

# Why Do Investors Buy Sovereign Default Insurance?<sup>☆</sup>

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## Abstract

We provide empirical evidence that the size of a country's debt, together with its level of economic activity, explains about 75% of the cross-country variation in net insured positions of sovereign credit default swaps (CDS). Based on a novel data set of net notional amounts outstanding for single-name sovereign CDS from October 2008 to September 2015, we show that the net notional amount outstanding amounts of sovereign CDS contracts are mostly driven by local factors. 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. This is consistent with the conclusion that net sovereign debt insurance is driven primarily by country-specific risk. Thus, even in the absence of granular time-series data, we are able to document evidence on 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 of sovereign debt.

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

**JEL:** C1, C5, C68, G12, G13, G15, F34.

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## 1. Introduction

The academic literature on asset pricing is primarily concerned with the determinants of prices and returns of financial assets. There is, however, significantly less research on what explains asset *trading* and the resultant traded quantities, which underly 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 quantities*, in contrast to CDS *prices*, i.e., spreads.

We focus on sovereign CDS trading, since recent global developments 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. The market for CDS trading is heavily concentrated among the major US broker-dealers, with the top 10 counterparties accounting for about 89% of the total protection sold (Giglio, 2014), and reporting dealers maintaining a market share of 71% 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 and show empirically that sovereign CDS spreads share a common component and US/global factors explain a large portion of the variation in these spreads and their implied default probabilities.

The conclusion that amounts insured, i.e., the cumulative quantities traded on the CDS market, also share a global component may intuitively follow, given the shared importance of prices and quantities in determining the equilibrium of the market. In fact, when we examine the factor structure in CDS traded *quantities*, and compare it with that in CDS spreads, we find, contrary to expectations, very little evidence of a common factor in the trading of sovereign CDS. Quantitatively, the first principal component of sovereign CDS spreads explains about 54% of their common variation, while the first principal component for net notional amounts outstanding explains only 7% of their common variation. The modest amount of common variation in traded quantities, moreover, is mainly driven by technical considera-

tions, such as standard contract roll dates and the depreciation of the US dollar, given that the Derivatives Clearing and Trading Corporation (DTCC) data are reported in USD equivalents using quarter roll conventions.

We further study the cross-sectional and time-series determinants of the net notional amounts outstanding and show that government debt and the size of an economy (GDP) alone explain 75% of the cross-sectional variation in net quantities of insured sovereign credit risk. The economic magnitudes of the impact are sizable, as a 10 percent increase in total debt outstanding leads to an increase in net notional amount outstanding of 1-2 percent. We show that both domestic and international debt are important predictors of net notional amounts outstanding, consistent with the legal differences between the sovereign CDS contracts for developed (DM) versus emerging market (EM) countries.

In the time-series, significant predictors of the weekly percentage changes in net notional amount outstanding are the country's level of credit risk and the volatility of the return in the domestic stock market, which are positively and negatively related, respectively, to the net notional amounts of CDS outstanding. The explanatory power of the two variables, however, is remarkably small. Global risk factors, moreover, add little additional explanatory power to the time-series variation. We support the results that CDS net notional amounts are driven by local, rather than global, factors by calculating local ratios (LR), a proxy for the relative explanatory power of domestic vs. global risk factors: 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 and show that the average local ratio is 70%. Hence, the vast majority of the variation in net sovereign CDS exposures is thus explained by country-specific risk, rather than by global factors.

After establishing that (i) sovereign CDS quantities exhibit little commonality, characterized by low explanatory power of the first principal component, (ii) both domestic and international debt are two key determinants of net notional amounts of CDS outstanding, and (iii) the dynamics of sovereign CDS trading are better explained by country-specific rather than by global risk factors, we identify two country-specific shocks, to tease out economic channels that can 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. 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 Basel framework of bank regulation. We find that credit rating downgrades that lead to an increase in regulatory capital are associated with an *increase* in net insured quantities. In contrast, regulatory rating upgrades are associated with a reduction in net notional amounts of CDS outstanding. Rating changes that do not result in a change in regulatory risk weights bear a smaller or negligible impact on net aggregate CDS positions.

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 issuance of sovereign debt and its announcement on sovereign CDS trading. We find that the issuance of sovereign debt leads to a significant increase in net CDS positions, and the effect is mostly driven by the issuance of debt eligible to trigger a CDS credit event. The economic magnitude of the increase in net insured interest suggests that a debt issue of one billion USD is accompanied by an increase of approximately 100 million USD in net notional CDS. Around debt issuances, the country's CDS spread is unaffected, further suggesting the detachment between insurance prices and its quantities: CDS spreads do not react to debt issuances, and the amounts of CDS outstanding do not react to the announcement of debt issuance, which could instead have pricing implications.

In Section 2 we survey the related literature. We discuss our data sources 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 in Section 3. We examine two economic channels of sovereign insurance trading, i.e., the credit rating and the debt issuance channels in the following section, Section 4. We conclude in Section 5.

## **2. Literature and Contribution**

Oehmke and Zawadowski (2016) 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 (2014). 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, as evidenced by the absence 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 attributed 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 (2016) 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, their emphasis is not on the economic channels that may lead to trading in the sovereign CDS market, perhaps due to the relatively short data sample that they employ, which does not encompass a period of significant turbulence in the CDS market, i.e.,

the European sovereign crisis. 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), network structures (Peltonen et al., 2014; Halaj et al., 2017; D'Errico et al., 2017) or counterparty risk (Du et al., 2016; Cetina et al., 2017), but only a few focus on the determination of traded *quantities*. For example, (Boyarchenko and Shachar, 2016) examine hedging and speculative motives in the corporate CDS market by U.S. financial institutions, while Acharya et al. (2016) pursue a similar goal in the sovereign CDS market for German financial institutions. Several other focus on the impact of particular events on individual or aggregate trading positions, such as the Greek default (Halaj et al., 2017), or the CDS Small Bang regulatory overhaul (Gündüz et al., 2016). More importantly, they all examine *corporate* CDS, and do not study *sovereign* CDS, the subject of this paper. The matter of global- versus local-factors and lack of a common component for traded quantities, furthermore, relates specifically to sovereign entities. Acharya et al. (2016) study the hedging and risk incentives in the sovereign CDS market for German financial institutions. In contrast to their work, we take a macroeconomic perspective and examine the aggregate CDS market. In addition, we focus on two specific channels that impact CDS insured interest, i.e., regulatory rating changes and sovereign debt issuance.

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*.

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.<sup>1</sup> 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 variables, for both risk premia and default probabilities.<sup>2</sup> 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 (2016) 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 net protection bought by net buyers (or equivalently net protection sold by net sellers) with respect to any single reference entity. The net notional amount 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).<sup>3</sup> 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, 2016). It also provides a direct indication of the net insured interest, and is therefore analogous to open interest in futures and options markets, which is the reason why it is our preferred metric to answer the question of

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<sup>1</sup>See Augustin (2014) and Augustin et al. (2014) for related surveys.

<sup>2</sup>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.

<sup>3</sup>Of course, the net notional amount outstanding represents the maximum possible transfer of funds only under the assumption of zero counterparty risk in the CDS contract, which is reasonable given that the contracts are generally cleared.

why investors buy sovereign default insurance.

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.<sup>4</sup>

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.<sup>5</sup> 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 notional amount outstanding, at all times throughout our sample period.<sup>6</sup>

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<sup>4</sup> 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.

<sup>5</sup> 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.

<sup>6</sup> 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, 2016).



### 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 six and a half 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 net notional amount outstanding is equal to \$3.55 billion, ranging from a low of \$0.08 billion to a high of \$27.05 billion. The most active market is Italy, which leads the list with an average of \$21.34 billion, while the country with the lowest average net notional of \$0.25 billion is Cyprus. The standard deviation of the net notional amount is \$4.61 billion, an economically significant number.<sup>7</sup> 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 the Bank for International Settlements (BIS).<sup>8</sup> 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,

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<sup>7</sup>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.

