehouse position to another party, it does not affect Gross Notional Value or Contract totals*. For the purpose of aggregated *net* notional amounts, the fact that certain trades may be novated has no effect either. This would be different, however, if the purpose was to study the net exposure of individual counterparties at the micro level. Note that there may also be *partial* assignments/novations.

*A-II.D. Cancellations/Terminations and Compressions*

Terminations or Cancellation of trades refers to the unwinding of a certain contracts in the Warehouse. This may reduce both the gross and net notional amount outstanding, but more likely the gross amount. The practice of termination has become more common since the call by regulators for increased credit risk mitigation. As a consequence, the industry engages in *trade compression* cycles on a periodic basis for single name reference entities and indices. *The objective of a trade compression is to maintain the same risk profile but reduce the number of contracts and Gross Notional value held by participants*. Compression cycles involve both Full Terminations and New Trades. According to ISDA explanations, "Portfolio compression reduces the overall notional size and number of outstanding contracts in credit derivative portfolios. Importantly, it does so without changing the overall risk profiles of these portfolios. This is achieved by terminating existing trades on single name reference entities and on indices and replacing them with a smaller number of new trades, but with substantially smaller notionals that carry the same risk profile and cash flows as the initial portfolio."[12] Trade compression has the effect of reducing gross (and sometimes net) notional amounts outstanding.

*A-II.E. Matured Transactions, Backloads, and Exits*

Another mechanism, by which gross and net notional outstanding (in DTCC), as well as open interest (CME and NYSE) may be influenced is *matured transactions*, which occurs when contracts have reached the end of the contract (referred to as the scheduled Termination Date). A small source of error for weekly data are *backloads* and *exits*. Backloads refer to the fact that the Warehouse allows participants to register contracts previously executed and confirmed non-electronically. These transactions impact both gross notional value and contract totals, but are not indicative of new trade activity. Exits, in contrast, represent contracts that have been removed from the Warehouse bilaterally by participants. Exits are most commonly processed at the conclusion of a single name credit event, succession event, or upon other activity typically confirmed outside the Warehouse (e.g. bankruptcy close out procedures).

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[11] See also http://www.isda.org/isdanovationprotII/isdanovationprotII.html,
and http://www.isda.org/isdanovationprotII/novprotII_opin.html for an opinion by Allen & Overy under New York law and English law regarding the enforceability of the ISDA Novation Protocol II.

[12] http://www.isdacdsmarketplace.com/market_statistics/portfolio_compression

*A-II.F. Volume and Open Interest*

The CME and NYSE (through Intercontinental Exchange (NYSE: ICE)) both provide clearing platforms for OTC credit derivatives.[13] They report on their websites information on *open interest* and daily *volume*. In a footnote, they define "*open interest as the sum of the net notional outstanding per contract*." This should thus be in line with the definitions of net notional amounts outstanding reported bt DTCC. Moreover, "*Volume is defined as the sum of the notional for trades where both the buyer and seller agree to clearing the transaction*." The values are said to be one sided and volume is calculated daily. Open interest may therefore be affected by trade compressions, but not by novations. Volume should not be affected at all.

[13] See http://www.cmegroup.com/trading/cds/index.html and https://www.theice.com/homepage.jhtml

**Table A-1**

**Descriptive Examples of CDS Trading Components.** This table provides illustrates examples of how trading in credit default swaps generates gross and net notional amounts outstanding (Panels A, B, and C), and how these quantities are affected by novations (Panels D.1 and D.2), portfolio compressions (Panels E.1 and E.2), as well as by matured contracts and exits (Panel F). In each panel, we indicate the number of counterparties, *CP*, labeled A, B, and C. The last row in each panel reports the quantities as registered in the Depository Trust and Clearing Corproation (DTCC) data repository. Source: Authors' illustration.

**A: Gross and Net Notional, 2 CP, no Netting**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 20 | 0 | - | 0 | 0 | 20 | 0 | 0 |
| Counterparty B | 0 | - | 0 | -20 | - | 0 | 0 | -20 | -20 |
| Counterparty C | 0 | 0 | - | 0 | 0 | - | 0 | 0 | 0 |
| DTCC DATA | | | | | | | 20 | | 20 |

**B: Gross and Net Notional, 3 CP, Netting**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 20 | 0 | - | 0 | -20 | 20 | -20 | 0 |
| Counterparty B | 0 | - | 0 | -20 | - | 0 | 0 | -20 | -20 |
| Counterparty C | 20 | 0 | - | 0 | 0 | - | 20 | 0 | 20 |
| DTCC DATA | | | | | | | 40 | | 20 |

