Savior or Sinner?
Credit Default Swaps and the Market for Sovereign Debt

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Abstract

This paper analyzes the determinants and effects of credit default swap (CDS) trading initiation on sovereign bonds in 54 countries, focusing on market completeness, price efficiency and borrowing costs. We find that CDS initiation enhances market completeness for the majority of countries in our sample. Our results suggest that, for high default risk and low financial market openness countries, CDS initiation provides significant price efficiency benefits in the underlying market. In addition, we find that CDS initiation reduces risk premiums to investment-grade sovereigns while increasing borrowing costs for sub-investment-grade economies. CDS trading initiation is more likely following increases in local stock index volatility and the volatility risk premium and decreases in foreign currency reserves and the local currency exchange rate with the USD. Our results are robust to CDS initiation endogeneity controls constructed with these factors.

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Abstract

This paper analyzes the determinants and effects of credit default swap (CDS) trading initiation on sovereign bonds in 54 countries, focusing on market completeness, price efficiency and borrowing costs. We find that CDS initiation enhances market completeness for the majority of countries in our sample. Our results suggest that, for high default risk and low financial market openness countries, CDS initiation provides significant price efficiency benefits in the underlying market. In addition, we find that CDS initiation reduces risk premiums to investment-grade sovereigns while increasing borrowing costs for sub-investment-grade economies. CDS trading initiation is more likely following increases in local stock index volatility and the volatility risk premium and decreases in foreign currency reserves and the local currency exchange rate with the USD. Our results are robust to CDS initiation endogeneity controls constructed with these factors.

1. Introduction

Once lauded as one of the most significant and important financial innovations of the last decade, credit default swaps (CDS) have come under increasing criticism.[1] For example, in May 2011, concerns over negative CDS effects in the sovereign bond market lead German regulators to ban naked CDS positions of Eurozone sovereign bonds. On July 2, 2011, the European Union Parliament voted in favor of a similar ban on naked sovereign CDS positions.[2] Whether these regulatory measures are justified and necessary is heavily debated. Industry and academic experts have suggested that it is unlikely that CDS trading (naked or covered) could have a significant impact on sovereign bond yields due to the relatively small proportion of notional value protected by CDS contracts.[3] Beyond these observations, our understanding of the potential effects of CDS trading on the sovereign debt market is limited.[4]

In this paper, we utilize an event-study framework and analyze the impact of CDS trading initiation on sovereign bonds issued by 54 countries, from both developed and emerging markets. Although the generalized effects we analyze potentially differ from the specific effects of speculative CDS trading on troubled assets (that are the subject of the Eurozone bans), our analysis is a logical first step in advancing our understanding of the interaction between these

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[1] See for example, Acharya and Johnson (2007) and Stultz (2009) who discuss the criticisms and merits of CDS derivatives.

[2] The proportion of naked CDS positions (purchasing the CDS without owning the underlying bond) is not known given the opacity of CDS over-the-counter (OTC) trading. Industry experts have estimated the proportion to be as high as 80% (Kopecki and Harrington, 2009).

[3] See for example, the expert testimony of Robert Pickel, Executive Vice Chairman, International Swaps and Derivatives Association Inc. before the U.S. House of Representatives, April 29, 2010. In that testimony, Pickel notes that sovereign default protection via CDS contracts totalled $2 trillion USD, or 6% of the overall global sovereign bond market (Pickel, 2010). See also Duffie (2010).

[4] Corporate CDS research is more prevalent. For example, Ashcraft and Santos (2009) find that, in aggregate, CDS initiation has little effect on the cost of debt for corporations, but do note economically significant adverse effects for risky and informationally-opaque firms. Longstaff, Mithal and Neis (2005), Norden and Weber (2004) and Blanco et al. (2005) all document that the CDS market leads the corporate bond market in price discovery. We contrast the corporate and sovereign debt markets and discuss this literature in greater detail in Section 2.1.

two markets. Prior analysis has shown that the sovereign CDS market typically leads the bond market in price discovery (Ammer and Cai, 2011). Our first contribution is to extend this literature by examining the impact of CDS initiation on three key sovereign debt market characteristics not previously considered: market completeness, price efficiency and borrowing costs. Specifically, we examine three primary questions: 1) Does the initiation of CDS trading expand the information set that influences sovereign debt prices, or are CDS contracts redundant, replacing bonds as the primary asset for price discovery of previously existent risk factors? 2) What is the effect of CDS trading on the efficiency with which new information is impounded in sovereign bond prices? 3) Controlling for risk-free term structure and default risk effects, how does CDS initiation impact the cost of debt for global governments?

We employ three separate models to examine these questions. First, in a frictionless market, with no investment barriers or trading constraints, CDS contracts are potentially a redundant asset as they can be easily replicated via lending at the risk-free rate and borrowing the underlying bond. To analyze market completeness, we utilize this arbitrage linkage while controlling for liquidity premium and counterparty risk effects. Employing a procedure similar to Huberman and Kandel (1987) we test the spanning properties of CDSs, relating price innovations in the CDS market to joint innovations in the risk-free rate and bond market. We reject the hypothesis that CDSs are redundant assets for the majority of the countries in our sample. These results suggest that CDS initiation enhances the information set that influences sovereign debt prices, rendering the market more complete.

In the second model, we draw on Westphalen (2001) and Collin-Dufresne et al. (2001) and model sovereign bond spreads as a function of the local and global business climate, risk-free yield curve characteristics and the local currency-USD exchange rate. We then follow Hou and Moskowitz (2005) and calculate the delay in which new information is incorporated into bond prices by contrasting the R^2 from variants of the pricing model which separately include and exclude 5 lags of each price factor. The higher the R^2 of the model including lagged price factors, the greater the delay with which new information is incorporated into bond prices. This process allows us to evaluate CDS price efficiency effects separately for each price factor. Comparing the delay measure before and after CDS trading initiation, we find that, on average across the six price factors we examine, price informativeness increases for 58% of the countries in our sample. The average improvement in price efficiency is statistically significant (α=10%) for information related to the local and global business climates. The effects of CDS initiation on the sovereign bonds are in excess of a matched sample that controls for time-series trends in bond market efficiency.

Finally, to measure risk premium effects associated with CDS initiation we follow a model similar to Dittmar and Yuan (2008). In the first stage, we strip default risk and risk-free term structure premiums from the bond spread, obtaining the residual risk premium. In the second stage, we regress the residual risk premium on a CDS initiation indicator variable and fixed-effect controls. While no aggregate trends emerge, with few exceptions, CDS initiation reduces risk premiums for investment-grade sovereigns while increasing borrowing costs for sub-investment-grade countries.

Our second contribution is to examine the determinants of CDS initiation likelihood and the unique utilization of these factors as endogeneity controls. Although market-timing controls are employed in the models, a potential concern when interpreting the previously discussed results is endogeneity biases resulting from the non-random CDS initiation decision. If factors that influence CDS initiation likelihood jointly influence bond characteristics, characteristics common to bonds at the time of CDS initiation could spuriously be attributed as initiation effects. To mitigate these concerns, we utilize a logit model to identify factors that predict CDS initiation likelihood. We find that increases in local equity market volatility and the volatility risk premium and decreases in a country's ability to service USD-denominated debt (proxied by foreign currency reserves and the local currency-USD exchange rate) are the strongest predictors of sovereign CDS initiation. Our results are robust to inclusion of these factors as additional controls.

The final contribution of the paper is to explore determinants of the noted cross-sectional heterogeneity in CDS initiation effects across countries. We hypothesize that CDS initiation effects are likely to vary across two key country characteristics. First, CDS contracts allow heterogeneously informed investors to hedge country-level adverse selection costs, facilitating greater investor participation in international debt markets. Benefits of this nature are likely to be most pronounced for informationally-opaque countries, for which information asymmetries are likely most severe. Second, CDS initiation creates risk sharing opportunities between investors, increasing the ability of investors to speculate and hedge in the underlying market and reducing the uncertainty of obtaining a desired payoff. Risk sharing benefits are likely greatest for high default risk countries as risk sharing potential is greatest for these countries and the higher risk has likely limited participation by the largest proportion of investors.[5]

To test these hypotheses, we partition the country-level output from each model by default risk and financial market openness. We find that spanning enhancement is similar across these partitions. In contrast, we find that market efficiency benefits are isolated to high default risk and low financial market openness countries. We also find that risk premium benefits

[5] These hypotheses and the channels by which CDS initiation may influence the sovereign bond market are discussed in greater detail in Section 2.2.

accrue only to countries in the AAA-AA credit rating and high openness categories, resulting in a 15-26% reduction in borrowing costs (on average, 13 bps in real terms). Conversely, countries in the BB rating and low openness categories realize borrowing cost increases of 3-5% (on average, 14 bps in real terms).

In sum, our results suggest that the impact of CDS initiation on sovereign bonds depends, at least in part, on country level characteristics. In general, CDS initiation improves the quality of the sovereign debt market, increasing market completeness and enhancing price informativeness. The price efficiency benefits accrue to markets for which frictions limiting information flow and investor participation are likely most severe. Our results also suggest that improved flows come at a cost for high risk and informationally-opaque countries, as borrowing costs increase following CDS initiation for these countries. This result perhaps reflects a more accurate pricing of default risks by better informed investors. In contrast, borrowing cost reductions to low default risk and highly transparent countries are substantial. These results should be of interest of global financial market regulators contemplating the use of bans in the sovereign CDS market. Constraints on CDS trading have the potential to reverse the benefits we note and reduce the overall quality of the sovereign debt market.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and presents our hypotheses in greater detail. In section 3 we describe the data and report summary statistics. As a precursor to our primary analysis, in section 4 we examine the determinants of CDS initiation likelihood. Section 5 presents our empirical methods and summarizes the results and in section 6 we conclude.

2. Hypotheses and Related Literature

2.1. Context and Empirical Findings in the Literature

A considerable body of literature is dedicated to examining the relation between the CDS, corporate bond and equity markets. In the context of information flows, Hull et al. (2004) and Ismailescu and Kazemi (2010) report that credit rating announcements are anticipated by the CDS market. Similarly, Longstaff et al. (2005), Norden and Weber (2004) and Blanco et al. (2005) show that the CDS market takes a lead role in debt market price discovery relative to investment-grade corporate bonds.

More closely related to the focus of this paper, Das et al. (2010) find that corporate bond markets become less efficient, experience greater pricing errors and realize lower liquidity following CDS initiation. Ashcraft and Santos (2009) examine the impact of CDS initiation on the cost of corporate debt and fail to find any evidence of a reduction in borrowing costs for the average borrower. They do, however, document a significant adverse effect for higher risk and informationally-opaque firms, which they relate to a reduction in the usefulness of the lead bank's retained share to resolve information asymmetry problems. In contrast, Saretto and Tookes (2010) use CDS markets as a proxy for the relaxation of the firm's credit supply constraints and find that firms with traded CDS contracts are able to maintain higher leverage ratios and longer debt maturities.

The focus of our analysis is sovereign debt, which differs in several key aspects from the corporate, investment-grade debt examined in the previously discussed literature. First, sovereigns are among the largest borrows in the world, with greater liquidity and larger issues than their corporate counterparts and, correspondingly, have greater activity in the CDS market (Ammer and Cai, 2011). Thus, to the extent that CDS initiation effects may exist, they are likely more pronounced in the sovereign debt market. Second, countries in financial distress do not enter bankruptcy and assets are not liquidated. In the event of default, the debt contract is restructured, typically resulting in substantial haircuts for debt holders (Shleifer, 2003). Thus, the risk structure of sovereign debt is quite unique to the corporate context. Finally, the credit ratings of the bonds in our sample range from AAA to CCC. This greater range in credit risk provides the opportunity for broader and unique cross-sectional analysis than was possible in prior analysis, which has typically focused on investment-grade debt.