<sup>8</sup>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.

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.<sup>9</sup> 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 shown 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 global 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 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. 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

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<sup>9</sup>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.

of a period of uncertainty in sovereign CDS spreads, especially given the European debt crisis. Country average CDS spreads range from just 23 bps for Norway to 1786 bps 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. 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 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 from Fitch Ratings.<sup>10</sup> The average country in our sample has a credit standing equivalent to a A- rating.<sup>11</sup> A detailed description of the data is available in the Appendix Table A-4.

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

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, 2016).

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<sup>10</sup>We examine all results using ratings from both Fitch Ratings and Standard&Poors.

<sup>11</sup>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).

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 amount outstanding is 17% for DM countries. For EM economies, instead, the explanatory power of the first factor is substantially lower, i.e. 11.20%.<sup>12</sup>

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.<sup>13</sup> 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

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<sup>12</sup>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).

<sup>13</sup>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.

changes in sovereign CDS net notional data for each country  $i$ , ( $\Delta NN_{i,t}$ ), 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:

$$\Delta NN_{i,t} = c + \gamma_i + b_1 \text{March20Roll} + b_2 \text{June20Roll} + b_3 \text{Sep20Roll} + b_4 \text{Dec20Roll} + \epsilon_{i,t}, \quad (1)$$

where  $\text{March20Roll}$ ,  $\text{June20Roll}$ ,  $\text{Sep20Roll}$ , and  $\text{Dec20Roll}$  refer to the quarterly roll date indicators, which take on the value of one during the week of the roll, and zero otherwise.<sup>14</sup> 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 measure the true commonality in sovereign net notional quantities that is not driven by this institutional detail, we collect the residuals  $\epsilon_{i,t}$  from the regression in equation (1), and perform a principal component analysis on the correlation matrix of their weekly changes. The explanatory power of the principal components of the residuals captures the commonality in net notional changes that is not an artifact of the roll dates. 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. As a result, the first principal component of the “de-seasonalized” net notional only explains 6.7% of their variation.

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

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<sup>14</sup>In our data, there are seven instances of March and June rolls, and six for September and December.

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 confirm 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, we show that the same is not true for economic quantities, in particular net notional amounts of CDS outstanding, which have little common variation across countries, as the first principal component explains only about 6% of the time series variation, after we account for institutional mechanisms, such as the quarterly roll dates and the DTCC reporting in USD. We end by stating the first stylized fact about sovereign CDS quantities:

*Contrary to prices, sovereign CDS quantities exhibit little commonality, characterized by the low explanatory power of their 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.<sup>15</sup>

#### 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. To the extent possible, we investigate determinants that are theoretically motivated for trading in *corporate* credit default insurance, following Oehmke and Zawadowski (2014). We also examine

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<sup>15</sup>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.

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. It is essential to examine both domestic and international debt, 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) 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:

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

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.<sup>16</sup> 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

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<sup>16</sup>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.

amount of general government debt, which individually accounts for 27% of the cross-sectional differences in net notional amount 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. That is, net notional amounts are much better explained by cross-section factors, rather than by their time-series counterparts.

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 (adjusted  $R^2 = 75.2\%$ ) 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, 2014; 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, 2010).

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:

*Domestic and international debt are key determinants of net notional amounts of CDS outstanding.*

### 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 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.<sup>17</sup> 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. We proxy global risk premia by the monthly percentage changes in the cyclically adjusted price-earnings ratio of the S&P500 index.

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<sup>17</sup>The dollar factor represents an average exchange rate against the USD rate of a large basket of countries (Lustig et al., 2011).

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.

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.<sup>18</sup> 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

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<sup>18</sup>In unreported regressions, we find that domestic stock market volatility is *positively* associated with the *gross* notional amounts of CDS outstanding. This suggests 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.

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 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 of 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 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.<sup>19</sup> 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

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<sup>19</sup>While we acknowledge that there may also be some economic fluctuations due to foreign exchange effects, the mechanical effects are of first order.

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:

*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 ratings. 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.

#### **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: (i) shocks to the perception of sovereign credit risk through changes in credit ratings; and (ii) shocks to the stock of sovereign debt through government debt issuance.

##### *4.1. Shocks to Credit Risk*

We conjecture that shocks to a country's credit worthiness, in the form of changes to a country's credit rating may lead to changes in the quantity of insured credit risk. In particular, we investigate the *regulatory rating channel*: While any rating change may effect the demand for sovereign CDS, government

debt rating changes affecting regulatory capital—the amount of capital that institutions need to set aside to hold that government’s debt—should more markedly affect the demand for that government’s CDS contracts. The Basel II regulatory framework for bank capital indicates that the risk weights associated with sovereign credit ratings are 0% for bonds rated 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. If sovereign CDS are hedging vehicles, then credit rating changes that cross one of these thresholds will affect sovereign CDS demand more than credit rating changes that do not affect the associated risk weights, as institutions will seek capital relief in the form of larger CDS holdings. This leads us to formulate the following testable hypothesis.

*Hypothesis 1: When a country is upgraded, the net notional amount outstanding decreases. The decrease is larger if the upgrade is associated with a decrease in risk weights.*

Similarly, a rating downgrade results in an increase in net notional amount outstanding, and an even larger increase if the downgrade is associated with an increase in risk weights. To show this, we regress the weekly CDS net notional amount outstanding on a cohort of variables capturing rating changes and other controls. We first define a variable measuring any rating change, setting  $\Delta Rating$  to be 1 during the six weeks following any credit upgrade, -1 during the six weeks following any credit downgrade, and zero otherwise. To gauge the different effects of regulatory and non-regulatory rating changes, we further define  $\Delta Rating^R$  ( $\Delta Rating^N$ ) to be 1 during the six weeks following a credit upgrade that did (did not) result in a change in risk weights (following the Basel II framework), -1 during the six weeks following a credit downgrade that did (did not) result in a change in risk weights, and 0 otherwise. Finally, we split the variable  $\Delta Rating^R$  ( $\Delta Rating^N$ ) in the two dummies  $Upgrade^R$  and  $Downgrade^R$  (in  $Upgrade^N$  and  $Downgrade^N$ ), so that  $Upgrade^R$  is equal to one during the six weeks following a regulatory upgrade, and 0 otherwise;  $Downgrade^R$  is equal to one during the six weeks following a regulatory downgrade, and 0 otherwise;  $Upgrade^N$  is equal to one during the six weeks following a upgrade not associated with a risk weight change, and 0 otherwise;  $Downgrade^N$  is equal to one during the six weeks following a regulatory downgrade not associated with a risk weight change, and 0 otherwise.



Using S&P ratings, we identify 97 downgrades, 24 of which are regulatory, and 49 upgrades, 15 of which are regulatory. For all about 20,000 country-week observations in our sample, we regress the (natural logarithm of the) net notional amounts of CDS outstanding on the credit rating variables. The baseline regression is

$$\log(NN) = b_1 \cdot \Delta Rating_{i,t}^N + b_2 \cdot \Delta Rating_{i,t}^R + a_r + a_t + \varepsilon_{i,t} \quad (3)$$

where  $a_r$  and  $a_t$  are the rating and week fixed effects. Following the regulatory rating channel, we expect  $b_1$  and  $b_2$  to be negative: That is, when a country's debt is upgraded, investors who hold that government's debt have less of an incentive, *ceteris paribus*, to seek capital relief via purchase of CDS contracts (since the risk weights on the debt are lower). Moreover, we expect  $b_1$  to be lower in economic magnitude and statistical significance than  $b_2$ . To complement the analysis outlined in equation (3), we further distinguish between the effects of upgrades and downgrades, expecting downgrades to increase investors' propensity to seek regulatory capital relief, and upgrades to decrease it.