**C: Gross and Net Notional, 3 CP, Netting**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 20 | 0 | - | 0 | -20 | 20 | -20 | 0 |
| Counterparty B | 0 | - | 20 | -20 | - | 0 | 20 | -20 | 0 |
| Counterparty C | 20 | 0 | - | 0 | -20 | - | 20 | -20 | 0 |
| DTCC DATA | | | | | | | 60 | | 0 |

**D.1: Novation, 3 CP**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 20 | 0 | - | 0 | 0 | 20 | 0 | 20 |
| Counterparty B | 0 | - | 0 | -20 | - | 0 | 0 | -20 | -20 |
| Counterparty C | 0 | 0 | - | 0 | 0 | - | 0 | 0 | 0 |
| DTCC DATA | | | | | | | 20 | | 20 |

**D.2: Novation, 3 CP**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 20 | 0 | - | 0 | 0 | 20 | 0 | 20 |
| Counterparty B | 0 | - | 0 | 0 | - | 0 | 0 | 0 | 0 |
| Counterparty C | 0 | 0 | - | -20 | 0 | - | 0 | -20 | -20 |
| DTCC DATA | | | | | | | 20 | | 20 |

**E.1: Portfolio compression, 3 CP**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 0 | 5 | - | -10 | 0 | 5 | -10 | -5 |
| Counterparty B | 10 | - | 0 | 0 | - | -10 | 10 | -10 | 0 |
| Counterparty C | 0 | 10 | - | -5 | 0 | - | 10 | -5 | 5 |
| DTCC DATA | | | | | | | 25 | | 5 |

**E.2: Portfolio compression, 3 CP**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 0 | 0 | - | 0 | -5 | 0 | -5 | -5 |
| Counterparty B | 0 | - | 0 | 0 | - | 0 | 0 | 0 | 0 |
| Counterparty C | 5 | 0 | - | 0 | 0 | - | 5 | 0 | 5 |
| DTCC DATA | | | | | | | 5 | | 5 |

**F: Gross and Net Notional, 3 CP, Matured Contracts and existing positions**

| | Bought from | | | Sold CDS to | | | Total gross | | Net position |
|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | A | B | C | bought | sold | |
| Counterparty A | - | 0 | 0 | - | 0 | 0 | 20 | -10 | 10 |
| Counterparty B | 0 | - | 0 | 0 | - | 0 | 0 | -20 | -20 |
| Counterparty C | 0 | 0 | - | 0 | 0 | - | 10 | 0 | 10 |
| DTCC DATA | | | | | | | 40(t-1)$\mapsto$30 | | 20(t-1)$\mapsto$20 |

**Table A-2**
**Descriptive Statistics by Country.** This table reports summary statistics on CDS trading measures for the 60 sovereign reference entities (*Country*) in our sample which rank among the 1,000 most heavily traded contracts, and which are grouped into 5 ISDA Determination Committee regions (*DC Region*), with EMEA standing for Europe, the Middle East and Africa. We report the number of observations (*Obs*), the average (*Avg*) and standard deviation (*STD*) for the gross (*Gross Notional*) and net (*Net Notional*) notional amount (in billion USD) on CDS contracts outstanding in USD equivalents (using the prevailing foreign exchange rates). We report the average domestic and international general government debt (in billion USD), average ratio of net notional to debt outstanding, and the average ratio of debt outstanding to GDP. The sample period extends from the forth quarter of 2008 to the second quarter of 2015. The number of quarterly observations is reported under the *N*-titled column. CDS net notional data are obtained from DTCC, GDP and debt data are obtained from the Bank of International Settlements (BIS). Emerging market countries are marked with a star*.