Research focused on the impact of CDS trading on the sovereign bond market is relatively sparse. Ammer and Cai (2011) examine the relationship between CDS premiums and sovereign bond yields for nine emerging markets and find that sovereign bond spreads lead CDS premiums more often than found for investment-grade corporate bonds. Chan-Lau and Kim (2004) undertake a similar analysis, examining the lead-lag relationships between sovereign bond indices, sovereign CDS premiums and national stock indexes and report mixed results. Our contribution to this literature is to examine the effect of CDS initiation on three characteristics of the sovereign debt market not previously considered: market completeness, price efficiency and borrowing costs. These characteristics speak broadly to the effect of CDS initiation on market quality in the underlying market and the aggregate effect on the cost of debt for global governments.

2.2. Channels of CDS Initiation Effects and Related Hypotheses

CDS initiation effects may occur via a series of channels, which give rise to testable hypotheses. First, there is substantial evidence that country-level information asymmetries influence the international portfolio allocations of investors.[6] Investors tend to favor investment opportunities in countries with which they are familiar and potentially possess an informational advantage. Yuan (2005) shows that the ability to hedge adverse selection costs encourages greater information seeking by investors, leading to increased liquidity and price informativeness in the context of benchmark securities. Further, Shiller (1993) suggests that macro securities (such as sovereign CDSs) may complete the market by allowing investors to hedge systematic factors. CDS contracts may have a similar effect, allowing heterogeneously informed investors to hedge adverse selection costs in the sovereign bond market, facilitating greater investor participation. Benefits of this nature should be most pronounced for informationally-opaque countries for which information asymmetries are likely most severe.

Second, CDS initiation may expand the investment opportunity set available to investors. As shown theoretically by Detemple and Selden (1991) and Ross (1976) in the context of equities and the options market, introducing derivatives may facilitate risk sharing between investors, expanding the available return space. Specifically, derivatives can increase the ability of investors to speculate and hedge in the underlying asset while reducing uncertainty in the cost of obtaining a desired payoff (Grossman, 1988). In this context, CDS contacts may encourage participation by a larger segment of investors with heterogeneous risk preferences, resulting in a more certain and liquid sovereign bond market. These effects should be most marked for high default probability countries as the associated risk likely excludes the largest number of investors and for these assets the largest expansion of the return space is possible.

It should be noted that there are also potential adverse effects resulting from CDS initiation. Stein (1987) argues that the entry of new investors potentially lowers the

[6] See for example, among others, Brennan and Cao (1997), Kang and Stultz, (1997) and Van Nieuwerburgh and Veldcamp (2009).

informativeness of prices, reducing the ability of pre-existing investors to infer asset value. The overall effect can destabilize prices and be welfare reducing. Additionally, for existing investors there are potential advantages to trading in the CDS as opposed to the sovereign bond market. Notably, the opacity of the OTC CDS market potentially makes it the preferred venue for informed or insider traders seeking to hide their trades (Acharya and Johnson, 2007). Similarly, Gorton and Pennacchi (1993) suggest that reference securities have the potential to crowd out other securities, resulting in redistribution effects which could lower participation and liquidity in the underlying market. The overall effect of CDS initiation will reflect the aggregate influence of these various channels.

3. Data Description

We obtain CDS data from Markit, a leading vendor of credit pricing data that provides daily CDS spreads on over 3,000 reference entities. Collected from more than 70 global banks and brokers that act as CDS market makers, the data undergoes a rigorous cleaning process prior to formation of daily composite quotes. Contracts are available in different maturities, documentation clause levels, and currencies. We use daily spreads for 5-year, USD-denominated, senior tier CDS contracts with the Cum (With) Restructuring or Old Restructuring (CR) clause, as contracts of this type are the largest and most liquid.[7] We focus on USD-denominated contracts as, without exception for sovereign entities, contracts in this currency initiate trading prior to all other currencies. The Markit dataset commences on January 1, 2000 and concludes on February 27, 2009.

[7] For more information about the documentation clauses, see ISDA Credit Derivatives Definitions published in February 2003.

CDS trading is conducted OTC and is presumably initiated based on supply and demand amongst market participants, although the actual factors that influence trading initiation are not well understood. In the absence of a consensus listing date on a recognized exchange, we treat the day that a reference entity first appears in the Markit dataset as the date of CDS trading initiation. Markit requires a minimum of three spread observations for each respective reference entity and maturity. Thus, the first appearance of a contract in the Markit dataset represents the date that CDS trading became adequately widespread to consistently meet the reporting threshold.

It is likely that CDS trading commenced sometime prior to the date we recognize as the initiation date, but as those trades occurred on an OTC market with no reporting convention or requirement, they are unobservable. The initiation date we use represents the date that CDS spreads became public, and thus, reflect the date we would expect information flows across debt markets to become most pronounced. It is important to note that any potential inaccuracy in the estimated initiation date, if anything, biases against the results we report. For robustness, we compared the CDS initiation dates suggested by the Markit dataset to those suggested by two alternative CDS data providers, CMA and Thomson-Reuters (available in Datastream). Initiation dates were either consistent across data providers or appeared earlier in the Markit dataset. Given the more comprehensive nature of the Markit dataset we elected to utilize it as our CDS data source.

Sovereign bond data is obtained from Datastream. To avoid potential confounding effects associated with variation in bond covenants and to match the currency denomination of the CDS contracts, we focus on straight, fixed-coupon, USD-denominated sovereign bonds traded in international markets. The bond data available includes notional amount outstanding, maturity and the daily stripped-spread (defined as the difference between the bond yield and the yield of a comparable-maturity US T-bill).[8]

We limit our analysis to countries that have CDS contracts written on their sovereign bonds, and a minimum of 100 simultaneous observations in both the bond and CDS datasets. These criteria results in a sample of 443 bonds issued by 54 countries from both developed and emerging markets. Table I reports the start dates of the bond and CDS data series, the number of bonds, the mean and standard deviation for the bond stripped-spreads and CDS spreads, bond total outstanding market values and the Standard and Poor's (S&P) average credit ratings by country.[9] Average spread characteristics are similar between the bond and CDS datasets, but the values are not directly comparable due to time-series length variation between individual bonds and the CDS contract for each country. The average CDS spread is 202 bps with a standard deviation of 174 bps, while the mean and standard deviation for the bond stripped-spread is 240 bps and 200 bps, respectively. On average, the total outstanding market value of sovereign bonds is 1.01 billion USD. The largest borrower is Germany, with bonds outstanding worth 5.04 billion USD, while the least dependent on USD-denominated debt is Iceland, with an average of 193 million USD outstanding. Average credit ratings in our sample range from AAA to CCC, including 32 investment-grade and 22 sub-investment-grade rated countries.

4. Determinants of CDS Initiation Likelihood

As a precursor to our primary analysis, we first examine the determinants of CDS initiation likelihood, as these factors are the foundation of the endogeneity control process

[8] Datastream also reports monthly trading volume, but the reporting consistency is sporadic and was only complete for two of the countries in our dataset. This data restriction precludes analysis of the change in liquidity or trading frequency associated with CDS initiation.

[9] Throughout the paper, sovereign credit rating is the foreign currency rating reported in the Standard and Poor's Sovereign Rating and Country Transfer and Convertibility Assessment Histories (2009).

utilized further in the paper. As previously discussed, a concern with the event-study approach utilized is the potential to spuriously attribute characteristics common to bonds at the time of CDS initiation as initiation effects. Endogeneity issues of this type are well recognized in the equity option introduction literature, where option listing is also non-random and has been shown to be dependent on characteristics of the underlying stock (Mayhew and Mihov, 2004). To mitigate endogeneity concerns, a common approach is to utilize a control sample drawn from stocks eligible for option listing, but not yet listed, which match on factors shown to influence the option listing decision.[10] In this manner, option introduction effects can be isolated from characteristics common to stocks which are typically selected for option listing.

Following Mayhew and Mihov (2004) and Danielsen et al. (2007) who undertake similar analyses in the context of equity options, we estimate a logit model of 364 pooled, quarterly observations for all 5-year sovereign CDS contracts in the Markit database not yet trading:

$$\begin{aligned} L(TRADE) = {} & \beta_0 + \beta_1 INDEX_{t-1} + \beta_2 WORLD_{t-1} + \beta_3 VOL_{t-1} + \beta_4 ER_{t-1} + \beta_5 CREDIT_{t-1} + \\ & \beta_6 GDP_{t-1} + \beta_7 FORES_{t-1} + \beta_8 EQU_{t-1} + \beta_9 VOLPRM_{t-1} + \beta_{10} DEF_{t-1} + \\ & \beta_{11} REG_{t-1} + \beta_{12} GLOBE_{t-1} + \beta_{13} OPEN_{t-1} + \varepsilon_t \end{aligned} \qquad (1)$$

where *L(TRADE)* is the log-odds ratio that a country will be selected for initiation of CDS trading. *INDEX*, *WORLD*, *VOL* and *ER* are the local and global index return, local index volatility and local currency-USD exchange rate. *CREDIT* is the Standard and Poor's foreign currency credit rating, *GDP* is Gross Domestic Product, *FORES* is foreign currency holdings, *EQU* is the equity risk premium, *VOLPRM* is the volatility risk premium, *DEF* is the default spread, *REG* and *GLOBE* are the orthoganalized regional and global sovereign CDS spread

[10] See for example, Mayhew and Mihov (2005) and Phillips (2011).

indexes and *OPEN* is financial system openness proxied by the ratio of local equity market capitalization and GDP. Where applicable, all values are expressed in USD. Detailed descriptions of the determinant variables appear in Appendix A.

As candidate countries for CDS initiation we consider all countries with sovereign CDS contracts included in the Markit CDS dataset as of December 31st, 2010. As previously discussed, we treat the first day of trading of the 5-year maturity contract as the CDS initiation date. The dataset includes 79 sovereign CDS initiations between 2001 and 2008. Ideally, our sample should include all countries eligible for CDS initiation but not yet trading. Presumably CDS initiation is driven by investor demand but the actual criteria are not well understood. The absence of any additional initiations after 2008 gives us confidence that our sample includes all countries which reasonably meet the unknown eligibility thresholds. From this list, we exclude countries present at the start of the dataset for which we cannot determine trading initiation dates (3 countries). We also exclude countries missing continuous equity index data in Datastream between 2001 and 2008 (16 countries), resulting in a final sample of 60 countries.

When considering potential determinants of CDS initiation, we make the logical assumption that factors that influence sovereign debt prices also influence CDS contract demand. The variables we include in the logit model are shown to influence sovereign debt prices in either the bond or CDS markets (see Westphalen, 2001; Collin-Dufresne et al., 2001; Longstaff et al., 2001). To this aggregate list, we add *GDP* as investor demand may vary with international exposure and the breadth of investment opportunities, proxied by the size of a country's economic output. As an additional proxy for these factors we include financial market openness (*OPEN*) as used by Rajan and Zingales (2003), who measure openness as the market capitalization of the country's equity market standardized by GDP.

The standardized slope estimates from the logit models are presented in Table II. Ex-ante, we hypothesize that both the level and the trend in the determinant variables may influence CDS contract demand. Thus, we consider each separately in models 1 and 2. Typically, the factor change as opposed to its level is a more significant predictor of sovereign CDS trading initiation likelihood. With the exception of the default spread (*DEF*) and the equity risk premium (*EQU*), slope estimate significance increases for all of the determinant variables between the level and trend models. Via iterative substitution we identify the model that optimizes significance for each variable and report this output in model 3.