We document our findings in Table 8. The first column indicates that a downgrade is associated, all else equal, with a decrease in net notional outstanding. To show that the channel is indeed regulatory in nature, we separate rating changes that affect risk weights ( $\Delta Rating^R$ ) from ratings that do not ( $\Delta Rating^N$ ). If CDS are used to alleviate capital requirements, we should find that the former affect net notional amount outstanding more than the latter. Column 3 supports our interpretation, implying that the effects in column 1 are driven by regulatory changes, as the regression parameter for  $\Delta Rating^N$  is not significant, while that for  $\Delta Rating^R$  is larger in magnitude, negative, and significant. If we further restrict the definition of the rating variables—thus, lowering the power of the test for each of them—and separate downgrades from upgrades, we reach the same conclusion: regulatory upgrades (downgrades) decrease (increase) the amount of net notional amount outstanding more than their non-regulatory counterparts, as shown in column 5. In column 7, we show that the results are robust to including cross-sectional determinants of sovereign insurance quantities, such as the GDP and debt level of country  $i$ .

To support the economic interpretation of the regulatory channel, we hypothesize that a one-notch regulatory upgrade, e.g., from A+ to AA-, and a non-regulatory one-notch upgrade, e.g., from AA- to AA, are different in their effect on the quantity of net notional amount outstanding, while their effect on credit risk is the same. For the results reported in columns 1, 3, 5, and 7, we substitute the left-hand side variable *Log NN* with the natural logarithm of the CDS spread level, *Log CDS*. As expected, the findings in column 2 suggest that upgrades are followed by an improvement in country credit risk. However, as shown in column 4, the magnitude of the effect of a regulatory and a non-regulatory credit change on credit risk are approximately the same (as opposed to their effect on net notional amount outstanding). Splitting the results between upgrades and downgrades shows that the result is mostly driven by upgrades, while regulatory and non-regulatory downgrades have different effects on credit risk. Nonetheless, the increase from non-regulatory to regulatory downgrades is larger for the net notional amount outstanding than for credit risk.

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

As domestic and international government debt are two primary determinants of the cross-sectional dispersion in net notional amounts of CDS outstanding, 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. We thus postulate a second hypothesis.

Hypothesis 2: *Net notional amounts of CDS outstanding increase following the issuance of 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 issuances are often mechanical debt roll-overs or employed in the context of monetary policy interventions, e.g., in the United States. Only 58 countries issued debt during our sample period, between November 7, 2008 and June 26, 2015, and we identify 2,524 weeks with bond issuances.<sup>20</sup>

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<sup>20</sup> Abu Dhabi, Saudi Arabia and Estonia did not issue any bonds during the sample period. Saudi Arabia, like China, has

In Table 9, we report summary statistics on the debt issuance, and we report more detailed statistics at the country level in Table A-5 in the Appendix. In total, there are 3,428 bond issuances, among which 1,993 represent debt issues that are included in the CDS reference obligations that could trigger a credit event, and 1,435 debt issues correspond to bonds that are unlikely to trigger a credit event. For each event, we examine both the announcement and the effective issuance date. A country issues on average 59 bonds during our sample period, as indicated in column (2). Column (3) indicates that there is a large amount of variation across countries, based on the standard deviation of 81 bonds. The country statistics in Table A-5 suggest that the number of bond issuances ranges from one for Tunisia to 392 for the U.S. As our dependent variable is measured at a weekly frequency, we aggregate several bond issues of the same country within the same week. On a weekly basis, we document in column (4) an average of 41 bond issuance weeks, with a standard deviation of 49. The average issuance size in billion USD equivalents is 11.92 billion USD. The country statistics suggest that the average maturity ranges from 4.2 years for Lebanon to 20.6 years for South Africa. To test our hypothesis, we examine the following regression specification:

$$\ln(NN_{i,t+1}/NN_{i,t}) = a + b \cdot Issue\_Amount_{i,t} + \delta X_{i,t} + \gamma Y_t + \alpha_i + \varepsilon_{i,t}, \quad (4)$$

where  $Issue\_Amount_{i,t}$  reflects amount of debt issued, in billion USD, during the week of the issuance,  $X_{i,t}$  and  $Y_t$  are the vector of country-specific and global control variables we used earlier, in addition to the country's credit rating.<sup>21</sup> We use country fixed effects in most regressions and cluster all standard errors by country.

We report the results in Table 10. The findings in Panel A suggest that actual debt issuance dates are related to changes in net notional amounts outstanding, but not the announcement dates of debt issues. We do not report the results for the latter as they are insignificant. Thus, it is truly an increase in outstanding debt amounts that matter for sovereign insured interest, and not just the announcement of it. The results

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never issued an international bond, thus far, although it is reported to be exploring this possibility.

<sup>21</sup>The domestic control variables include percentage changes in exchange rates and changes in FX volatility, the level of sovereign credit rating, domestic equity returns, percentage changes in domestic equity market volatility, percentage changes in CDS spreads, CDS spread volatility and CDS liquidity.

are also economically meaningful. A debt issue of one billion USD is associated with an increase in net notional amount of CDS outstanding of 0.6%. A similar regression of simple changes in net notional amounts outstanding on debt issuance yields a coefficient of 0.135. In other words, an issue of one billion USD is associated with an increase of 135 million USD in net notional amounts, corresponding to about 13% of the debt issued. The descriptive sample statistics indicate that the average net notional per debt outstanding is approximately 8%. Thus, the ratio of insured interest to debt outstanding appears to remain similar following the issuance of sovereign debt. Overall, this finding is consistent with the cross-sectional regressions that show a strong complementarity between CDS open interest and outstanding sovereign debt.

The inclusion of country or time fixed effects absorbs some of the variation in net notional amounts outstanding, but it does not drive out the statistical significance. For the specification reported in column (6), we use only sovereign debt issues that are included in the contractual terms of the CDS contract, while in column (7), we use only debt issues that are not included in the contractual terms of the contract. We find that the result is driven by the CDS-debt, i.e., bonds that may trigger a credit event. The regression coefficient is larger in magnitude (0.009) and significant, although we lose some power, while the coefficient reported in column (7) is insignificant. In unreported regressions, we examine whether the effect we document is stronger for short-term debt issues, which face greater refinancing risk. We find some evidence that the increase in net notional amounts of CDS is greater for the issuance of riskier short-term debt, but the significance is weak.

In Panel B of Table 10, we repeat the same regression specification, but substitute the dependent variable with percentage changes in CDS spreads. As all results are statistically insignificant, the findings suggest that the increase in CDS insurance is not driven by an increase in credit risk. Overall, our findings indicate that CDS insurance is related to debt issuance. This suggests that CDS are least to some extent used for hedging purposes.

## 5. Conclusion

The extensive literature on CDS spreads, i.e., on their determinants and commonality, is not matched by a comparable body of work investigating the drivers of CDS traded quantities. We study the determinants of sovereign insured interest, in light of current regulatory discussions on the Basel capital requirements that prescribe sovereign CDS as hedging tools against sovereign counterparty risk. An examination of net traded quantities in the sovereign credit insurance market reveals that its 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, jointly explain up to 75% of the cross-sectional differences in net economic insured interest. Contrary to CDS spreads, for which the principal component explains 54% of their variation, net notional amounts of sovereign CDS show almost no common factor, as their first principal component explains less than 6% of their changes. CDS outstanding amounts are explained by local factors, such as a country's debt and GDP, rather than by global factors.