| **Country** | **DC Region** | **N** | **Gross Notional** | | **Net Notional** | | **ID** | **DD** | **NN/Debt** | **Debt/GDP** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | STD | Avg | STD | Avg | Avg | Avg | Avg |
| AbuDhabi* | EMEA | 23 | 7.55 | 2.70 | 1.08 | 0.28 | 4 | 0 | 26% | 3% |
| Argentina* | Americas | 24 | 42.09 | 12.63 | 1.69 | 0.56 | 45 | 54 | 2% | 19% |
| Australia | Australia/NZ | 24 | 21.99 | 11.98 | 3.30 | 1.64 | 10 | 449 | 1% | 33% |
| Austria | EMEA | 26 | 48.42 | 11.24 | 5.62 | 1.70 | 108 | 155 | 2% | 63% |
| Belgium | EMEA | 26 | 45.87 | 16.92 | 4.60 | 1.32 | 36 | 418 | 1% | 89% |
| Brazil* | Americas | 26 | 145.71 | 18.69 | 15.06 | 2.89 | 54 | 1242 | 1% | 58% |
| Bulgaria* | EMEA | 26 | 16.05 | 3.61 | 0.84 | 0.36 | 2 | 0 | 47% | 4% |
| Chile* | Americas | 26 | 5.70 | 2.08 | 0.72 | 0.27 | 4 | 24 | 3% | 11% |
| China* | Asia X-Jp. | 26 | 54.75 | 22.52 | 7.23 | 3.96 | 9 | 1167 | 1% | 15% |
| Colombia* | Americas | 26 | 28.07 | 3.17 | 1.96 | 0.32 | 20 | 79 | 2% | 30% |
| Croatia* | EMEA | 26 | 9.52 | 2.99 | 0.67 | 0.15 | 8 | 14 | 3% | 37% |
| Cyprus* | EMEA | 12 | 1.88 | 0.15 | 0.25 | 0.05 | 4 | 7 | 2% | 45% |
| Czech Rep.* | EMEA | 26 | 10.85 | 2.64 | 0.79 | 0.25 | 13 | 57 | 1% | 33% |
| Denmark | EMEA | 26 | 15.00 | 4.93 | 2.15 | 0.46 | 18 | 129 | 1% | 45% |
| Dubai* | EMEA | 26 | 6.93 | 2.00 | 0.57 | 0.12 | 4 | 0 | 17% | 2% |
| Egypt* | EMEA | 21 | 3.54 | 0.89 | 0.49 | 0.26 | 5 | 0 | 12% | 2% |
| Estonia* | EMEA | 26 | 2.64 | 0.65 | 0.33 | 0.15 | 0 | 0 | 138% | 1% |
| Finland | EMEA | 26 | 14.99 | 4.74 | 2.10 | 0.35 | 16 | 89 | 2% | 40% |
| France | EMEA | 26 | 109.82 | 50.40 | 13.71 | 5.59 | 12 | 1965 | 1% | 72% |
| Germany | EMEA | 26 | 102.65 | 36.14 | 14.08 | 3.24 | 114 | 1905 | 1% | 56% |
| Greece | EMEA | 17 | 55.69 | 29.54 | 5.31 | 2.80 | 81 | 239 | 2% | 107% |
| Hungary* | EMEA | 13 | 55.30 | 11.27 | 3.61 | 0.56 | 24 | 54 | 5% | 58% |
| Iceland | EMEA | 26 | 6.43 | 1.79 | 0.69 | 0.21 | 3 | 6 | 9% | 65% |
| Indonesia* | Asia X-Jp. | 26 | 35.28 | 4.15 | 2.82 | 0.75 | 26 | 95 | 2% | 15% |
| Ireland | EMEA | 26 | 39.67 | 9.26 | 3.35 | 1.40 | 20 | 105 | 3% | 54% |
| Israel | EMEA | 26 | 10.33 | 2.97 | 1.23 | 0.48 | 12 | 122 | 1% | 52% |