Focusing on Model 3 in Table II, the percentage of observations classified correctly is 73.5% which indicates an estimate precision similar to that attained by Mayhew and Mihov (2004) who report 72.8% of observations classified correctly in their full sample model. We find positive and significant coefficients for *VOL* and *ΔEXCHG* (p-values 0.0004 and 0.0059), suggesting that higher local equity index volatility and loss of local currency purchasing power relative to the USD increases the likelihood of CDS trading initiation. The coefficients for *ΔFORRES* and *VOLPRM* are negative and significant (p-value 0.0178 and 0.0322), indicating that reductions in foreign currency reserves and reductions in the spread between realized and expected volatility are similarly associated with increases in CDS trading initiation likelihood. The significance of these variables is perhaps not unexpected. Longstaff et al. (2011) note a similar strong negative relation between the volatility risk premium and CDS spreads for the majority of countries in their sample and find that this variable has the strongest influence on sovereign CDS spreads.

The remainder of the determinant variables are insignificant, but we do find marginally significant and negative coefficients for *DEF* and *GLOBE* (p-values 0.090 and 0.088), suggesting that when the default spreads for US corporate bonds and the residual spread on the global CDS index are narrow, CDS trading initiation is more likely. DEF and CDS index spreads are both narrow during periods of favorable economic conditions when default likelihood is relatively low. A negative association between CDS trading initiation and these variables is consistent with investors anticipating a peak in the business cycle and taking bearish positions on systematic risk factors. In summary, greater levels of uncertainty in financial markets at the local (*VOL*) and global (*VOLPRM*) levels and factors which reflect a country's ability to service its USD-denominated debt (*ΔFORRES* and *ΔEXCHG*) have the greatest influence on the likelihood of sovereign CDS trading initiation.

5. Empirical Analysis

5.1. Market Completeness

We start our empirical analysis by examining the effect of CDS trading initiation on the completeness of the market for sovereign debt. As previously discussed, prior research has shown that the CDS market commonly leads the sovereign bond market in price discovery. We seek to understand if the initiation of CDS trading expands the factor set which contributes to sovereign debt prices, or simply replaces the bond market as the venue of price discovery for a pre-existent and common set of factors.

Duffie (1999) shows that, in a frictionless market, the combined cash flows from an n-year, par value bond and a matching maturity risk-free note match the cash flows of an n-year CDS contract written on the bond. In this framework, a CDS is a redundant asset as it can be replicated synthetically by shorting a par, fixed-coupon bond on the same reference entity, with the same maturity, and investing the proceeds in a par, fixed-coupon, risk-free note.[11] In practice, the arbitrage linkage between the bond and credit derivative markets is well understood by market participants, such as relative value strategy hedge funds, and is applied in a more generalized framework. For example, for relative value arbitrage positions, investors seek the closest CDS-bond pair matched on underlying entity, maturity and par value. When only imperfect matches are available, use of "adjusted basis" to detect spread misalignment between the two assets is common, allowing arbitrage positions using a broad range of CDS-bond pairs.[12]

The two questions we address in this section are: 1) Do the underlying bond yield and the risk-free note span prices in the economy, or do CDS spreads contribute unique price factors that help complete the sovereign debt market? and 2) In light of the previously discussed hypotheses, should CDS initiation enhance market completeness, to what extent do spanning properties vary across country characteristics, specifically financial market openness and default risk? Our market completeness analysis is motivated by the mean-variance spanning tests in Huberman and Kandel (1987) who propose a generalizable likelihood-ratio test of the hypothesis that the minimum-variance frontiers of two sets of assets coincide.[13] Coinciding minimum-variance frontiers implies the prices of the asset sets respond to common risk factors and in this context, the bond and CDS markets would be said to span each other.

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[11] The same position can also be realized via a reversed repo combined with a cash sale, relaxing the need for a counterparty in a short-sale.

[12] See Liao (2006) and Duffie (1999) for a discussion. Investors commonly utilize "adjusted basis" for arbitrage positions which reflects the estimated value of the "true" spread difference between the CDS and underlying bond adjusting for maturity, par value and cash flow timing mismatches. Duffie (1999) also discusses common relaxations of the arbitrage linkage by investors. For example, as long as seniority applies at default the matching maturity requirement can be relaxed and if no floating-rate note of the same credit quality is available then investors can "back out' the reference par spread.

[13] For robustness, in unreported tests, we replicate the spanning analysis using a SDF-based GMM Wald test based on Bekaert and Urias (1996) and obtain consistent results.

The spanning test model is based on the common cash flows between the CDS contract and the combination of a risk-free asset and the underlying bond:

$$r_{cds,t} = \alpha + \beta_{sb} r_{sb,t} + \beta_u r_{u,t} + \varepsilon_t \quad (2)$$

where r_{cds}, r_{sb}, and r_u are the returns of the CDS, sovereign bond, and US T-Bill (risk-free rate proxy), respectively. Our null hypothesis is that CDS derivatives are redundant assets, i.e. the underlying bond and the risk-free note span the CDS derivative. Assuming that α, β_{sb}, and β_u are constant over the timeframe of the analysis and drawing on commonality in cash flows between the asset sets, Huberman and Kandel (1987) show that the necessary and sufficient conditions for spanning are:

$$H_0 : \alpha = 0,\ \beta_{sb} + \beta_u = 1 \quad (3)$$

The null hypothesis is tested with a likelihood ratio test, which in small samples has an F-distribution.[14]

As the magnitude of CDS spreads varies significantly across countries, we follow Acharya and Johnson (2007) and define the CDS return as the daily percent spread change and bond returns as the daily percent change in bond stripped-spreads. Since sovereign bonds of emerging economies are usually collateralized, the stripped-spread is typically a better measure of bond price (Dittmar and Yuan, 2008).[15] To create the return series of the comparable maturity risk-free note, we compute daily averages of the returns of two US Treasury bond indices: 3-5

[14] See Kan and Zhou (2011) for a discussion of the correct F-test when there is only one test asset.

[15] Results based on transacted bond prices (unreported) are similar to those summarized in Table III.

and 5-7 years, both collected from Datastream. We focus on daily returns as across our sample, 97% and 81% of bond and CDS returns, respectively, are non-zero, suggesting that information arrival in these markets is typically, at least, daily in frequency. As we discuss below, the spanning test results are robust to the use of longer frequency returns.

It is important to note that, as we focus on innovation in CDS and bond prices, this analysis differs fundamentally from research that seeks to explain the determinants of basis persistence in the sovereign CDS market.[16] Basis may persist due to structural differences between the CDS and the underlying bond or may result from limits to arbitrage.[17] By focusing on price innovations, we are able to isolate variation in the response to new information in the bond and CDS markets, analysing variation around the mean basis which may differ from zero. If the mean basis is constant, this variation will result entirely from differences in price factor sensitivities between the two markets. In contrast, if the mean basis is not constant, potential spanning enhancement we document may also result from innovations in frictions between markets and not exclusively from variation in price factor sensitivity.

Conscious of these issues, we proceed as follows. The first stage of our analysis (Sections 5.1.1 and 5.1.2) assumes that structural differences and limits to arbitrage are constant during our sample period. In the second stage (Section 5.1.3) we replicate our analysis controlling for innovations in potentially confounding factors. We utilize this two-stage approach as liquidity premium proxies are available for a limited number of the bonds within our

[16] Basis is defined as the difference between the CDS spread and the Z-spread for the underlying bond of the same maturity. The Z-spread is the number of basis points added to the Treasury spot rate yield curve such that the net present value of the bond cash flows equals the market price of the bond. Thus, the Z-spread reflects the risk premium over the risk-free rate across the yield curve.

[17] For example, Levy (2009) shows that the difference in the CDS and bond liquidity premiums and counterparty risk in the CDS explain the majority of the basis spread for a sample of 16 emerging market countries between January 2000 and May 2008. Bai and Collin-Dusfresne (2010) find that funding liquidity risk, counterparty risk and collateral quality jointly determine CDS-bond basis during the financial crisis of 2007-2009.

sample. Thus, we undertake our primary analysis with the full sample and then conduct robustness tests with a subset of the sample.

In the market completeness tests, ideally, the CDS and bond maturities should match to mitigate potential maturity related factor sensitivity differences. Unfortunately, there are commonly less than two or three bonds outstanding for a given country at a given time. Thus, a matching maturity bond (5-year) is rarely available and interpolation across the yield curve is not always possible. In order to maximize the number of sample countries eligible for spanning analysis in the first stage, for each country we create an equally-weighted bond portfolio based on returns of bonds with maturities between 3 and 7 years. With this approach, tests for market completeness are possible for 47 of the 54 countries in our sample. In the second stage, in addition to including market friction controls, we match CDS and bond maturity via interpolation, which further limits the sample size. The spanning results we present may also reflect timing differences between the bond and CDS market. As previously discussed, it is generally held that the CDS market leads the bond market in price discovery. Thus, the absence of spanning may alternatively reflect delayed reaction of the bond market to risk factors common with the CDS market. To mitigate this concern, in unreported tests, we replicate all the spanning tests using both 2-day and weekly returns and find similar results.

5.1.1. Aggregate Spanning Test Analysis Using Bond Portfolios

The aggregate results of our first-stage spanning tests are reported in Table III.A. Recall that the tests in this section exclude controls for frictions between the bond and CDS markets and are completed using bond portfolios. The null hypothesis that CDS spreads are redundant is rejected at a significance level of 10% or less for 27 of 47 countries. This finding suggests that for 57% of the countries in our sample, CDS prices cannot be replicated using the risk-free note and the underlying bond. This result is perhaps not unexpected in light of recent CDS research. For example, Longstaff et al. (2011) argue that CDS spreads are most sensitive to global risk factors and bear little or no country-specific risk. These findings are in contrast to a long established relationship between country fundamentals and sovereign bond spreads documented in the international economics and finance literature.[18] This result is consistent with unique investor clienteles between the CDS and sovereign bond markets, which are primarily international investors in CDS markets, while a mix of domestic and international investors in sovereign bond markets.

5.1.2. Spanning Test Cross-sectional Analysis

As previously discussed, given the potential for CDS contracts to mitigate information asymmetry and risk preference related implicit investment barriers, CDS initiation effects may vary in the cross-section of these factors. The next step of our analysis is to explore how spanning potential varies with country-level default risk and informational-opacity. We measure a country's default risk by its Standard and Poor's credit rating. To capture country-level information availability we follow Rajan and Zingales (2003) and measure financial openness as the market capitalization of the country's equity market standardized by GDP. This ratio captures the extent to which foreign investors have access and interest in the domestic equity market, which motivates information seeking. Further, the more developed and complete the domestic equity exchange, the greater the availability and accuracy of systematic risk information.

[18] See for example, Westphalen (2001), Ferrucci, (2003), Baldacci et al. (2008) and Hilsher and Nosbusch (2010).

The results of the sub-sample analysis are reported in Table III.B. We first focus on the credit rating sub-groups. To form four similarly sized partitions, we divide each major rating category in two sub-groups: investment-grade ratings into AAA-AA and A-BBB partitions, and sub-investment-grade ratings into BB and B-CCC partitions. We then report the number and percent of spanning test rejections by rating sub-group. Spanning enhancement opportunities are largely consistent for the main (investment-grade and sub-investment-grade) groups, with the spanning null hypothesis rejected for approximately 56-57% of the countries in either category. Looking at the finer default risk partitions, however, a slightly higher cross-sectional heterogeneity emerges. Countries in the AAA-AA and BB default risk partitions maintained slightly higher rejection rates of the null spanning hypothesis, but as default risk increases in both investment grade and sub-investment grade categories, rejection rates decline. For A-BBB countries the null spanning hypothesis was rejected for only 47% of countries and the rejection rate dropped to 44% for B-CCC rated countries.

To form financial openness partitions, using the entire World Bank dataset of 115 countries, we divide the dataset into tertiles and classify each country as high, moderate and low financial openness based on these divisions.[19] This classification method results in sub-samples of 21 high, 16 moderate and 10 low financial openness countries. Partitioning the spanning results based on financial openness yields results similar to the default risk partitions. On average, we reject the spanning null hypothesis for approximately 50% of the countries in the high and low-openness categories, and approximately 70% in the mid-openness partition.