We pinpoint two economic channels that explain the dynamics of net open interest. Negative shocks to credit ratings (i.e., downgrades) that result in an increase in regulatory capital lead to higher net insured interest, while credit rating upgrades that lead to a reduction of regulatory capital requirements are associated with lower amounts of insured interest. Similar effects are not found for rating changes that are unrelated to changes in regulatory bank capital. Debt issuance dates are also shocks that increase net amounts of sovereign CDS outstanding, and these effects are more pronounced for the issuance of bonds that can trigger a credit event.

Further research based on more granular data at a bank-by-bank level, preferably with counterparty IDs, which are becoming available, would throw more light on the decisions made by individual bank and portfolio managers. Only such data can conclusively document the role of hedging motive in driving traded quantities.

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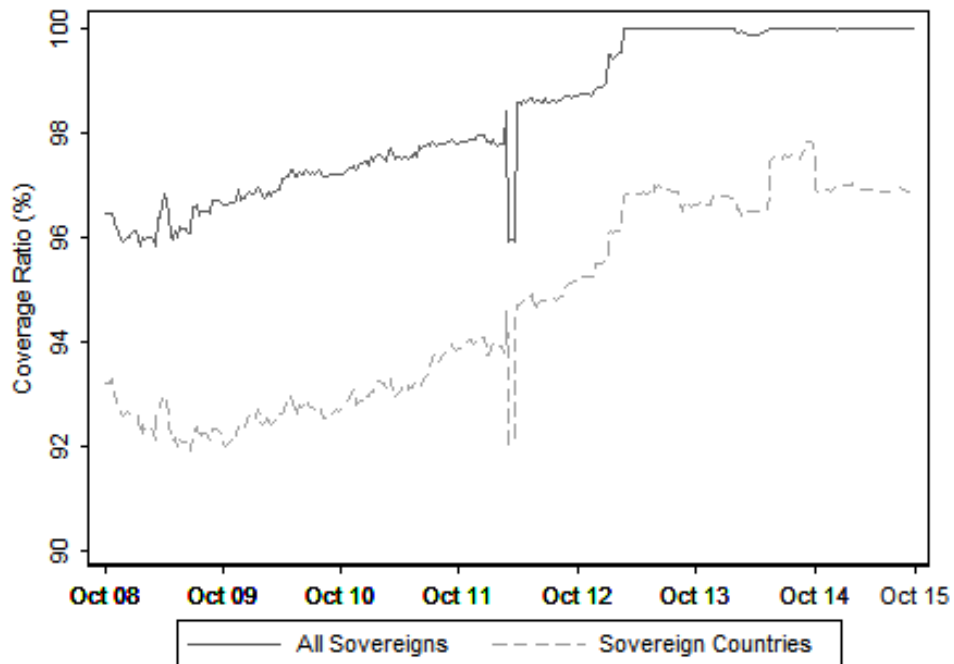
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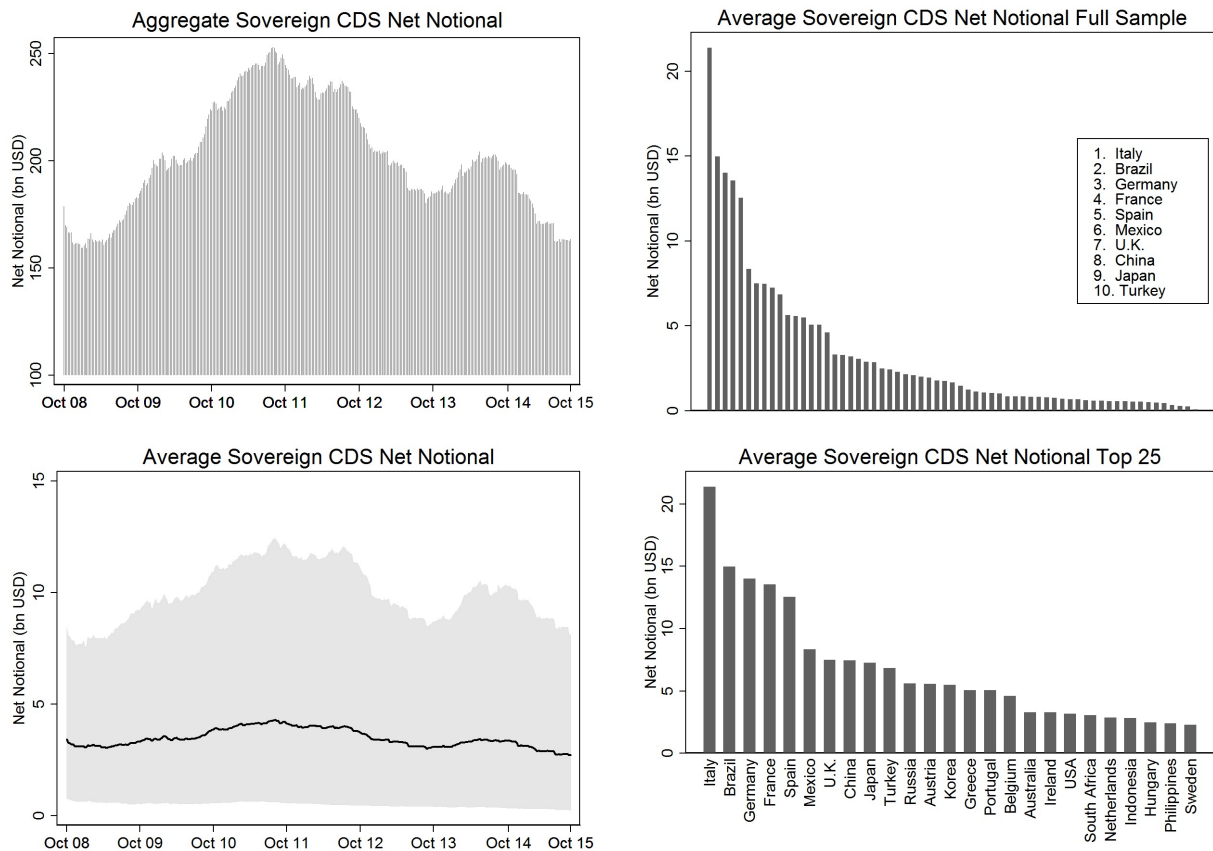
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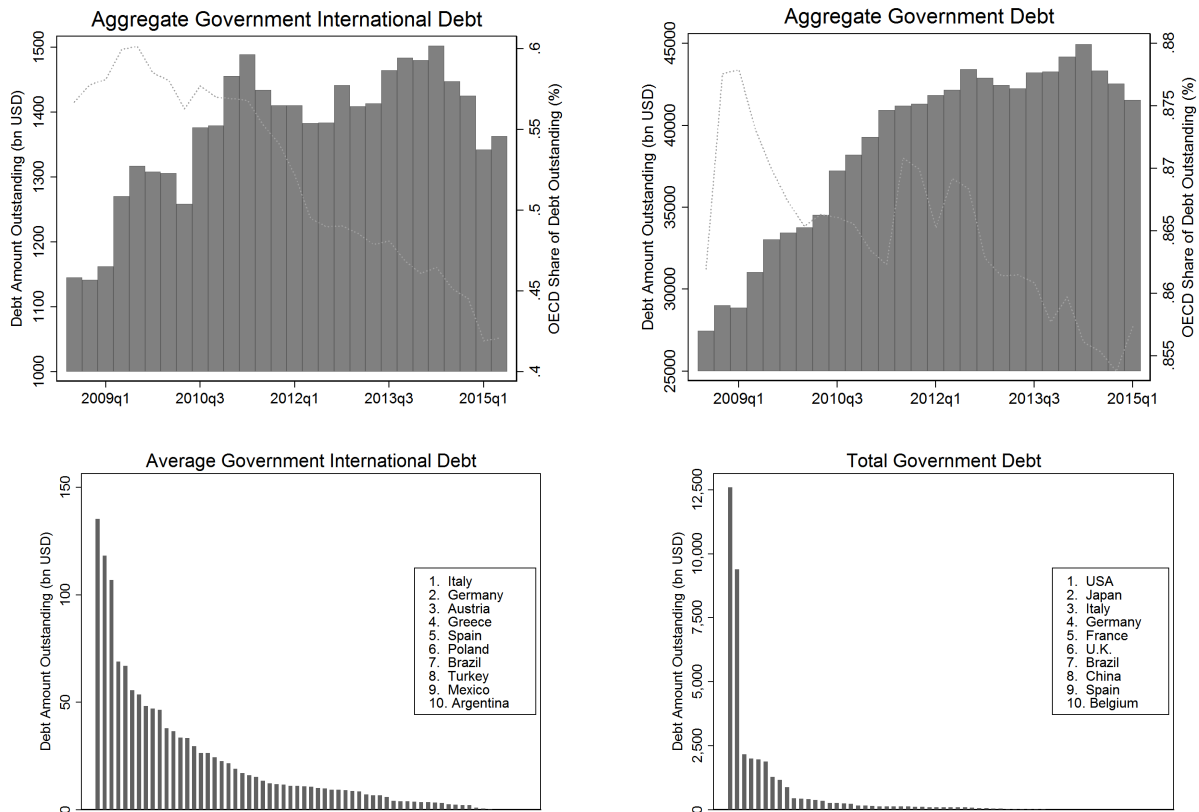
**Fig. 1. DTCC Sovereign Coverage Ratio.** This figure shows how much of the overall single name sovereign CDS trading volume is accounted for by the sovereign reference entities listed among the 1,000 most heavily traded reference entities in the DTCC Trade Information Warehouse over the time period 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.