*Continued on next page*

Table A-2 – *Continued from previous page*

| Country | DC Region | N | Gross Notional | | Net Notional | | ID | DD | NN/Debt | Debt/GDP |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Avg | STD | Avg | STD | Avg | Avg | Avg | Avg |
| Italy | EMEA | 26 | 308.76 | 83.37 | 21.34 | 2.69 | 133 | 2033 | 1% | 101% |
| Japan | Japan | 26 | 52.43 | 25.88 | 7.23 | 3.10 | 3 | 9481 | 0% | 181% |
| Kazakhstan* | EMEA | 26 | 16.80 | 5.95 | 0.84 | 0.31 | 0 | 0 | 14% | 0% |
| Korea* | Asia X-Japan | 26 | 65.95 | 11.52 | 5.34 | 1.47 | 7 | 379 | 1% | 32% |
| Latvia* | EMEA | 26 | 8.56 | 1.20 | 0.58 | 0.16 | 3 | 2 | 16% | 16% |
| Lebanon* | EMEA | 22 | 2.01 | 0.13 | 0.53 | 0.09 | 28 | 34 | 1% | 142% |
| Lithuania* | EMEA | 26 | 5.99 | 1.18 | 0.56 | 0.17 | 10 | 0 | 6% | 24% |
| Malaysia* | Asia Ex-Jp. | 26 | 17.78 | 1.81 | 1.40 | 0.34 | 4 | 125 | 1% | 45% |
| Mexico* | Americas | 26 | 106.49 | 15.04 | 8.31 | 2.12 | 48 | 299 | 2% | 30% |
| Netherlands | EMEA | 26 | 23.87 | 9.01 | 2.91 | 0.48 | 24 | 396 | 1% | 49% |
| New Zealand | Australia/NZ | 22 | 3.19 | 0.64 | 0.53 | 0.04 | 1 | 49 | 1% | 29% |
| Norway | EMEA | 26 | 7.41 | 2.67 | 0.86 | 0.23 | 0 | 91 | 1% | 19% |
| Panama* | Americas | 26 | 6.61 | 0.95 | 0.58 | 0.13 | 9 | 0 | 6% | 28% |
| Peru* | Americas | 26 | 20.99 | 3.93 | 1.71 | 0.25 | 13 | 11 | 8% | 14% |
| Philippines* | Asia Ex-Jp. | 26 | 49.51 | 14.25 | 2.42 | 0.34 | 27 | 70 | 3% | 42% |
| Poland | EMEA | 26 | 32.24 | 8.84 | 1.68 | 0.52 | 60 | 163 | 1% | 44% |
| Portugal | EMEA | 26 | 62.84 | 13.07 | 5.21 | 2.13 | 38 | 131 | 3% | 73% |
| Qatar* | EMEA | 26 | 7.73 | 2.05 | 0.82 | 0.35 | 14 | 0 | 6% | 8% |
| Romania* | EMEA | 26 | 15.17 | 2.80 | 1.06 | 0.21 | 10 | 0 | 18% | 5% |
| Russia* | EMEA | 26 | 110.74 | 13.10 | 5.48 | 1.63 | 35 | 90 | 5% | 7% |
| Saud.Arabia* | EMEA | 17 | 2.64 | 0.35 | 0.44 | 0.05 | 0 | 27 | 2% | 4% |
| Slovakia* | EMEA | 26 | 10.00 | 1.80 | 0.82 | 0.17 | 12 | 26 | 2% | 40% |
| Slovenia* | EMEA | 25 | 6.04 | 2.10 | 0.70 | 0.17 | 6 | 16 | 3% | 46% |
| Sth.Africa* | EMEA | 26 | 44.65 | 7.43 | 2.95 | 1.05 | 11 | 118 | 2% | 35% |
| Spain | EMEA | 26 | 147.47 | 45.55 | 12.71 | 3.27 | 71 | 823 | 2% | 63% |
| Sweden | EMEA | 26 | 18.24 | 5.03 | 2.34 | 0.75 | 42 | 119 | 2% | 31% |
| Switzerland | EMEA | 6 | 1.41 | 0.04 | 0.51 | 0.01 | 0 | 111 | 0% | 16% |
| Thailand* | Asia X-Jp. | 26 | 15.00 | 3.56 | 0.99 | 0.20 | 0 | 90 | 1% | 26% |
| Turkey* | EMEA | 26 | 141.22 | 13.96 | 6.76 | 1.39 | 50 | 203 | 3% | 34% |
| Ukraine* | EMEA | 26 | 35.26 | 11.74 | 1.13 | 0.61 | 13 | 0 | 13% | 9% |
| U.S. | Americas | 26 | 18.72 | 7.07 | 3.24 | 1.12 | 4 | 12766 | 0% | 80% |
| U.K. | EMEA | 26 | 53.07 | 18.09 | 7.63 | 3.29 | 16 | 1902 | 0% | 73% |
| Venezuela* | Americas | 26 | 46.50 | 7.55 | 1.90 | 0.27 | 32 | 0 | 6% | 13% |
| Vietnam* | Asia X-Jp. | 26 | 7.33 | 1.75 | 0.58 | 0.13 | 2 | 0 | 25% | 2% |