[19] Tertiles cut offs from the World Bank dataset were formed using the average market capitalization to GDP for each country from 2001 to 2009. A country's openness classification is based on its average market capitalization to GDP from the CDS initiation date to February 27, 2009.

5.1.3. Spanning Tests Using 5-year Maturity Bonds Including Market Friction Controls

As previously discussed, a concern when interpreting the results in Table III is the potentially confounding influences of maturity differences between the bond portfolio and the CDS contract. To mitigate this concern, we create the yield time-series of a 5-year generic bond for each country as follows: 1) At each date, two bonds one with a 3-5 year maturity and one with a 5-7 year maturity are selected and used to linearly interpolate the spread of a 5-year bond. If more bonds meet the maturity criterion, the closest to the 5-year maturity is chosen; 2) If no bond data are available for interpolation, but bonds with 3-7 year maturities are available, the two bonds with maturities closest to 5-years are selected and used to linearly extrapolate the spread of the 5-year bond. 3) Countries with no bond data available either for interpolation or extrapolation are excluded.

To control for the potential influence of innovations in market frictions, we follow Levy (2009) and strip bond and CDS prices of liquidity and counterparty risk premiums. As proxies for CDS and bond liquidity premiums, we use the midpoint of the bid-ask spread for each asset collected from Datastream. As a proxy for counterparty risk we use the 5-year swap spread, calculated as the difference between the swap rate and the corresponding maturity Treasury yield. The swap spread captures the default risk associated with the financial institution quoting LIBOR, where financial institutions are also the counterparties in CDS contracts. In total, 29 of the 45 countries in the spanning sample have adequate bond data to estimate the spread time-series of 5-year maturity bonds. Missing bid-ask spread data for 9 countries results in a final sample of 20 countries.

To strip the 5-year CDS and bond spreads of market friction factors, we regress the CDS spread on its liquidity premium proxy and the counterparty risk proxy, and likewise regress the

5-year bond spread on the bond liquidity premium proxy. We then replicate the spanning test in equation (2) using the residuals from these regressions. The results are reported in Table IV. In aggregate, we find highly similar results between the two methods (57% relative to 50% spanning rejection rate between the simple and augmented tests, respectively).

In unreported tests, we also replicate the sub-sample analysis, partitioning on default risk and financial market openness. The results are similar to those based on bond portfolios, but are difficult to interpret due to the small number of countries in each partition, resulting in very coarse increments in the percentage of countries for which spanning is rejected. As a final robustness check, in unreported tests we replicate the full sample analysis in Table III excluding the crisis period from September 15, 2008 (Lehman Brothers bankruptcy) to the end of the sample. We find similar results, suggesting that the crisis related limits to arbitrage factors documented by Bai and Collin-Dusfresne (2010) are not influencing our results.

To summarize the spanning test results, for 50-57% of the countries in our sample, we find that CDS trading initiation contributes new factors that influence the price of sovereign debt, rendering the market more complete. Spanning enhancement effects are similar across default risk and financial market openness partitions. Although CDS derivatives are not redundant in the majority of the markets we examine, benefits are not pervasive and opportunities exist for future research which further explores and seeks to explain the cross-sectional variation in spanning enhancement.

5.2. Price Informativeness Analysis

In the previous section, we examined the extent to which debt markets become more complete following CDS trading commencement. We now examine the impact of CDS trading initiation on the speed with which previously existent risk factors are impounded in sovereign bond prices.

Drawing on Westphalen (2001) and Collin-Dufresne et al. (2001), at the daily frequency, we model the change in sovereign bond spreads as a function of:

i. *Local Business Climate*

The strength and robustness of a country's economy relates to its government's taxation cash flows and correspondingly its ability to service and repay debt. To proxy for local business conditions we use the return to the Morgan Stanley Capital International (MSCI) equity index for each country (*INDEX*).

We also include the volatility of the MSCI country index to proxy for uncertainty in the local business climate. To measure volatility (*VOL*) we follow Avramov et al. (2006) and Jones et al. (1994) who use the absolute residual from the regression of the index return on twelve lags of the index return and day of the week indicator variables.

ii. *Global Business Climate*

Longstaff et al. (2011) and Attinasi et al. (2009) show that global risk perceptions factor strongly in sovereign debt pricing in the CDS and sovereign bond markets. To proxy for global market conditions we use the return of the MSCI global stock index (*WORLD*).

iii. *Yield Curve Characteristics*

To capture yield curve characteristics we follow Brandt and Kavajecz (2004) and extract the first three orthogonal principle components from a set of US T-Bills (90 day, 1-year, 2-year, 5-year, 7-year, and 10-year maturities obtained from the Federal Reserve's H.15 report) performed on the covariance matrix of the yields. It is commonly held that these three factors, associated with level (*YL*), slope (*YS*) and curvature (*YC*), govern the default-free term structure (see also Dittmar and Yuan, 2008 and Litterman and Scheinkman, 1991).

iv. *Exchange Rate*

To capture default likelihood we include the local currency-USD exchange rate (*ER*). As the sovereign bonds we examine are denominated in USD, purchasing power relative to the USD is a reflection of the ability to repay debt. Further, exchange rates reflect political stability and currency investor perceptions of country risk. In support of the use of exchange rate as a default risk proxy, Jahjah and Yue (2004) document a link between exchange rate policy, sovereign bond spreads and default likelihood.[20]

Our focus on these factors is motivated by the need for a parsimonious model, based on variables that are available at a daily frequency and are known to influence sovereign bond prices. For these reasons we utilize the models proposed by Westphalen (2001) and Collin-Dufresne et al. (2001) and, by necessity, exclude some of the variables considered in the previously discussed CDS initiation likelihood logit models.

To measure the speed with which these factors are incorporated in sovereign bond spreads, we follow Hou and Moskowitz (2005), who study cross-firm variation in the lagged response of equity prices to market news. In the context of sovereign debt, for each bond *i*, we calculate the daily frequency, time-series regression:

$$\Delta SP_{i,t} = \alpha_i + \beta_i^I INDEX_{j,t} + \beta_i^W WORLD_t + \beta_i^V \Delta VOL_{j,t} + \beta_i^{Y1} \Delta YL_t + \beta_i^{Y2} \Delta YS_t + \beta_i^{Y3} \Delta YC_t + \beta_i^E \Delta ER_{j,t} + \varepsilon_{i,t} \quad (4)$$

[20] We are constrained from using more direct measures of default likelihood, such as leverage or total sovereign debt as these proxies are only available at an annual frequency. Exchange rate and MSCI index data are obtained from Datastream.

where ΔSP is the change in the sovereign bond spread, j is the issuing country and t denotes time. In six separate models (one for each price factor with the exception of *ER*), we then augment this model to include five lags of each price factor.[21] In this manner, the change in price informativeness for each price factor is evaluated separately. Comparing the R^2 obtained from the base model (equation 4) relative to the augmented models which include lagged values for one price factor, we calculate the delay in spread adjustment to each price factor as:

$$D_{rsq} = 1 - \frac{R^2_{base}}{R^2_{augmented}} \tag{5}$$

The faster new information is incorporated into bond spreads, the smaller the difference between the R^2 of the augmented and base models, as lagged price factors add little by the way of explanatory power. Thus, as the speed of spread adjustment increases, the D_{rsq} delay measure decreases. To provide a sense of the model explanatory power, the mean and standard deviation of the R^2 from equation (4) is 39% and 24%, respectively, calculated by bond over the 3-month period prior to the initiation of CDS trading. When five lags of index return are added to the model, the average R^2 increases to 46% with a standard deviation of 21%. These statistics suggest that the model has reasonable explanatory power and that there is significant cross-sectional variation in the predictive power across bonds as lagged factor values are added to the model.

For each bond, we separately calculate D_{rsq} values for the 3-month period bracketing CDS trading initiation. The difference in the pre and post-initiation delay measures captures the

[21] We do not evaluate the change in price informativeness related to exchange rate as this variable is constant for countries with currencies pegged to the USD (Panama) and exhibits high serial correlation for China, Lebanon, El Salvador and Qatar. Phillips (2011) and Acharya and Johnson (2007) similarly utilize the Hou and Moskowitz (2005) model employing five daily lags of price factors when evaluating the price efficiency implications of derivatives.

effect of CDS trading on sovereign bond price efficiency. We seek to utilize a proximal timeframe relative to the initiation of CDS trading to minimize potential endogenous factors and follow Dittmar and Yuan (2008) who use similar timeframes when they analyze the effects of sovereign bond issuance on the corporate bond market.[22] The inclusion of the contemporaneous price factors in each model allows us to control for endogenous factors which may influence price efficiency coincidental with the initiation of CDS trading. Further, the use of differences in delay allows us to implicitly control for cross-country variations in efficiency and factor sensitivities. Further robustness analysis controlling for the previously discussed CDS initiation endogeneity biases follow in section 5.2.3.

5.2.1. Aggregate Analysis

Table V.A reports the mean change in spread adjustment efficiency, by country, for each price factor. Only bonds with spread data available 3-months before and after CDS trading initiation are considered in the price informativeness analysis, excluding 6 bonds from the analysis. In total 213 bonds from 48 countries were available for analysis. As two or fewer bonds were available for approximately half of the sample, we lack statistical power to make inferences regarding statistical significance at the country level and thus, we limit our discussion of Panel A to aggregate trends.

First, focusing on the raw changes, it can be observed that, on average, an improvement in spread adjustment efficiency (negative change in delay) is realized for all but one of the price factors (*YS*, the slope of the default-free term structure). Only efficiency improvements in relation to local and global business conditions are statistically significant at the 10% level (t-

[22] Dittmar and Yuan (2008) evaluate a range of 1 to 7 weeks following sovereign bond issuance. We extend this period slightly to 12 weeks and conduct robustness analysis over the same time range.

statistics -1.80 and -2.15). To provide a sense of scale, drawing on the unreported D_{rsq} values and focusing on the *INDEX* price factor, across all bonds the average D_{rsq} dropped from 0.1961 to 0.1597 following CDS trading initiation, representing a 19% improvement in yield adjustment efficiency. The *WORLD* and *VOL* factors realized similar magnitude efficiency gains. Second, it can also be noted that the gains observed in aggregate are not pervasive across countries. The number of countries which realize improvements in yield efficiency ranges from a high of 69% of countries in relation to the *INDEX* factor to a low of 48% countries for the *ΔYC* factor. There is also significant cross-sectional variation in the magnitude of the gains and losses in efficiency. We examine this variation in more detail in Panels B and C of Table V.

It is possible that the efficiency changes we note reflect time-series trends in sovereign bond characteristics (i.e. sovereign bonds may endogenously be improving in efficiency over time). To mitigate this concern, we create a time-series matched control sample for each country. We exclude from the control sample the bonds for countries for which CDS trading initiation occurred within 3 months of the test country but place no other restrictions.[23] The control sample average change in efficiency is calculated separately for each country and risk factor, contrasting price adjustment delay 3-months before and after CDS initiation of the test country. We then calculate the excess change in efficiency as the difference in the average change in efficiency for the test country and the time-series matched control sample. In Table V.A. only the raw changes are reported by country, but we summarize the mean excess change in efficiency by risk factor at the bottom of the panel. The mean change in efficiency and the percentage of negative mean observations is similar between the two change measures. The significance levels of the changes in the local and world indexes and in the local index volatility

[23] The control sample includes bonds for countries with and without a traded CDS. As we examine the change in efficiency, if bonds with a traded CDS are inherently less or more efficient, this systematic difference will be controlled for in the first difference of the process.

are higher; all are significant at the 5% level (t-statistics -2.77, -2.76 and -2.23, respectively). These results suggest that, if anything, general efficiency in the sovereign bond market decreased coincidentally with CDS initiation and that the efficiency gains we document superseded these aggregate trends.