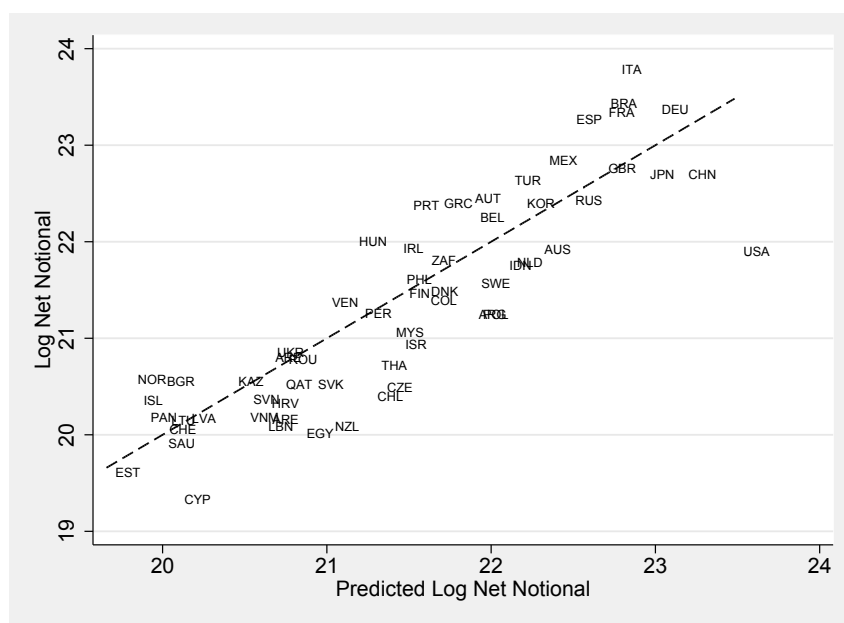
**Fig. 3. International General Government Debt.** The top left (right) panel of the figure presents the aggregate quarterly international (total, i.e., domestic and international) general government debt outstanding in billion USD. The dotted line in the top figures represents the share of the aggregate (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).



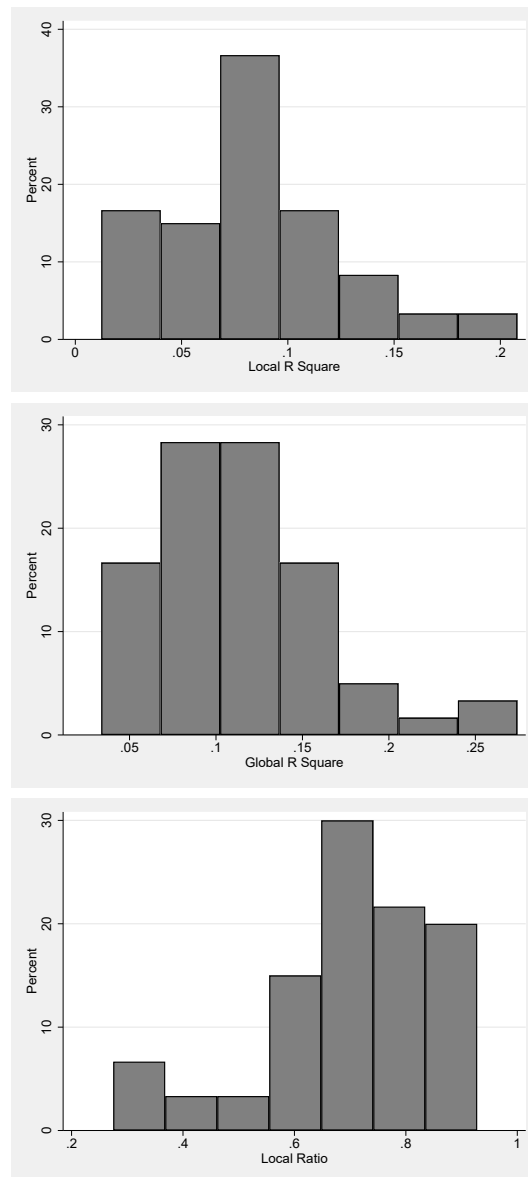
**Fig. 4. Predicted vs. Actual Net Notional Amount of CDS Outstanding.** This figure plots the predicted net notional amount of CDS outstanding against the actual net notional amount of CDS outstanding using the empirical model

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

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 net 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
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
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
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.  $\sigma_{CDS}^2$  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,  $\sigma_{FX}^2$  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  $\sigma_{MKT}^2$  is the weekly return variance of the country's stock index.  $\sigma_{CDS}^2$ ,  $\sigma_{FX}^2$ , and  $\sigma_{MKT}^2$  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
$\sigma_{CDS}^2$	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
$\sigma_{FX}^2$	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
$\sigma_{MKT}^2$	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
$\sigma_{CDS}^2$	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
$\sigma_{FX}^2$	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
$\sigma_{MKT}^2$	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
$\sigma_{CDS}^2$	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
$\sigma_{FX}^2$	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
$\sigma_{MKT}^2$	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.