**Table A-3**

**Descriptive Statistics by Country.** This table reports summary statistics (at the quarterly frequency) of the explanatory variables in the cross-sectional regressions for the 60 sovereign reference entities (*Country*) in our sample which rank among the 1,000 most heavily traded contracts in the DTCC Trade Information Warehouse, and which are grouped into 5 ISDA Determination Committee regions (*DC Region*). We report the average quarterly GDP (*GDP*), the foreign currency reserves of the country (*Reserves*), Both measured in billion USD. We also report the average CDS Spread in % (*CDS Spread*), the variance of weekly relative changes in the CDS Spread ($\sigma^2_{CDS}$), CDS liquidity defined as the number of dealer quotes used in the computation of the 5-year mid-market CDS spread (*CDS Liquidity*), the country's stock market capitalization in trillion USD (*Market Cap*), the variance of weekly relative changes in the country's stock index ($\sigma^2_{MKT}$), the average inflation (*Inflation*), the variance of changes in the FX rate against the US Dollar ($\sigma^2_{FX}$), and the average foreign long-term credit rating as reported by Fitch Ratings (*Rating*). All countries are ranked in alphabetical order. The countries are grouped into five regions: Americas, Asia ex-Japan, Australia and New Zealand, Europe/Middle East and Africa (EMEA) and Japan. Emerging market countries are marked with a star*. The sample period is Q4 2008 through Q2 2015. Source: BIS, Markit, Datastream, FitchRatings, World Bank.

| Country | GDP | Reserves | CDS Spread | $\sigma^2_{CDS}$ | CDS Liquidity | Market Cap | $\sigma^2_{MKT}$ | Inflation | $\sigma^2_{FX}$ | Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| AbuDhabi* | 176 | 25 | 0.93 | 0.21 | 5.38 | 0.14 | 0.05 | 3.18 | 0.00 | AA |
| Argentina* | 522 | 41 | 16.91 | 0.98 | 6.95 | 0.05 | 0.21 | 18.43 | 0.01 | CC |
| Australia | 1385 | 44 | 0.50 | 0.45 | 6.07 | 1.33 | 0.04 | 2.46 | 0.03 | AAA |
| Austria | 415 | 11 | 0.81 | 0.58 | 7.15 | 0.11 | 0.15 | 1.66 | 0.02 | AAA |
| Belgium | 509 | 17 | 1.10 | 0.53 | 6.69 | 0.30 | 0.08 | 1.49 | 0.02 | AA |
| Brazil* | 2238 | 316 | 1.63 | 0.43 | 8.87 | 1.18 | 0.11 | 7.73 | 0.04 | BBB |
| Bulgaria* | 53 | 17 | 2.40 | 0.37 | 6.88 | 0.01 | 0.03 | 2.47 | 0.02 | BBB- |
| Chile* | 238 | 35 | 0.98 | 0.39 | 7.07 | 0.27 | 0.09 | 3.87 | 0.03 | A+ |
| China* | 7776 | 3121 | 0.97 | 0.47 | 8.38 | 4.02 | 0.05 | 3.58 | 0.00 | A+ |
| Colombia* | 328 | 34 | 1.50 | 0.43 | 8.76 | 0.19 | 0.07 | 3.61 | 0.02 | BBB- |
| Croatia* | 59 | 15 | 3.19 | 0.33 | 6.38 | 0.03 | 0.46 | 1.46 | 0.02 | BBB- |
| Cyprus* | 24 | 0 | 8.20 | 0.28 | 4.85 | 0.00 | 0.04 | -0.36 | 0.01 | B |
| CzechRep* | 210 | 44 | 0.95 | 0.36 | 5.03 | 0.04 | 0.09 | 1.08 | 0.03 | A+ |
| Denmark | 330 | 78 | 0.53 | 0.43 | 6.10 |  | 0.09 | 1.65 | 0.02 | AAA |
| Dubai* | 172 | 23 | 3.58 | 0.25 | 5.20 | 0.14 | 0.17 | 2.33 | 0.00 | AA |
| Egypt* | 256 | 18 | 4.25 | 0.17 | 6.23 | 0.06 | 0.12 | 12.09 | 0.00 | B+ |
| Estonia* | 23 | 1 | 1.51 | 0.20 | 4.87 |  | 0.08 | 2.85 | 0.02 | A |
| Finland | 262 | 8 | 0.37 | 0.42 | 6.16 |  | 0.10 | 2.04 | 0.02 | AAA |
| France | 2756 | 49 | 0.81 | 0.52 | 6.67 | 1.92 | 0.10 | 0.83 | 0.02 | AAA |
| Germany | 3618 | 62 | 0.43 | 0.54 | 6.07 | 1.50 | 0.10 | 1.46 | 0.02 | AAA |
| Greece* | 292 | 1 | 17.87 | 1.09 | 5.87 | 0.07 | 0.24 | 0.98 | 0.02 | BB |
| Hungary* | 135 | 45 | 3.42 | 0.47 | 8.69 | 0.03 | 0.17 | 2.97 | 0.07 | BBB |
| Iceland | 15 | 5 | 3.37 | 0.11 | 4.57 |  | 0.10 | 4.59 | 0.04 | BBB- |
| Indonesia* | 817 | 91 | 2.20 | 0.44 | 7.31 | 0.35 | 0.08 | 7.90 | 0.01 | BB+ |