5.2.2. Sub-sample Analysis

To evaluate the cross-sectional variation in sovereign bond price efficiency associated with CDS initiation, we establish financial openness and default risk partitions as previously described in section 5.1, but use values at the time of CDS initiation as opposed to time-series averages. This approach yields partitions containing 20 high, 15 moderate and 13 low financial openness countries. Table V.B reports the financial market openness sub-sample analysis results. Two key results can be observed. Statistically significant improvements in bond price efficiency are isolated to the low financial openness group, for which significant improvements in efficiency are realized for all of the price factors with the exception of global index return (*WORLD*) and term structure level (*YL*), t-statistic -1.60 and -1.02, respectively.

Second, the magnitude of the improvement in efficiency for the low openness group is substantially greater than either the high or moderate openness groups across all six price factors, again with the exception of the global index return factor for which efficiency gains are consistent across openness partitions. For example, contrasting the high and low openness partitions for the *INDEX* price factor, for the low openness group D_{rsq} decreased by 0.0571 representing a 32% improvement in price efficiency (based on the unreported D_{rsq} values). In contrast, the change in efficiency for the high openness group was -0.0135, representing an improvement of less than 9%, which, as previously reported, is not statistically significant.

Disparity across openness partitions is similar or greater for the other price factors, with the noted exception of the global index return.

Highly similar results are found when we partition instead on credit rating. Credit rating subsets are established as previously described, which yields reasonably even groups of 10 to 14 countries in each subset. Without exception, statistically significant improvement in price efficiency is isolated to the B-CCC credit rating group, which realizes statistically significant improvements across all six price factors. Similarly, the magnitude of the improvement is typically greater for the B-CCC credit rating partition relative to the other partitions. For example, contrasting the B-CCC and the AAA-AA partitions, the average improvement across the six price factors is 0.0954 relative to 0.0049, respectively. As noted for the openness partitions, the magnitude of the difference for the global index return factor is lower, 0.0446 for the AAA-AA partition relative to 0.0617 for the B-CCC partition.

We undertake the same robustness tests (unreported), calculating excess change in efficiency by openness and rating group. We recognize that efficiency trends possibly vary across country characteristics, thus in addition to time series matching, we also match each control sample separately on openness and credit rating group (i.e. using the mean change in efficiency to control sample bonds in the same credit rating or openness group as the test country). Results calculated using the excess change in efficiency for the sub-sample partitions are highly similar and are available upon request.

In summary, we find that price efficiency effects related to CDS trading initiation vary significantly across country-level attributes. While on average price efficiency gains are noted for the aggregate sample across five of the six price factors we examine, sub-sample analysis indicates that statistically significant efficiency gains are, in fact, isolated to high default risk and low financial market openness countries. These results are consistent with the previously presented hypotheses that the potential impacts of CDS trading initiation should be most pronounced for countries that stand to benefit the most from improvement in the ability to hedge adverse selection costs and expansion of the risk-return space.

5.2.3. CDS Initiation Robustness

As previously discussed, a concern with the approach utilized in this analysis is the potential to spuriously attribute characteristics common to bonds at the time of CDS initiation as initiation effects. To mitigate these concerns, we use a control process similar to Mayhew and Mihov (2005) and Phillips (2011), who construct control samples drawn from stocks eligible for option listing, but not yet listed, which match on factors shown to influence the option listing decision. In those papers, a difference-in-difference approach between the test and control samples is utilized to disentangle option introduction effects from characteristics common to stocks selected for option listing.

Our ability to construct a control sample is extremely limited by the small number of countries with sovereign debt data available in Datastream. Beyond the 54 countries included in our analysis, sovereign bond data is available for only 3 additional countries. The small sample size, and short timeframe over which sovereign CDS initiations occur, further precludes construction of a within-sample control. Given these limitations, as an alternative endogeneity control approach, we regress the country level change in price efficiency for each of the six price factors (reported in Table V.A) on the four factors found to predict CDS initiation likelihood in section 4:

$$\Delta D_{rsq,n}^{i} = \alpha_0 + \beta_1 VOL_t + \beta_2 VOLPRM_t + \beta_3 \Delta FORRES_t + \beta_4 \Delta ER_t + \varepsilon_i \tag{6}$$

where Δ is the change in price efficiency for price factor *n*, for country *i* ; *VOL*, *VOLPRM*, *ΔFORRES* and *ΔER* are as previously defined; and *t* is the quarter prior to CDS initiation. In this model, the four determinant variables capture the proportion of the change in price efficiency related to bond characteristics common to bonds at the time of CDS initiation. The residual of this regression is the change in price efficiency stripped of this potential endogeneity bias. Via this approach we are able to achieve the same effect as implementing a difference-in-difference control sample.

The results of the endogeneity control regressions are reported in Table VI. With the exception of the volatility risk premium (*VOLPRM*) coefficient in the global index return (*WORLD*) regression (t-statistic 2.07), none of the coefficients for the determinant variables are significant in each of the six regression models. This result suggests that factors common to bonds at the time of CDS initiation have little explanatory power in relation to price efficiency gains realized at the time of initiation. In other words, we can with greater confidence assert that the previously noted price efficiency changes are truly CDS initiation effects. As a further test, in unreported results, we replicate Panels B and C of Table V using the residual change in efficiency values calculated in equation (6). As would be expected given the low significance of the coefficient values and the small model R^2, our conclusions were unaffected. Significance in the change in residual price efficiency remained isolated to countries with low financial openness and high default risk.

5.3. Risk Premium Effects

To conclude our empirical analysis, we evaluate if the reported post-CDS improvements in sovereign bond price informativeness translate into risk premium reductions. Duffie et al. (2003) show that sovereign bond yields are dependent on the risk-free term structure, default risk and liquidity effects. To isolate the liquidity premium portion of the bond yield (which we term the excess risk premium), we utilize a method similar to Dittmar and Yuan (2008):

$$SP_{i,t} = \gamma_0 + \gamma_1 YL_t + \gamma_2 YS_t + \gamma_3 YC_t + \gamma_4 JPMI_{i,t} + \gamma_5 ER_{i,t} + \eta_{i,t} \quad (7)$$

where $SP_{i,t}$ is the stripped-spread for bond *i*, *YL, YS* and *YC* are the first three principal components of a series of Treasury bonds (as previously defined), $JPMI_{i,t}$ is the stripped-spread of the JP Morgan country bond index, $ER_{i,t}$ is the local currency-USD exchange rate, and $\eta_{i,t}$ is the residual spread which reflects the excess risk premium.[24] For a country to be included in the risk premium analysis, both bond stripped spread and JP Morgan bond index data must be available in Datastream for the 3 month periods bracketing CDS initiation. These criteria result in a sample of 36 countries.

We select the JP Morgan EMBI and JP Morgan GBI Bond indexes as proxies for default risk in emerging economies and developed markets, respectively.[25] Beyond their role as a proxy for country credit risk, the indices serve as endogeneity control factors. CDS initiation may be

[24] The logarithm of each variable is used in the model.

[25] JP Morgan bond index data is obtained from two sources. For emerging markets we use the reported stripped-spread of the JP Morgan EMBI Global bond index. For developed markets, we calculate the stripped-spread as the redemption yield of the JP Morgan GBI Bond index less the yield of a comparable-maturity US T-Bill. The JP Morgan EMBI Global index consists of USD-denominated Brady Bonds, Eurobonds, Traded Bonds and local market debt instruments issued by emerging market sovereign and quasi-sovereign reference entities. The JP Morgan GBI indices generally track fixed rate issuances from high-income countries spanning North America, Europe, and Asia.

an endogenously motivated event, as the CDS writers may issue CDS contracts as a source of income when default probabilities are low. As all bonds in our sample are USD-denominated, the exchange rate is used to isolate the bond spread from the effect of any currency shocks. The resulting residuals represent the innovation in the yield spreads independent of the average yield movements in the country, and the default-free term structure and currency effects. They reflect the bond's excess risk premium.

It should be recognized that a change in the excess risk premium associated with CDS initiation may result via multiple channels. On one hand, CDS initiation may provide a liquidity service, reducing barriers to investment, increasing investor participation and ultimately reducing the liquidity premium for the underlying bond. Alternatively, a change in the excess risk premium could result from a change in default risk factor sensitivity due to enhanced hedge access or improved information flows. Only if risk factor sensitivity effects are consistent across the assets which comprise the JP Morgan index and the bonds we examine, can we, with confidence, ascribe changes in the excess risk premium as liquidity service effects. As CDS initiation effects on bond risk premiums potentially stem jointly from the two channels, we refer to the change in the spread after controlling for the risk-free term structure and default risk as the change in the excess risk premium.[26]

The risk premium effect is measured as the change in the residual bond spread obtained in equation (7), contrasting the periods 3-months before and after CDS initiation.[27] For each country in the sample, we estimate the pooled regression model:

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[26] Dittmar and Yuan (2008) similarly note that they cannot conclusively tie the improvement in yield spreads in their model to liquidity effects, acknowledging that some of the yield spread change may be due to credit-risk impacts.

[27] For robustness, we replicate the tests on 2-month and 4-month windows surrounding CDS initiation. As results are consistent across all three timeframes, in the interest of brevity we report only the 3 month window results.

$$\eta_{ij,t} = \alpha_j + \beta_j CDS_{j,t} + \sum_k \gamma_{kj} SB_{kj} + \sum_l \delta_{lj} YM_{lj} + \varepsilon_{ij,t} \tag{8}$$

where η_{ij} is the residual for bond i issued by country j obtained in equation (7), CDS_j is an indicator variable that takes the value of one after CDS initiation and zero before, SB_{kj} are indicator variables for other sovereign bonds issued by country j and outstanding in the 6-month period surrounding CDS initiation and YM_{lj} are indicator variables for each distinct year-month combination. Standard errors are corrected based on the Newey and West (1987) procedure. A negative (positive) coefficient for CDS_j reflects a reduction (increase) in excess risk premiums following CDS initiation, with the magnitude of the effect captured by the absolute value of the coefficient.

The regression results are reported in Table VII.A. We find that CDS initiation has a statistically significant impact on the excess risk premium of the majority of sovereign bonds in our sample. The sign of the indicator variable coefficient (*CDS*), however, is mixed, reflecting a risk premium reduction for some sovereigns and an increase in borrowing costs for others. For example, during the 3-month period after CDS initiation, Chile's excess risk premium declined on average by 5.91% relative to the 3-month period before the event, while Panama's excess risk premium increased by 8.00% over the same period. We explore this cross-sectional heterogeneity in more detail in the following section.

5.3.1. Sub-sample Analysis

Based on the previously discussed motivation, we evaluate cross-sectional variation in CDS initiation risk premium effects across default risk and financial market openness partitions (as defined in section 5.2). Daily residual stripped-spreads are calculated as in equation (8). We then calculate a pooled regression model similar to equation (8) separately for each default risk and financial market openness partition:

$$\eta_{j,t} = \beta_0 + \beta_1 CDS_{j,t} + \sum_k \lambda_k X_k + \sum_l \theta_l YM_l + \xi_{j,t} \tag{9}$$

where η_j is country j's average residual stripped-spread, X_k are country fixed-effects and the remaining variables are as previously defined.

The risk premium sub-sample regression results are reported in Table VII.B. Focusing first on the default risk partitions, we find that sovereigns in the AAA-AA rating category realize the largest borrowing cost reductions, with an average excess risk premium decline of 26.73% in the 3-months following CDS initiation. Based on average country bond spreads, in real terms this reflects a yield reduction of approximately 13 bps. Conversely, the BB rating category realized an average borrowing cost increase of 2.70%, equivalent to an average spread increase of approximately 14 bps. CDS initiation effects for the other two credit rating categories (B-CCC and A-BBB) are not statistically significant.