Principal Component	Full Sample		Developed		Emerging	
	Percent Explained	Total	Percent Explained	Total	Percent Explained	Total
Panel A						
<i>Δ Spread</i>						
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						
<i>Δ Net Notional</i>						
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						
<i>Δ Net Notional De-Seasonalized</i>						
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)
	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %
Mar20Roll	-2.084*** (0.176)	-2.084*** (0.176)	-2.283*** (0.193)	-2.283*** (0.193)
Jun20Roll	-2.410*** (0.176)	-2.410*** (0.176)	-2.525*** (0.193)	-2.525*** (0.193)
Sep20Roll	-1.422*** (0.189)	-1.423*** (0.189)	-1.471*** (0.208)	-1.471*** (0.208)
Dec20Roll	-1.781*** (0.177)	-1.780*** (0.177)	-1.981*** (0.193)	-1.981*** (0.193)
Constant	0.112*** (0.032)	0.113*** (0.025)	0.123*** (0.034)	0.123*** (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*** (7.03)	0.051*** (6.74)	0.017** (2.51)	0.017** (2.48)	0.020*** (3.21)	-0.068 (-0.64)
International Debt			0.062*** (2.76)	0.060*** (3.47)	0.060*** (3.54)	0.083*** (6.99)	0.080*** (4.28)
GDP				0.496*** (7.09)	0.499*** (7.05)	0.498*** (7.10)	0.522*** (9.08)
DD·Emerging							0.080 (0.75)
ID·Emerging							-0.031 (-1.00)
Emerging							-1.637 (-0.60)
Constant	17.573*** (8.36)	20.218*** (142.66)	18.942*** (32.27)	16.789*** (31.97)	16.880*** (31.73)	5.887*** (3.24)	18.634*** (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 ( $\sigma_{CDS}^2$ ), the liquidity of the CDS market, the country's stock market capitalization, the variance of weekly relative changes in the country's stock index ( $\sigma_{MKT}^2$ ), inflation, and the variance of changes in the FX rate against the US Dollar ( $\sigma_{FX}^2$ ). 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** (2.31)	0.018*** (2.90)	0.021** (2.60)	0.014** (2.08)
International Debt	0.056*** (3.46)	0.038*** (3.03)	0.039** (2.07)	0.036*** (2.93)
GDP	0.573*** (4.94)	0.577*** (5.95)		0.590*** (5.88)
FX Reserves	-0.084 (-1.30)	-0.115** (-2.30)	-0.096 (-1.60)	-0.114** (-2.34)
CDS Spread		0.081 (1.10)	0.068 (0.66)	0.109 (1.61)
$\sigma_{CDS}^2$		0.044 (1.14)	0.189*** (3.72)	0.026 (0.62)
CDS Liquidity		0.902*** (3.52)	1.044*** (3.85)	0.915*** (3.12)
Market Capitalization			0.366*** (4.33)	
$\sigma_{MKT}^2$				0.035 (0.81)
Inflation				-0.012 (-1.34)
$\sigma_{FX}^2$				0.012 (0.58)
Constant	16.826*** (31.54)	15.244*** (30.34)	19.000*** (25.38)	15.430*** (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 regional 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 <sup>2</sup>		-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 <sup>⊥</sup>			-0.002	-0.002	-0.005	-0.004	-0.004
Equity <sup>2</sup>			-0.358***	-0.358***	-0.339***	-0.343***	-0.239*
FX			-0.038	-0.038	-0.039	-0.040	-0.030
FX <sup>2</sup>			-0.627	-0.627	-0.624	-0.600	-0.742
Global CDS <sup>⊥</sup>				-0.002	-0.003	-0.001	0.001
Regional CDS <sup>⊥</sup>				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 <sup>2</sup>	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 <sup>2</sup>							0.009
N							1414

**Table 8**

**Credit Rating Changes and Net Notional Outstanding** This table reports tests of whether credit ratings affect the amount of net notional outstanding and the level of CDS spread. We regress the natural logarithm of the net notional on various credit rating variables:  $\Delta Rating$  is 1 during the six weeks following any credit upgrade, -1 during the six weeks following any credit downgrade, and zero otherwise;  $\Delta Rating^R$  ( $\Delta Rating^N$ ) is 1 during the size weeks following a credit upgrade that did (did not) result in a change in risk weights (following the Basel II framework), -1 during the size weeks following a credit downgrade that did (did not) result in a change in risk weights, and 0 otherwise. We split the variable  $\Delta Rating^R$  in the two dummies  $Upgrade^R$  and  $Downgrade^R$ , so that  $Upgrade^R$  is equal to one during the six weeks following a regulatory upgrade, and 0 otherwise;  $Downgrade^R$  is equal to one during the six weeks following a regulatory downgrade, and 0 otherwise.  $Upgrade^N$  and  $Downgrade^N$  are defined similarly for non-regulatory rating.  $GDP$  and  $Debt$  are the levels of the country's gross domestic product and outstanding debt, respectively. All specifications include rating fixed effects, while specification 7 and 8 also include week fixed effects. The results are based on weekly data for 60 countries. Standard errors are calculated as per Driscoll and Kraay's covariance estimator. \*, \*\*, and \*\*\* indicate a statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log NN	Log CDS	Log NN	Log CDS	Log NN	Log CDS	Log NN	Log CDS
$\Delta Rating$	-0.275**	-0.246***						
	(-2.553)	(-4.084)						
$\Delta Rating^N$			-0.169	-0.269***				
			(-1.184)	(-4.362)				
$\Delta Rating^R$			-0.508***	-0.197*				
			(-2.966)	(-1.828)				
$Upgrade^N$					-0.161	-0.261***	-0.132	-0.245***
					(-1.117)	(-4.184)	(-0.914)	(-5.152)
$Upgrade^R$					-0.493***	-0.177*	-0.470***	-0.175**
					(-2.906)	(-1.667)	(-3.325)	(-2.292)
$Downgrade^N$					0.381***	0.503***	0.391***	0.386***
					(3.494)	(6.862)	(3.405)	(5.879)
$Downgrade^R$					0.619***	0.685***	0.625***	0.543***
					(3.035)	(4.831)	(3.034)	(4.158)
$GDP$							0.163***	-0.004
							(16.477)	(-0.775)
$Debt$							-0.010*	-0.025***
							(-1.879)	(-4.402)
R <sup>2</sup>	0.130	0.676	0.131	0.676	0.135	0.685	0.238	0.804
Obs	19018	18997	19018	18997	19018	18997	18042	18034
Rating FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Week FE	No	No	No	No	No	No	Yes	Yes

**Table 9**  
**Debt Issuance Channel - Net Notional CDS Outstanding.** In this table, we report summary statistics of the sovereign debt issuances for the 58 countries that issued debt between November 7, 2008 and June 26, 2015. The data source is Bloomberg. We report the total number of bond issuances (*Total # Bonds*), the average number of bonds issued per country (*# Bonds Issued, Avg./Country*), the standard deviation of the number of bonds issued across countries, (*# Bonds Issued, Std. across Country*), the average number of weekly bond issuances per country (*# Weekly Bond Iss., Avg./Country*), the standard deviation of weekly bond issuances across countries (*# Weekly Bond Iss., Std. across Country*), the average issuance size in billion USD (*Avg. Iss. Size (bill. USD)*), and the standard deviation of issuance size in billion USD (*Std. Iss. Size (bill. USD)*). All debt amounts are converted to USD using the prevailing weekly exchange rate. We report statistics separately for bonds that are included as reference obligations in the CDS contract, i.e., debt that can potentially trigger a CDS payout (*CDS Debt*), debt that is unlikely to trigger a credit event (*non-CDS Debt*), as well as the overall sample of bond issuances (*All*).

	(1) Total #	(2) # Bonds Issued	(3) # Bonds Issued	(4) # Weekly Bond Iss.	(5) Std. Weekly Bond Iss.	(6) Avg. Iss. Size	(7) Std. Iss. Size
	Bonds	Avg./Country	Std./Country	Avg./Country	Std./Country	(bill. USD)	(bill. USD)
CDS Debt	1993	36.91	78.25	23.39	43.95	18.24	8.20
Non-CDS Debt	1435	42.21	51.79	18.42	33.03	3.14	5.30
All	3428	59.10	81.27	41.37	49.12	11.92	8.40

**Table 10**

**Debt Issuance Channel** In Panel A of this table, we report the results from a panel regression of weekly percentage changes of net notional amounts of sovereign CDS outstanding on the announcement of debt issuance dates multiplied by the size of the debt issuance in billion USD. In Panel B, we use weekly percentage changes of sovereign CDS spreads. All debt amounts are converted to USD using the prevailing weekly exchange rate. For the specification reported in column (6), we use the sub-sample of issued bonds that are included as reference obligations in the CDS contract, i.e., debt that can potentially trigger a CDS payout. In the specification reported in column (7), we use only non-CDS debt, i.e., debt which is not listed as a reference obligation and, hence, would unlikely trigger a credit event. As local controls, we use percentage changes in exchange rates and changes in FX volatility, the sovereign credit rating, domestic equity returns, percentage changes in domestic equity market volatility, percentage changes in CDS spreads, CDS spread volatility and CDS liquidity. Quarterly roll date dummies and the dollar factor are included in the absence of time fixed effects. The data frequency is weekly. Standard errors are clustered at the country level. The sample period spans from November 7, 2008 to June 26, 2015.