*Continued on next page*

Table A-3 – *Continued from previous page*

| Country | GDP | Reserves | CDS Spread | $\sigma^2_{CDS}$ | CDS Liquidity | Market Cap | $\sigma^2_{MKT}$ | Inflation | $\sigma^2_{FX}$ | Rating |
|---|---|---|---|---|---|---|---|---|---|---|
| Ireland | 233 | 2 | 3.04 | 0.58 | 7.36 | 0.11 | 0.10 | -0.56 | 0.02 | A |
| Israel | 258 | 72 | 1.33 | 0.20 | 6.09 | 0.19 | 0.08 | 2.36 | 0.01 | A |
| Italy | 2158 | 48 | 2.14 | 0.66 | 7.55 | 0.55 | 0.15 | 1.27 | 0.02 | A |
| Japan | 5260 | 1148 | 0.71 | 0.47 | 7.44 | 3.78 | 0.09 | -0.75 | 0.02 | AA- |
| Kazakhstan* | 182 | 23 | 2.71 | 0.38 | 6.60 | 0.03 | 0.20 | 10.80 | 0.02 | BBB |
| Korea* | 1193 | 303 | 1.19 | 0.48 | 8.13 | 1.07 | 0.06 | 1.84 | 0.03 | A+ |
| Latvia* | 29 | 6 | 3.10 | 0.21 | 6.19 | | 0.06 | 0.76 | 0.02 | BBB |
| Lebanon* | 44 | 35 | 3.79 | 0.06 | 3.81 | 0.01 | 0.01 | 2.75 | 0.00 | B |
| Lithuania* | 43 | 7 | 2.49 | 0.21 | 5.76 | | 0.06 | 1.90 | 0.02 | BBB+ |
| Malaysia* | 281 | 117 | 1.14 | 0.48 | 7.01 | 0.41 | 0.02 | 2.07 | 0.01 | A- |
| Mexico* | 1143 | 141 | 1.41 | 0.45 | 8.27 | 0.45 | 0.07 | 3.89 | 0.02 | BBB |
| Netherlands | 855 | 19 | 0.54 | 0.49 | 5.79 | 0.67 | 0.10 | 0.90 | 0.02 | AAA |
| NewZealand | 172 | 18 | 0.57 | 0.31 | 6.07 | 0.06 | 0.01 | 2.29 | 0.03 | AA |
| Norway | 472 | 55 | 0.23 | 0.40 | 4.78 | 0.24 | 0.10 | 2.66 | 0.03 | AAA |
| Panama* | 34 | 3 | 1.43 | 0.37 | 8.06 | 0.01 | 0.03 | 3.31 | 0.00 | BBB- |
| Peru* | 172 | 50 | 1.48 | 0.41 | 8.44 | 0.08 | 0.11 | 3.17 | 0.00 | BBB |
| Philippines* | 234 | 60 | 1.61 | 0.35 | 7.09 | 0.18 | 0.07 | 3.23 | 0.01 | BB+ |
| Poland* | 502 | 91 | 1.41 | 0.41 | 6.94 | 0.17 | 0.06 | 2.17 | 0.04 | A- |
| Portugal | 233 | 3 | 4.22 | 0.79 | 7.75 | 0.07 | 0.09 | 0.76 | 0.02 | BBB+ |
| Qatar* | 165 | 28 | 1.06 | 0.24 | 5.27 | 0.16 | 0.11 | 2.65 | 0.00 | AA |
| Romania* | 182 | 42 | 2.90 | 0.33 | 6.53 | 0.01 | 0.13 | 4.59 | 0.03 | BBB- |
| Russia* | 1741 | 437 | 2.49 | 0.59 | 8.40 | 0.75 | 0.24 | 9.00 | 0.04 | BBB |
| Saud.Arabia* | 721 | 642 | 0.83 | 0.13 | 4.41 | 0.42 | 0.04 | 4.02 | 0.00 | AA- |
| Slovakia* | 94 | 2 | 1.13 | 0.35 | 5.78 | 0.00 | 0.06 | 0.52 | 0.02 | A+ |
| Slovenia* | 49 | 1 | 1.91 | 0.41 | 5.31 | 0.01 | 0.05 | 0.90 | 0.02 | A |
| SthAfrica* | 362 | 41 | 1.90 | 0.42 | 9.03 | 0.87 | 0.07 | 6.40 | 0.04 | BBB+ |
| Spain | 1432 | 28 | 2.16 | 0.59 | 6.82 | 1.12 | 0.13 | 0.19 | 0.02 | A+ |
| Sweden | 527 | 48 | 0.40 | 0.46 | 5.76 | | 0.08 | 1.45 | 0.03 | AAA |
| Switzerland | 687 | 483 | 0.38 | 0.12 | 3.15 | 1.48 | 0.03 | -0.17 | 0.01 | AAA |
| Thailand* | 342 | 155 | 1.31 | 0.42 | 8.12 | 0.31 | 0.07 | 2.21 | 0.00 | BBB |
| Turkey* | 755 | 89 | 2.15 | 0.37 | 8.48 | 0.24 | 0.13 | 7.03 | 0.03 | BB+ |
| Ukraine* | 150 | 25 | 13.52 | 0.64 | 5.72 | 0.03 | 0.25 | 12.00 | 0.13 | B- |
| U.S. | 15917 | 122 | 0.37 | 0.44 | 3.71 | 19.19 | 0.06 | 1.48 | 0.00 | AAA |
| U.K. | 2614 | 77 | 0.58 | 0.40 | 6.04 | 1.87 | 0.07 | 2.13 | 0.02 | AAA |
| Venezuela* | 253 | 12 | 13.94 | 0.51 | 7.90 | | 0.15 | 26.48 | 0.17 | B |
| Vietnam* | 144 | 22 | 2.89 | 0.22 | 5.94 | 0.03 | 0.11 | 10.33 | 0.00 | B+ |