The results for the financial openness tertiles are strikingly similar. High financial openness countries realize a significant reduction in excess risk premiums following CDS initiation (15.09%). In contrast, effects on countries with moderate financial openness are statistically insignificant while low openness countries realize an average increase in borrowing costs of 4.53%. Although these results are consistent with our expectation of cross-sectional variation in risk premium effects across default risk and information asymmetry dimension, our ex-anti expectation was that benefits would be greater for higher default risk and more informationally-opaque countries. These results suggests that improved informational efficiency following CDS initiation comes at a cost for high default risk and low opacity countries, where the improved information environment appears to be related to increased risk premiums.

In order to more carefully attribute the cause of the documented CDS initiation effects, a natural test would be the analysis of transaction volume between the two exchanges. Unfortunately transaction volume for CDS contracts is not available and our data source reports only sporadic transaction volume data at a monthly frequency for a small sub-sample of bonds. Das et al. (2010) report that, on average, liquidity decreases after CDS initiation for corporate bonds, but they do not evaluate cross-sectional variation across default risk or information asymmetry partitions. We are unfortunately forced to leave a more detailed analysis of the causes of our documented risk premium effects to future research at a time when richer data is available.

In summary, we find that borrowing costs for less risky and more financially open countries decrease in the months following CDS initiation. In contrast, riskier and more opaque governments realize an increase in the cost of debt following the onset of CDS trading. These results are potentially driven by a series of liquidity related effects. First, enhanced hedge access associated with CDS initiation may reduce monitoring and the related trading by financial institutions as hedged assets need not be monitored as closely. Second, in the absence of a CDS market, as the default risk of an entity increases, trading activity increases as bondholders seek to divest riskier or troubled securities. Conversely, bondholders in a CDS-bond covered position have more to gain from holding the CDS contract at default than selling the troubled asset, which may diminish the liquidity of the underlying bond.

5.3.2. CDS Initiation Robustness

We implement the same CDS initiation endogeneity control process described in section 5.2. Specifically, we regress the *CDS* coefficients (reported in Table VII) on the four factors found to most strongly predict CDS initiation likelihood (see section 4 for details): the volatility of the local country equity index (*VOL*), the volatility risk premium (*VOLPRM*), foreign currency reserves (*FORRES*) and the local currency-USD exchange rate (*ER*):

$$CDS_{coeff} = \alpha_0 + \beta_1 VOL_t + \beta_2 VOLPRM_t + \beta_3 \Delta FORRES_t + \beta_4 \Delta ER_t + \varepsilon_i \tag{10}$$

where *t* is the quarter prior to CDS initiation.

The results of the endogeneity control regression are reported in Table VIII. Without exception, all four coefficient values are insignificant with absolute t-statistic values no greater than 0.38. These results suggest that factors shown to predict CDS initiation likelihood have no significant relation to the average change in residual bond spreads (yields stripped of risk-free term structure and default risk) at the time of initiation. This finding gives us confidence that the risk premium effects we document are indeed CDS initiation effects and not endogenous trends in bond characteristics common to bonds selected for CDS trading.

6. Conclusion

In this paper, we examine the effects of sovereign CDS trading initiation on the underlying bonds from 54 countries, focusing on market completeness, price efficiency and borrowing costs. We find that, for the majority of countries we examine, CDSs contribute unique factors to the pricing of sovereign debt and the initiation of their trading enhances market completeness. Bonds issued by countries with high default risk and low financial market openness realize significant improvement in price adjustment efficiency following CDS initiation. Conversely, countries with moderate to low default risk and mid to high openness realize minimal price efficiency effects. Borrowing cost benefits similarly vary with country-level characteristics. Countries with high financial market openness and low default risk realize significant reductions in borrowing costs while low openness and high default risk countries realize risk premium increases.

If factors that influence the CDS initiation decision similarly influence bond characteristics, the potential exists to spuriously attribute characteristics common to bonds at the time of CDS initiation as initiation effects. As part of the endogeneity control process we identify the determinants of CDS initiation likelihood. Increases in local equity market volatility and the volatility risk premium and decreases in foreign currency reserves and in the local currency-USD exchange rate are found to increase the likelihood of CDS initiation for a given country. These results are consistent with investor demand for CDS contracts being driven by local and global financial market uncertainty and the ability of a country to service USD-denominated debt. Our results are robust to a method based on these factors, designed to control for characteristics common across bonds chosen for CDS initiation.

Taken collectively, these results suggest that the impact of credit derivatives in the sovereign bond market is broadly positive. Debt markets become more complete and informative (at least for informationally-opaque countries, for which it likely matters the most) and borrowing costs are substantially reduced for low default risk and high financial market openness countries. The adverse impact on borrowing costs for informationally-opaque countries, although negative for the country in question, potentially reflects more accurate pricing of default risk resulting from enhanced information flows. While our results cannot necessarily be extended to the context of naked, speculative CDS positions that are the focus of the Eurozone bans, they regardless have bearing. Broad reaching bans on naked CDS positions, which likely represent the majority of CDS trading, have potentially adverse and unintended implications on the quality of the sovereign debt market, reversing the benefits we document.

Appendix

A. Variable Definitions

This appendix provides additional details regarding the determinant variables used as predictors of sovereign CDS trading initiation likelihood in section 4.

1. **Local Stock Market Return (*INDEX*).** The local stock market return is the quarterly total return including dividends for the equity index of each country. The data is obtained from Datastream, with MSCI or S&P IFC as the underlying source of each index.
2. **Local Stock Market Volatility (*VOL*).** Local stock market volatility is calculated as the sum of squared monthly returns, by quarter, for the local stock market index (*INDEX*). As daily returns are available for a limited number of the countries in our sample, by necessity, we calculate volatility in this manner in contrast to the method described in Section 5.2.
3. **Exchange Rate (*ER*).** Exchange rates are expressed as units of local currency to the USD and are obtained from Bloomberg.
4. **Foreign Currency Reserves (*FORRES*).** The USD value of foreign currency holdings are collected from Datastream with the World Bank as the underlying source. Defined as Foreign Exchange Reserves, they include foreign banknotes, bank deposits, treasury-bills, short and long-term government securities, ECUs and other claims usable in the event of a balance of payment need.
5. **Sovereign Credit Rating (*CREDIT*).** The foreign currency credit rating is obtained from the Standard and Poor's Sovereign Rating and Country Transfer and Convertibility Assessment Histories (2009). The ratings are assigned a numeric value where AAA=1, AA=2 through C=9.

6. **Gross Domestic Product (*GDP*).** Gross domestic product in USD, seasonally and inflation adjusted, is collected from Datastream with the World Bank as the underlying source.
7. **Global Index Return (*WORLD*).** Global index return is the total return to the MSCI Global Equity Index.
8. **Equity Risk Premium (*EQU*).** As a proxy for the equity risk premium we follow Longstaff et al. (2011) and use the price-earnings ratio for the S&P 100 index obtained from Datastream.
9. **Volatility Risk Premium (*VOLPRM*).** The volatility risk premium is calculated as the difference between the VIX index (expected volatility) and realized volatility calculated as in Garman and Klass (1980). The S&P 500 index open, close, low and high values used in the Garman-Klass calculation are obtained from Datastream. The VIX index corresponding to the S&P 500 index is obtained from the Chicago Board Option Exchange website.
10. **Default Spread (*DEF*).** The default spread is calculated as the difference in yields between the BBB and AAA rated US corporate bond index yields obtained from the Federal Reserve Bank of St. Louis.
11. **Regional (*REG*) and Global (*GLOBE*) CDS Spreads.** For each country, we calculate the regional CDS spread as the equal-weighted average CDS spread for all countries in that region, excluding the spread for that country. We use five broad regions: Asia, Middle East, Eastern Europe, Western Europe and Latin America. Canada and the United States, being the only North American countries, are included in the Western Europe region. The regional and global indexes are then orthoganalized by regressing them on the other determinant variables. The residuals from these regressions are then used as the measures of the regional and global CDS spreads.

12. **Financial Market Openness (*OPEN*).** Financial market openness is calculated as the ratio of local stock market capitalization to gross domestic product, obtained from the World Bank.

References

Acharya, V. and T. Johnson. 2007. Insider trading in credit derivatives. *Journal of Financial Economics* 84, 110-141.

Ammer, J. and F. Cai. 2011. Sovereign CDS and bond dynamics in emerging markets: Does the cheapest-to-deliver option matter? *Journal of International Financial Markets, Institutions and Money* 21, 369-387.

Ashcraft, A. and J. Santos. 2009. Has the CDS market lowered the cost of corporate debt? *Journal of Monetary Economics* 56, 514-523.

Attinasi, M., C. Checherita and C. Nickel. 2010. What explains the surge in Euro area sovereign spreads during the financial crisis of 2007-09? Working paper, European Central Bank.

Avramov, D., T. Chordia and G. Amit. 2006. The impact of trades on daily volatility. *Review of Financial Studies* 19, 1241-1277.

Bai, J. and P. Collin-Dufresne. 2010. The determinants of the CDS-bond basis during the financial crisis of 2007-2009. Working paper, Federal Reserve and Columbia University.

Baldacci, E., S. Gupta and A. Mati. 2008. Is it (still) mostly fiscal? Determinants of sovereign spreads in emerging markets. IMF Working paper No. 259.

Bekaert, G. and M. Urias. 1996. Diversification, integration and emerging market closed-end funds. *Journal of Finance* 51, 835-869.

Blanco, R., S. Brennan and I. Marsh. 2005. An empirical analysis of the dynamic relationship between investment-grade bonds and credit default swaps. *Journal of Finance* 60, 2255-2281.

Brandt, M. and K. Kavajecz. 2004. Price discovery in the U.S. treasury market: The impact of orderflow and liquidity on the yield curve. *Journal of Finance* 59, 2623-2654.

Brennan, M. and H. Cao. 1997. International portfolio investment flows. *Journal of Finance* 52, 1851-1880.

Chan-Lau, J. and Y. Kim. 2004. Equity prices, credit default swaps and bond spreads in emerging markets. Working paper, International Monetary Fund.

Collin-Dufresne, P., R. Goldstein and S. Martin. 2001. The determinants of credit spread changes. *Journal of Finance* 56, 2177-2207.

Danielsen, B., B. Van Ness and S. Warr. 2007. Reassessing the impact of option introductions on market efficiency: A less restrictive test for event-date effects. *Journal of Financial and Quantitative Analysis* 42, 1955-1980.

Das, S., M. Kalimipalli and S. Nayak. 2010. Did CDS trading improve the market for corporate bonds? Working paper, Santa Clara University.

Detemple, J. and L. Selden. 1991. A general equilibrium analysis of option and stock market interactions. *International Economic Review* 32, 279-303.

Dieckmann, S. and T. Plank. 2010. Default risk of advanced economies: An empirical analysis of credit default swaps during the financial crisis. Working Paper, University of Pennsylvania.

Dittmar, R., and K. Yuan, 2008. Do sovereign bonds benefit corporate bonds in emerging markets? *Review of Financial Studies* 21, 1983-2014.

Duffie, D. 2010. Is there a case for banning short speculation in sovereign bond markets? *Financial Stability Review* 14, 55-59.

Duffie, D. 1999. Credit swap valuation. *Financial Analysts Journal* 55, 73-85.

Duffie, D., L. Pedersen, and K. Singleton. 2003. Modeling sovereign yield spreads: A case study of Russian debt. *Journal of Finance* 58, 119–59.

Ferrucci, G. 2003. Empirical determinants of emerging market economies' sovereign bond spreads. Working paper No. 205, Bank of England.

Garmin, M. and Klass, J. 1980. On the estimation of security price volatilities from historical data. *Journal of Business* 53, 67-78.

Gorton, G., and G. Pennacchi. 1993. Security Baskets and Index-Linked Securities, *Journal of Business* 66, 1–27.

Grossman, S. 1988. An analysis of the implications for stock and futures price volatility of program trading and dynamic hedging strategies. *Journal of Business* 43, 617-633.