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %	$\Delta$ NN %
Issued (USD bil)	0.006*** (0.002)	0.004*** (0.001)	0.005*** (0.002)	0.003*** (0.001)	0.003*** (0.001)	0.009* (0.005)	0.007 (0.009)
Constant	0.067** (0.030)	0.071*** (0.014)	-0.109*** (0.033)	-5.535*** (1.720)	-0.136 (0.707)	-0.144 (0.705)	-0.128 (0.708)
R-squared	0.030	0.035	0.075	0.080	0.079	0.079	0.079
Roll Dummy	Yes	Yes	No	No	No	No	No
Country FE	No	Yes	No	Yes	Yes	Yes	Yes
Time FE	No	No	Yes	Yes	Yes	Yes	Yes
Local Controls	No	No	No	No	Yes	Yes	Yes
Sovereigns	61	61	61	61	61	61	61

Panel B	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	$\Delta$ CDS %	$\Delta$ CDS %	$\Delta$ CDS %	$\Delta$ CDS %	$\Delta$ CDS %	$\Delta$ CDS %	$\Delta$ CDS %
Issued (USD bil)	0.005 (0.005)	0.006 (0.006)	0.001 (0.002)	-0.000 (0.002)	0.001 (0.002)	-0.001 (0.010)	-0.016* (0.008)
Constant	-0.204*** (0.047)	-0.206*** (0.013)	-0.196*** (0.044)	-8.784*** (1.662)	14.039*** (1.187)	14.041*** (1.186)	14.039*** (1.186)
Observations	20,024	20,024	20,024	20,024	19,949	19,949	19,949
R-squared	0.000	0.002	0.495	0.497	0.519	0.519	0.519
Country FE	No	Yes	No	Yes	Yes	Yes	Yes
Time FE	No	No	Yes	Yes	Yes	Yes	Yes
Local Controls	No	No	No	No	Yes	Yes	Yes
Sovereigns	61	61	61	61	61	61	61

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

# Internet Appendix

## Why Do Investors Buy Sovereign Default Insurance?

### 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).<sup>1</sup> The difference between gross and net notional amount outstanding is best illustrated by adapting the examples from Oehmke and Zawadowski (2016), 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 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

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<sup>1</sup>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.



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).<sup>2</sup> Hence, the net notional amount outstanding is often considered to be the economically more meaningful measure (Oehmke and Zawadowski, 2016). 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.<sup>3</sup> 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 *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. Dongyoun (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

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<sup>2</sup>Of course, the net notional amount outstanding represents the maximum possible transfer of funds only under the assumption of zero counterparty risk.

<sup>3</sup>It goes without saying that there would be, however, an effect on individual counterparty net notional amounts outstanding.

\$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:

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

where the new transactions,  $T$ , are contemporaneous trades that effectively transfer risks between counterparties.<sup>4</sup> DTCC also refers to *market risk transfer activity*, a quantity that we will subsequently refer

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<sup>4</sup>To be precise, total reductions in the gross notional amount outstanding are also affected by *post-trade event* (PTE) in-

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.<sup>5</sup>

## 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.”<sup>6</sup> 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 adjustments to their risk positions.”*<sup>7</sup> 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.”<sup>8</sup>

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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.

<sup>5</sup>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.

<sup>6</sup>[http://www.isda.org/c\\_and\\_a/oper\\_commit-dcg-glossary.html#g](http://www.isda.org/c_and_a/oper_commit-dcg-glossary.html#g)

<sup>7</sup>[http://www.isdaacdsmarketplace.com/market\\_statistics/understanding\\_notional\\_amount](http://www.isdaacdsmarketplace.com/market_statistics/understanding_notional_amount)

<sup>8</sup>[http://www.bis.org/publ/otc\\_hy1111.pdf](http://www.bis.org/publ/otc_hy1111.pdf)

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.<sup>9</sup> Another form of netting guided by 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 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.<sup>10</sup> Given that net notional posi-

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<sup>9</sup><http://www.isda.org/researchnotes/pdf/Netting-ISDAResearchNotes-1-2010.pdf>

<sup>10</sup>[http://www.dtcc.com/downloads/products/derivserv/tiw\\_data\\_explanation.pdf](http://www.dtcc.com/downloads/products/derivserv/tiw_data_explanation.pdf)

tions 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, 2016).

#### *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 Glossary, an Assignment 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 consistent legal provisions apply to novation consent requests processed through different platforms.<sup>11</sup>

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

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<sup>11</sup>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.

*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.”<sup>12</sup> 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).

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

The CME and NYSE (through Intercontinental Exchange (NYSE: ICE)) both provide clearing platforms for OTC credit derivatives.<sup>13</sup> They report on their websites information on *open interest* and daily

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<sup>12</sup>[http://www.isdacdsmarketplace.com/market\\_statistics/portfolio\\_compression](http://www.isdacdsmarketplace.com/market_statistics/portfolio_compression)

<sup>13</sup>See <http://www.cmegroup.com/trading/cds/index.html> and <https://www.theice.com/homepage.jhtml>

*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 by 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.

**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 Corporation (DTCC) data repository. Source: Authors' illustration.

A: Gross and Net Notional, 2 CP, no Netting									B: Gross and Net Notional, 3 CP, Netting												
Bought from			Sold CDS to			Total gross		Net position	Bought from			Sold CDS to			Total gross		Net position				
A	B	C	A	B	C	bought	sold		A	B	C	A	B	C	bought	sold					
Counterparty A	-	20	0	-	0	0	20	0	0	Counterparty A	-	20	0	-	0	-20	20	-20	0		
Counterparty B	0	-	0	-20	-	0	0	-20	-20	Counterparty B	0	-	0	-20	-	0	0	-20	-20		
Counterparty C	0	0	-	0	0	-	0	0	0	Counterparty C	20	0	-	0	0	-	20	0	20		
DTCC DATA									20	20	DTCC DATA									40	20
C: Gross and Net Notional, 3 CP, Netting									D.1: Novation, 3 CP												
Bought from			Sold CDS to			Total gross		Net position	Bought from			Sold CDS to			Total gross		Net position				
A	B	C	A	B	C	bought	sold		A	B	C	A	B	C	bought	sold					
Counterparty A	-	20	0	-	0	-20	20	-20	0	Counterparty A	-	20	0	-	0	0	20	0	20		
Counterparty B	0	-	20	-20	-	0	20	-20	0	Counterparty B	0	-	0	-20	-	0	0	-20	-20		
Counterparty C	20	0	-	0	-20	-	20	-20	0	Counterparty C	0	0	-	0	0	-	0	0	0		
DTCC DATA									60	0	DTCC DATA									20	20
D.2: Novation, 3 CP									E.1: Portfolio compression, 3 CP												
Bought from			Sold CDS to			Total gross		Net position	Bought from			Sold CDS to			Total gross		Net position				
A	B	C	A	B	C	bought	sold		A	B	C	A	B	C	bought	sold					
Counterparty A	-	20	0	-	0	0	20	0	20	Counterparty A	-	0	5	-	-10	0	5	-10	-5		
Counterparty B	0	-	0	0	-	0	0	0	0	Counterparty B	10	-	0	0	-	-10	10	-10	0		
Counterparty C	0	0	-	-20	0	-	0	-20	-20	Counterparty C	0	10	-	-5	0	-	10	-5	5		
DTCC DATA									20	20	DTCC DATA									25	5
E.2: Portfolio compression, 3 CP									F: Gross and Net Notional, 3 CP, Matured Contracts and existing positions												
Bought from			Sold CDS to			Total gross		Net position	Bought from			Sold CDS to			Total gross		Net position				
A	B	C	A	B	C	bought	sold		A	B	C	A	B	C	bought	sold					
Counterparty A	-	0	0	-	0	-5	0	-5	-5	Counterparty A	-	0	0	-	0	0	20	-10	10		
Counterparty B	0	-	0	0	-	0	0	0	0	Counterparty B	0	-	0	0	-	0	0	-20	-20		
Counterparty C	5	0	-	0	0	-	5	0	5	Counterparty C	0	0	-	0	0	-	10	0	10		
DTCC DATA									5	5	DTCC DATA									40(t-1)→30	20(t-1)→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 fourth 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				
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%