**Table A-4**
Data Appendix

This table reports the definitions and data sources of all variables used in the analysis. The sources are the Depository Trust and Clearing Corporation (DTCC), Markit CDS (Markit), Thomson Reuters Datastream (Datastream), the Bank for International Settlement (BIS), the International Monetary Fund International Financial Statistics (IMF).

| Variable | Label | Source | Definition |
|---|---|---|---|
| Net Notional | NN | DTCC | Aggregate net notional amount of CDS outstanding defined as the sum of the net protection bought by net buyers (or equivalently net protection sold by net sellers), expressed in million US dollar equivalents using the prevailing foreign exchange rates. |
| Gross Notional | GN | DTCC | Aggregate gross notional amount of CDS outstanding defined as the sum of CDS contracts bought (or equivalently sold) for all Warehouse contracts, expressed in million US dollar equivalents using the prevailing foreign exchange rates. |
| Total Debt | TD | BIS | Total general government debt in billion USD. |
| International Debt | ID | BIS | Total international general government debt in billion USD. International debt comprises debt securities issued in a market other than the local market of the country where the borrower resides. This captures debt conventionally known as euro-bonds and foreign bonds. |
| Domestic Debt | DD | BIS | Total domestic general government debt in billion USD. Domestic debt comprises debt securities issued in the local market of the country where the borrower resides, regardless of the currency in which the security is denominated. |
| Gross Domestic Product | GDP | IMF | Gross domestic product (current prices) in billion USD. |
| Foreign Exchange Reserves | FX Reserves | IMF | Total foreign exchange reserves in billion USD. |
| Credit Default Swap Spread | CDS Spread | Markit | Five-year senior unsecured sovereign CDS spread with full restructuring credit event clause, expressed in percent, i.e. 100 basis points. |
| Credit Default Swap Spread Volatility | CDS iVol | Markit | Squared OLS residuals from the regression of CDS spread changes of country $i$ on changes of the global CDS spread, defined as the mean spread of all other countries $j \neq i$, expressed in percentages. |
| Credit Default Swaps Liquidity | CDS Liquidity | Markit | CDS liquidity or depth, defined as the number of dealer quotes used in the computation of the 5-year mid-market CDS spread. |
| Idiosyncratic stock market return | Equity iReturn | Thomson Reuters Datastream | OLS residuals from the regression of local benchmark equity index returns of country $i$ on the MSCI World return index, expressed in percentages. |
| Idiosyncratic Equity Volatility | Equity iVOL | Thomson Reuters Datastream | Squared OLS residuals from the regression of local benchmark equity index returns of country $i$ on the MSCI World return index, expressed in percentages. |
| Foreign exchange rate return | FX Ret | Thomson Reuters Datastream | Log percentage changes in the exchange rate vis-a-vis the USD, expressed in percentages. |
| Foreign exchange rate volatility | FX Vol | Thomson Reuters Datastream | Squared percentage changes in the exchange rate vis-a-vis the USD, expressed in percentages. |