Hilscher, J. and Y. Nosbusch. 2010. Determinants of sovereign risk: Macroeconomic fundamentals and the pricing of sovereign debt. *Review of Finance* 24, 235-262.

Hou, K. and T. Moskowitz. 2005. Market frictions, price delay, and the cross section of expected returns. *Review of Financial Studies* 18, 982-1020.

Huberman, G. and S. Kandel. 1987. Mean-variance spanning. *Journal of Finance* 42, 873-888.

Hull, J., M. Predescu and A. White. 2004. The relationship between credit default spreads, bond yields and credit rating announcements. *Journal of Banking and Finance* 28, 2789-2811.

Ismailescu, I. and H. Kazemi. 2010. The reaction of emerging markets credit default swap spreads to sovereign credit rating changes. *Journal of Banking and Finance* 34, 2861-2873.

Jahjah, S. and V. Yue. 2004. Exchange rate policy and sovereign bond spreads in developing countries. Working paper, International Monetary Fund.

Jones, C., G. Kaul and M. Lipson. 1994. Transactions, volume and volatility. *Review of Financial Studies* 7, 631-651.

Kan, R. and G. Zhou. 2011. Tests of mean-variance spanning. *Annals of Economics and Finance*, forthcoming.

Kang, J. and R. Stultz. 1997. Why is there a home bias? An analysis of foreign portfolio equity ownership in Japan. *Journal of Financial Economics* 46, 3-28.

Levy, A. 2009. The CDS basis spread in emerging markets: Liquidity and counterparty risk effects, Working paper, Israel Institute of Technology.

Liao, W., 2006, Single-name CDS arbitrage mechanisms, Working paper, City University of New York.

Litterman, R., and J. Scheinkman. 1991. Common factors affecting bond returns. *Journal of Fixed Income* 1, 54-61.

Longstaff, F., S. Mithal and E. Neis. 2005. Corporate yield spreads: Default risk or liquidity. *Journal of Finance* 60, 2213-2253.

Longstaff, F., J. Pan, L. Pedersen and K. Singleton. 2011. How sovereign is sovereign credit risk? *American Economic Journal: Macroeconomics* 3, 75-103.

Mayhew, S. and V. Mihov. 2004. How do exchanges select stocks for option listing? *Journal of Finance* 59, 447-463.

Mayhew, S. and V. Mihov. 2005. Short sale constraints, overvaluation and the introduction of options. Working paper, Texas Christian University.

Norden, L. and M. Weber, 2004. Informational efficiency of credit default swaps and stock markets: The impact of credit rating announcements. *Journal of Banking and Finance* 28, 2813-2843.

Phillips, B. 2011. Option introduction, short-sale constraints and market efficiency: A new perspective. *Journal of Banking and Finance* 35, 430-442.

Pickel, P. 2010. Testimony of Robert Pickel before the House Financial Services Subcommittee on Capital Markets, Insurance and the GSEs, U.S. House of Representatives, April 29, 2010.

Rajan, R. and L. Zingales. 2003. The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics* 88, 559-586.

Ross, S. 1976. Options and efficiency. *Quarterly Journal of Economics* 90, 75-89.

Saretto, A. and H. Tookes. 2010. Corporate leverage, debt maturity and credit default swaps: The role of credit supply. Working paper, University of Texas and Yale University.

Shiller, R. 1993. *Macro Markets.* Oxford University Press.

Shleifer, A. 2003. Will the sovereign debt market survive? *American Economic Review* 93, 85-90.

Standard and Poor's, 2009. Sovereign rating and country transfer and convertibility assessment histories. June 2009.

Stein, J. 1987. Informational externalities and welfare-reducing speculation. *Journal of Political Economy* 95, 1123-1145.

Stultz, R. 2009. Credit default swaps and the credit crisis. Working paper, European Corporate Governance Institute.

Van Nieuwerburgh, S. and L. Veldkamp. 2009. Informational immobility and the home bias puzzle. *Journal of Finance* 64, 1187-1215.

Westphalen, M. 2001. The determinants of sovereign bond credit spreads changes. Working paper, Universite de Lausannne.

Yuan, K. 2005. The liquidity service of benchmark securities. *Journal of European Economic Association* 3, 1156–1180.

Table I

Bond and CDS Data Summary Statistics

Table I reports the start dates of the bond and CDS data series, the number of bonds, the mean and standard deviation for the bond stripped-spreads and CDS spreads, bond market values and S&P foreign currency credit ratings by country. The sample starts on January 1, 2000 and ends on February 27, 2009. Table I is continued on the following page.

Country	Start of bond data	Start of CDS data	No. of bonds	Bond spread Mean (bps)	Bond Spread Std (bps)	CDS spread Mean (bps)	CDS spread Std (bps)	Bond market value (millions)	Average S&P credit rating
Australia	1/1/00	4/30/03	1	40.78	10.83	3.43	1.43	331.96	AAA
Austria	1/1/00	5/29/01	23	50.94	104.21	9.19	26.63	858.07	AAA
Bahrain	1/22/03	2/9/04	1	73.60	51.72	25.47	9.21	500.34	A
Belgium	1/1/00	1/31/01	6	48.66	27.77	9.58	18.62	724.82	AA
Brazil	1/1/00	1/11/01	29	479.19	454.64	517.66	637.15	1838.43	BB
Bulgaria	3/26/02	2/28/01	2	187.21	144.72	126.75	131.74	934.08	BBB
Canada	1/1/00	1/1/03	4	19.72	18.95	4.35	2.69	1954.47	AAA
Chile	1/1/00	2/1/02	4	104.91	54.03	69.39	71.69	763.29	A
China	1/1/00	1/2/01	10	107.65	132.40	43.98	32.07	703.49	A
Colombia	1/1/00	3/22/01	21	399.91	264.05	386.14	267.08	467.73	BB
Costa Rica	1/1/00	7/29/03	10	270.53	133.55	202.63	108.72	280.30	BB
Croatia	1/1/00	1/4/01	1	158.26	64.39	203.11	33.19	307.87	BBB
Denmark	1/1/00	11/26/02	10	18.07	15.69	6.21	15.77	735.47	AAA
Dominican Republic	9/21/01	6/30/03	3	684.21	478.76	730.03	659.86	220.23	B
Ecuador	8/21/00	6/6/03	4	978.91	952.00	892.28	906.32	1003.97	CCC
Egypt	7/2/01	3/21/02	3	188.20	133.09	216.58	159.59	1014.90	BB
El Salvador	1/1/00	4/30/03	8	253.52	194.19	181.48	128.89	672.19	BB
Finland	1/1/00	7/1/02	6	56.40	74.83	6.48	11.53	1034.18	AAA
Germany	1/1/00	7/2/02	2	35.35	36.59	8.02	14.46	5035.86	AAA
Ghana	9/28/07	5/15/08	1	1223.05	526.62	789.24	237.96	566.45	B
Greece	1/1/00	1/2/01	2	69.41	46.19	24.13	45.22	1887.45	A
Guatemala	1/1/00	7/29/03	6	251.97	197.36	215.12	119.34	342.54	BB
Hong Kong	7/16/04	7/30/04	1	85.07	28.86	24.35	29.11	1285.06	AA
Hungary	1/1/00	2/28/01	2	94.61	97.79	54.82	89.13	1102.54	A
Iceland	3/1/04	3/1/04	1	127.50	207.98	131.11	279.88	193.28	A

Table I continued

Country	Start of bond data	Start of CDS data	No. of bonds	Bond spread Mean (bps)	Bond Spread Std (bps)	CDS spread Mean (bps)	CDS spread Std (bps)	Bond market value (millions)	Average S&P credit rating
Indonesia	1/1/00	12/13/01	14	333.02	228.74	279.35	185.53	1083.86	B
Ireland	2/17/05	1/1/03	1	39.45	30.21	27.00	63.81	502.21	AAA
Israel	3/10/00	4/23/01	8	115.65	55.38	74.39	56.84	482.91	A
Italy	1/1/00	1/31/01	35	60.19	88.72	17.09	28.50	2501.10	AA
Jamaica	1/1/00	5/22/03	11	384.00	351.06	565.26	280.18	368.34	B
Kazakhstan	1/1/00	11/17/03	2	65.10	62.69	95.13	44.62	385.57	BBB
Korea	5/30/03	3/28/01	3	128.25	101.43	71.92	99.07	832.47	A
Lebanon	1/1/00	3/25/03	17	377.31	211.27	439.39	131.06	440.79	B
Malaysia	1/1/00	4/23/01	2	122.36	73.00	76.26	63.40	1853.93	A
Mexico	1/1/00	1/2/01	20	187.29	106.32	139.53	95.75	1788.36	BBB
New Zealand	1/1/00	7/31/03	6	106.93	62.77	20.02	37.21	210.46	AA
Pakistan	2/12/04	6/29/04	4	754.11	1402.63	676.32	845.27	438.24	B
Panama	1/1/00	2/1/02	11	273.31	133.86	225.01	137.39	656.82	BB
Peru	1/1/00	2/1/02	9	301.26	164.34	250.23	181.40	752.65	BB
Philippines	1/1/00	3/22/01	14	346.87	172.87	334.77	147.39	1152.33	BB
Poland	1/1/00	1/4/01	5	101.73	62.63	46.36	59.24	788.65	BBB
Portugal	1/1/00	2/7/02	2	16.90	20.42	8.58	2.27	1071.74	AA
Qatar	1/1/00	9/5/01	3	255.42	162.62	64.26	57.53	1571.51	A
Russia	1/1/00	9/18/01	12	279.44	216.45	256.13	206.27	2174.72	BB
South Africa	1/1/00	1/11/01	5	179.49	133.02	127.93	97.41	805.62	BBB
Spain	1/1/00	2/26/01	9	36.04	31.27	13.44	25.52	1381.65	AA
Sweden	1/1/00	5/29/01	16	40.02	40.33	8.35	21.54	900.91	AAA
Thailand	1/1/00	2/28/01	3	62.95	163.64	78.57	57.42	443.98	BBB
Turkey	1/11/00	1/19/01	25	384.27	260.20	417.87	290.29	1380.31	BB
Ukraine	3/15/00	9/26/02	8	517.22	860.79	486.44	755.75	715.19	B
United Kingdom	6/24/03	3/31/06	1	39.27	32.68	3.98	4.19	2950.16	AAA
Uruguay	1/1/00	4/29/02	17	640.37	468.95	403.84	612.93	249.52	B
Venezuela	1/1/00	2/26/01	17	530.93	404.40	652.12	644.00	1283.76	B
Vietnam	10/27/05	8/6/02	2	285.77	229.05	181.00	152.70	767.27	BB
Mean				240.23	199.68	202.26	174.48	1012.85	

Table II

The Determinants of CDS Trading Initiation

Table II reports standardized coefficient estimates and p-values from the logit model of CDS trading initiation as a function of global and country-specific factors. The determinant variables are quarterly in frequency and are lagged by one period in the model (the quarter before CDS initiation). *INDEX*, *WORLD*, *VOL* and *ER* are the local and global index return, local index volatility and the local currency USD exchange rate. *CREDIT* is the Standard and Poor's foreign currency credit rating, *GDP* is Gross Domestic Product expressed in USD, *FORES* is the USD value of foreign currency holdings, *EQU* is the equity risk premium, *VOLPRM* is the volatility risk premium, *DEF* is the default spread, *REG* and *GLOBE* are the orthoganalized regional and global sovereign CDS spread indexes and *OPEN* is financial system openness. Detailed descriptions of the determinant variables appear in Appendix A. The model is estimated on a pooled sample (364 observations) of all countries which appear in the Markit dataset between February, 2001 and November, 2010 that do not yet have trading CDS contracts.