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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				
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 ( $\sigma_{CDS}^2$ ), 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 ( $\sigma_{MKT}^2$ ), the average inflation (*Inflation*), the variance of changes in the FX rate against the US Dollar ( $\sigma_{FX}^2$ ), 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	$\sigma_{CDS}^2$	CDS Liquidity	Market Cap	$\sigma_{MKT}^2$	Inflation	$\sigma_{FX}^2$	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+

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Country	GDP	Reserves	CDS Spread	$\sigma_{CDS}^2$	CDS Liquidity	Market Cap	$\sigma_{MKT}^2$	Inflation	$\sigma_{FX}^2$	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-à-vis the USD, expressed in percentages.
Foreign exchange rate volatility	FX Vol	Thomson Reuters Datastream	Squared percentage changes in the exchange rate vis-à-vis the USD, expressed in percentages.

**Table A-5**

**Debt Issuance Statistics by Country.** In this table, we report country summary statistics of the sovereign debt issuances for the 58 countries that issued debt between November 7, 2008 and June 26, 2015. The data source is Bloomberg. For each country, we report the number of bond issuances (*# Issues*), the fraction of issued bonds that can trigger a credit event (*CDS Bonds %*), the average bond maturity (*Avg. Maturity*), the minimum issuance size in billion USD (*Min. Size (bill. USD)*), the average issuance size in billion USD (*Avg. Size (bill. USD)*), the maximum issuance size in billion USD (*Max. Size (bill. USD)*), the total issuance size in billion USD (*Total Issuance (bill. USD)*), and the fraction of total debt issuance that is accounted for by CDS bonds. All debt amounts are converted to USD using the prevailing weekly exchange rate. All countries are ranked in alphabetical order.

Country	# Issues	CDS Bonds (%)	Avg. Maturity	Min.Size (bill. USD)	Avg.Size (bill. USD)	Max.Size (bill. USD)	Total Issuance (bill. USD)	% Intl.
Argentina	14	50	10.2	0.5	2.1	4.5	30	54
Australia	26	100	11.1	2.7	11.8	23.1	307	100
Austria	19	100	12.1	0.5	7.7	14.7	146	100
Belgium	32	100	10.2	0.7	9.8	27.6	313	100
Brazil	57	9	8.3	1.8	26.4	99.1	1,505	1
Bulgaria	27	41	7.6	0.1	0.4	2.0	11	74
Chile	18	39	13.4	0.3	1.0	1.5	17	42
China	44	0	7.9	8.3	11.9	18.3	525	0
Colombia	24	33	11.3	0.5	3.4	10.4	81	19
Croatia	17	77	8.5	0.7	1.3	1.8	22	85
Cyprus	10	100	6.1	0.1	0.5	1.5	5	100
Czech Rep.	31	19	7.4	0.3	1.9	5.1	60	17
Denmark	22	100	6.7	0.4	6.4	20.8	141	100
Dubai	7	100	11.3	0.5	3.3	10.0	23	100
Egypt	84	6	5.0	0.3	1.2	3.0	101	7
Finland	35	100	7.6	0.3	3.4	9.0	118	100
France	45	100	9.8	3.3	30.0	58.0	1,350	100
Germany	72	100	6.7	4.0	21.8	33.0	1,571	100
Greece	68	100	10.6	0.3	3.3	15.0	227	100
Hungary	31	42	7.7	0.1	1.8	4.0	57	35
Iceland	19	21	8.8	0.1	0.6	1.7	11	32
Indonesia	40	50	14.7	0.7	2.7	11.5	108	30
Ireland	24	100	20.0	0.4	6.4	17.6	152	100
Israel	32	19	10.3	0.4	3.2	5.2	101	9
Italy	95	100	7.1	2.5	20.4	35.5	1,941	100
Japan	388	100	12.8	4.6	28.9	106.6	11,205	100
Kazakhstan	47	4	12.9	0.1	0.4	1.5	16	15
Korea	47	4	8.0	1.5	9.9	19.6	465	1
Latvia	16	88	6.1	0.1	0.4	1.4	7	97

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<b>Country</b>	<b>#</b>	<b>%</b>	<b>Avg.</b>	<b>Min.Size</b>	<b>Avg.Size</b>	<b>Max.Size</b>	<b>Total Issuance</b>	<b>%</b>
	<b>Issues</b>	<b>Intl.</b>	<b>Maturity</b>	<b>(bill. USD)</b>	<b>(bill. USD)</b>	<b>(bill. USD)</b>	<b>(bill. USD)</b>	<b>Intl.</b>
Lebanon	277	7	4.2	0.0	0.3	1.8	71	26
Lithuania	37	92	6.4	0.1	0.4	2.0	15	97
Malaysia	78	0	9.0	0.3	2.2	5.0	172	0
Mexico	50	40	17.2	0.9	4.1	15.9	204	22
Netherlands	24	100	8.9	3.3	17.4	22.9	418	100
New Zealand	7	100	13.0	1.6	5.1	8.9	36	100
Norway	4	100	10.5	2.8	7.4	10.9	30	100
Panama	12	8	11.1	0.1	0.7	1.5	9	6
Peru	15	13	8.6	0.2	0.9	2.5	14	25
Philippines	56	23	12.4	0.2	1.4	6.0	81	22
Poland	58	48	7.0	0.6	4.6	11.1	266	18
Portugal	15	100	8.9	0.3	5.8	15.6	87	100
Qatar	34	24	6.6	0.3	1.5	9.1	51	30
Romania	39	46	6.4	0.6	1.7	2.7	68	42
Russia	44	9	7.9	1.3	3.8	9.2	166	7
Slovakia	29	100	9.3	0.2	1.8	4.2	52	100
Slovenia	17	100	8.5	1.0	1.8	2.5	30	100
Sth. Africa	21	33	20.6	0.7	4.1	11.0	85	12
Spain	51	100	7.7	2.0	18.1	33.0	921	100
Sweden	47	100	5.6	0.4	3.0	17.6	139	100
Switzerland	2	100	20.5	0.9	1.8	2.7	4	100
Thailand	30	0	14.0	0.6	3.3	10.2	99	0
Tunisia	1	0	12.0	0.1	0.1	0.1	0	0
Turkey	84	21	7.7	1.0	4.4	9.5	371	10
Ukraine	198	11	6.3	0.1	0.3	3.0	57	31
U.S.	392	100	6.8	14.7	36.6	74.2	14,343	100
U.K.	237	100	15.4	2.5	9.9	53.9	2,335	100
Venezuela	67	9	8.0	0.3	1.3	4.2	85	18
Vietnam	111	2	4.3	0.1	0.3	1.0	31	7