**Table A-5**

**Credit Risk Channel - List of Treatment and Matched Samples.** This table reports the list of treatment and matched control samples from the tests that examine the impact of credit risk shocks on CDS trading. We match with replacement countries from the same geographical region using the first best match based on the Mahalanobis distance between the vector of observed covariates across treated and non-treated countries. The match is based on the CDS spread level, the credit rating, and the ratio of net notional to debt outstanding in the quarter immediately preceding the rating or outlook action. We perform a match for downgrades (Panel A) and lagged negative rating outlook changes (Panel B). In the statistics, we report the treatment date, the names of the treated and matched countries, and the rating immediately prior to the rating action.

| **Panel A: Downgrades** | | | | | **Panel B: Negative Outlook Changes** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| N | Date | Treated Country | Rating | Matched Country | N | Date | Treated Country | Rating | Matched Country |
| 1 | 9 Nov 08 | Romania | BBB | Russia | 1 | 2 Mar 2009 | Hungary | BBB | Croatia |
| 2 | 22 Dec 08 | Lithuania | A- | Hungary | 2 | 30 Apr 2009 | Bulgaria | BBB- | Russia |
| 3 | 8 Apr 09 | Estonia | BBB- | Iceland | 3 | 21 May 2009 | Croatia | BBB- | Romania |
| 4 | 8 Apr 09 | Latvia | A- | Iceland | 4 | 14 Jan 2011 | Tunisia | BBB | Sth Africa |
| 5 | 8 Dec 09 | Greece | A | Poland | 5 | 28 Sep 2011 | Slovenia | AA- | Belgium |
| 6 | 5 Jan 10 | Iceland | BB+ | Latvia | 6 | 11 Nov 2011 | Hungary | BBB- | Croatia |
| 7 | 6 Oct 10 | Ireland | AA- | Portugal | 7 | 30 Oct 2012 | Argentina | B | Venezuela |
| 8 | 9 Dec 10 | Ireland | AA- | Portugal | 8 | 29 Nov 2012 | Croatia | BBB- | Romania |
| 9 | 23 Dec 10 | Portugal | AA- | Ireland | 9 | 28 Jun 2013 | Ukraine | B | Cyprus |
| 10 | 14 Jan 11 | Greece | BBB- | Ireland | 10 | 30 Jul 2013 | Malaysia | A- | Thailand |
| 11 | 1 Apr 11 | Portugal | BBB- | Ireland | 11 | 19 Dec 2013 | Lebanon | B | Egypt |
| 12 | 13 Jul 11 | Greece | B+ | Portugal | 12 | 21 Mar 2014 | Russia | BBB | Iceland |
| 13 | 24 Nov 11 | Portugal | BBB- | Ireland | 13 | 13 Jun 2014 | Sth Africa | BBB | Turkey |
| 14 | 6 Jan 12 | Hungary | BB+ | Croatia | 14 | 16 Jan 2015 | Greece | B | Cyprus |
| 15 | 27 Jan 12 | Slovenia | AA- | Slovakia | 15 | 9 Apr 2015 | Brazil | BBB | Panama |
| 16 | 27 Jan 12 | Spain | AA- | Italy | | | | | |
| 17 | 22 May 2012 | Japan | AA | New Zeal | | | | | |
| 18 | 7 Jun 12 | Spain | A | Italy | | | | | |
| 19 | 25 Jun 12 | Cyprus | BBB- | Portugal | | | | | |
| 20 | 27 Nov 12 | Argentina | B | Venezuela | | | | | |
| 21 | 12 Dec 12 | Tunisia | BBB- | Turkey | | | | | |
| 22 | 8 Mar 13 | Italy | A- | Slovenia | | | | | |
| 23 | 17 May 13 | Slovenia | A- | Italy | | | | | |
| 24 | 20 Sep 13 | Croatia | BBB- | Hungary | | | | | |
| 25 | 7 Feb 14 | Ukraine | B- | Cyprus | | | | | |
| 26 | 18 Dec 14 | Venezuela | B | Colombia | | | | | |
| 27 | 27 Mar 15 | Greece | B | Cyprus | | | | | |