	Model 1		Model 2		Model 3	
	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
$INDEX_{t-1}$	-0.047	0.7393	0.0212	0.8870	0.0121	0.9347
VOL_{t-1}	0.3725	0.0065	0.5328	0.0002	0.5008	0.0004
ER_{t-1}	0.000832	0.9947				
ΔER_{t-1}			0.4514	0.0050	0.4567	0.0059
$FORRES_{t-1}$	0.3524	0.0431				
$\Delta FORRES_{t-1}$			-0.4563	0.0156	-0.4529	0.0178
$CREDIT_{t-1}$	-0.2409	0.2336				
$\Delta CREDIT_{t-1}$			-0.2787	0.1406	-0.2673	0.1429
GDP_{t-1}	0.0316	0.8725				
ΔGDP_{t-1}			0.1828	0.2843	0.1303	0.4251
$WORLD_{t-1}$	0.1388	0.5148	0.4447	0.0280	0.3079	0.1258
EQU_{t-1}	0.2074	0.2941				
ΔEQU_{t-1}			0.00114	0.9944	0.0482	0.7683
$VOLPRM_{t-1}$	-0.2981	0.1723	-0.3698	0.0703	-0.5062	0.0322
DEF_{t-1}	-0.463	0.0505			-0.3692	0.0905
ΔDEF_{t-1}			0.1227	0.5218		
REG_{t-1}	0.0389	0.8224	0.0679	0.6325	0.0932	0.5228
$GLOBE_{t-1}$	-0.1753	0.2938	-0.241	0.1405	-0.2763	0.0888
$OPEN_{t-1}$	-0.3144	0.1938			-0.2435	0.1682
$\Delta OPEN_{t-1}$			0.1812	0.2747		
% classified correctly	68.9		72.7		73.5	
% classified incorrectly	30.5		26.8		26.1	
% tied	0.6		0.5		0.4	

Table III

Mean-variance Spanning Tests with Bond Portfolios

Table III reports the number of observations, F-test statistic and p-values of the spanning tests based on Huberman and Kandel (1987): $r_{cds,t} = \alpha + \beta_{sb} r_{sb,t} + \beta_u r_{u,t} + \varepsilon_t$, where r_{cds}, r_{sb}, and r_u are the returns of the CDS, sovereign bond portfolio and US Treasury bond portfolio, respectively. The necessary and sufficient conditions for spanning are: H_0: $\alpha = 0$, $\beta_{sb} + \beta_u = 1$. The number and percentage of countries for which the null hypothesis is rejected with 90% confidence is reported in the final row. Panel A reports results for the aggregate sample and Panel B reports sub-sample results for partitions formed based on default risk and financial market openness. Default risk is proxied by the county's S&P credit rating and financial openness is proxied by the capitalization of the country's equity market standardized by GDP. The three openness partitions are defined relative to the openness tertile cut offs in the World Bank Dataset of 115 countries between 2001 and 2009.

Panel A. Aggregate Sample Analysis

Country	No. obs.	F-test	p-value	Country	No. obs.	F-test	p-value
Austria	2018	4.94	0.0072	Israel	1553	0.42	0.6592
Bahrain	151	0.08	0.9263	Italy	2102	10.96	<.0001
Belgium	1590	2.39	0.0923	Jamaica	1420	1.53	0.2164
Brazil	2116	23.72	<.0001	Korea	716	7.97	0.0004
Bulgaria	297	3.68	0.0264	Lebanon	1543	15.65	<.0001
Canada	460	0.46	0.6339	Malaysia	1592	0.59	0.5561
Chile	1786	1.99	0.1366	Mexico	2120	7.62	0.0005
China	2123	1.12	0.3257	New Zealand	653	0.72	0.4862
Colombia	2066	17.37	<.0001	Pakistan	420	1.99	0.1378
Costa Rica	1430	1.86	0.1565	Panama	1601	26.48	<.0001
Denmark	341	2.75	0.0653	Peru	1603	9.86	<.0001
Dominican R	854	1.52	0.2193	Philippines	2053	27.76	<.0001
Ecuador	822	1.89	0.1512	Poland	1064	7.03	0.0009
Egypt	1362	2.11	0.1211	Qatar	1044	7.51	0.0006
El Salvador	1089	0.18	0.8354	Russia	948	9.43	<.0001
Finland	1288	3.34	0.0358	South Africa	2103	1.62	0.1975
Germany	1044	1.06	0.3482	Spain	1878	8.34	0.0002
Greece	1196	1.61	0.2000	Sweden	1623	2.93	0.0535
Guatemala	1369	3.76	0.0235	Thailand	1438	0.80	0.4503
Hong Kong	412	2.72	0.0668	Turkey	2110	68.50	<.0001
Hungary	826	4.47	0.0117	Ukraine	1301	18.14	<.0001
Iceland	513	9.19	0.0001	Uruguay	1433	1.84	0.1585
Indonesia	691	4.40	0.0126	Venezuela	2084	6.71	0.0012
Ireland	623	0.63	0.5353				
No. Significant (%)							27 (57%)

Panel B: Sub-sample Analysis

Credit rating	N	No. (%) of significant spanning tests	Openness group	N	No. (%) of significant spanning tests
AAA-AA	12	8 (67%)	High	21	11 (52%)
A-BBB	15	7 (47%)	Mod	16	11 (69%)
Total IG sovereigns	27	15 (56%)	Low	10	5 (50%)
BB	11	8 (73%)			
B-CCC	9	4 (44%)			
Total HY sovereigns	20	12 (57%)			
Total sovereigns	47	27 (57%)	Total sovereigns	47	27 (57%)

Table IV

Mean-variance Spanning Tests with 5-year Maturity Bonds and Market Friction Controls

Table IV reports the number of observations, F-test statistic and p-values of the spanning tests based on Huberman and Kandel (1987): $r_{cds,t} = \alpha + \beta_{sb} r_{sb,t} + \beta_u r_{u,t} + \varepsilon_t$, where r_{cds}, r_{sb}, and r_u are the returns of the 5-year CDS, and 5-year generic bond, and the 5-year US Treasury bond rate, respectively. r_{cds} is stripped of the liquidity component and counterparty risk and r_{sb} is likewise stripped of the liquidity component. The necessary and sufficient conditions for spanning are: H_0: $\alpha = 0$, $\beta_{sb} + \beta_u = 1$. The number and percentage of countries for which the null hypothesis is rejected with 90% confidence is reported in the final row.

Country	No. obs.	F-test	p-value	Country	No. obs.	F-test	p-value
Austria	1275	18.63	<.0001	Korea	311	3.36	0.0361
Brazil	1277	2.62	0.0731	Mexico	1028	3.66	0.0260
Chile	703	8.54	0.0002	Peru	260	0.90	0.4075
China	389	0.90	0.4089	Poland	527	4.94	0.0075
Colombia	1217	1.84	0.1593	South Africa	433	1.72	0.1795
Costa Rica	225	0.56	0.5694	Sweden	324	0.41	0.6661
Guatemala	209	1.99	0.1391	Turkey	1163	0.37	0.6877
Indonesia	175	0.18	0.8365	Ukraine	677	5.29	0.0053
Israel	495	5.61	0.0039	Uruguay	203	1.52	0.2204
Italy	926	12.40	<.0001	Venezuela	487	5.48	0.0044
No. Significant (%)							10 (50%)

Table V

Price Informativeness Analysis

Table V reports the change in sovereign bond spread adjustment delay associated with CDS trading initiation. Spread adjustment delay is measured as one minus the ratio of the R^2 values from the base and augmented variants of the time-series factor model. In the base variant of the factor model, the change in the bond striped-spread is regressed on the six factors described below plus the local currency USD exchange rate. The augmented variant of the model additionally includes five lagged values of one price factor as dependent variables, calculated separately for each price factor excluding exchange rate. The price factors are as follows: *INDEX* is the return to the issuing country's MSCI index, *WORLD* is the return to the global MSCI index, *ΔVOL* is the change in volatility of the issuing country's MSCI index, measured as the residual from the regression of index return regressed on twelve lags of the index return and day of week dummy variables. *ΔYL*, *ΔYS* and *ΔYC* are the change in the first three principle components of a set of US T-Bills (90 day, 1-year, 2-year, 5-year, 7-year, and 10-year maturities). The change in spread adjustment delay for each price factor is calculated as the difference in the delay measure calculated over the period 3-months before relative to 3-months after CDS trading initiation. T-statistics are reported in parentheses. Significance at 1, 5, and 10% level is denoted by ***, **, and *, respectively. Panel A reports results for the aggregate sample and Panel B and C report sub-sample results for partitions formed based on default risk and financial market openness, respectively. Excess change in efficiency in Panel A is calculated as the efficiency change difference between the test country and a time series match control sample. Default risk is proxied by the county's S&P credit rating and financial openness is proxied by the market value of the country's equity market standardized by GDP. The three openness partitions are defined relative to the openness tertile cut offs in the World Bank Dataset of 115 countries between 2001 and 2009. Table V is continued on the following page.

Panel A. Change in Spread Adjustment Delay by Country and Price Factor

Country	*N*	*INDEX*	*WORLD*	*ΔVOL*	*ΔYL*	*ΔYS*	*ΔYC*
Australia	2	-0.0087	-0.0904	0.1019	-0.0326	-0.0625	-0.1427
Austria	9	0.1947	0.0819	-0.0327	0.1194	0.0672	0.0798
Bahrain	1	0.0253	0.0499	-0.0005	0.0822	0.0680	-0.0782
Belgium	7	0.0340	0.0269	0.0264	0.0663	0.0340	0.1422
Brazil	9	0.0115	-0.0876	-0.0264	-0.0949	-0.1241	0.0430
Canada	4	-0.1546	-0.0715	-0.0695	-0.1155	-0.0910	-0.0757
Chile	2	0.0511	0.0329	0.2243	0.1063	0.1704	0.0584
China	8	-0.0338	-0.1142	0.0207	-0.1130	-0.0822	0.0324
Colombia	11	-0.1823	-0.1496	-0.2418	-0.3950	-0.3451	-0.2942
Costa Rica	8	-0.0247	-0.0656	-0.0327	-0.1238	-0.1280	-0.1105
Croatia	1	-0.0707	-0.1675	-0.1342	0.5194	-0.1521	-0.3580
Cyprus	1	-0.0285	0.1951	0.0626	-0.1517	-0.0645	-0.3332
Denmark	9	-0.0665	-0.1256	0.0622	0.0060	0.0415	0.0256
Dominican Republic	2	-0.0480	0.0473	-0.2714	-0.0680	-0.0270	-0.3378
Ecuador	2	-0.2637	-0.1869	-0.2213	-0.2377	-0.2884	-0.1260
Egypt	3	0.1599	0.0320	0.1100	0.0116	-0.0147	0.0637
El Salvador	5	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003	-0.0003
Finland	4	-0.0779	-0.1069	-0.2097	-0.2480	-0.2321	-0.1721
Germany	2	-0.0112	0.0036	0.0459	0.0178	0.0230	0.0363
Ghana	1	0.0582	0.0542	0.0466	-0.0183	0.0003	0.0023
Greece	1	-0.0176	-0.0281	0.0674	0.2962	0.0815	0.5445
Guatemala	3	0.0195	0.0092	0.0126	-0.0168	-0.0189	0.0172
Hungary	1	-0.1229	0.0717	-0.3290	0.5224	0.2009	0.2232

Table V continued

Country	*N*	*INDEX*	*WORLD*	*ΔVOL*	*ΔYL*	*ΔYS*	*ΔYC*
Indonesia	1	-0.1238	0.0235	0.0160	-0.0028	-0.0124	0.1301
Israel	4	-0.1151	0.1392	0.0092	0.0967	0.1188	0.0549
Italy	11	0.0125	-0.1224	-0.0667	0.1438	0.1230	0.1903
Jamaica	6	-0.0598	-0.2125	-0.1220	-0.2991	-0.3015	-0.1749
Lebanon	11	-0.0001	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001
Malaysia	1	0.2747	0.1986	0.4700	0.3718	0.2995	0.5197
Mexico	7	-0.1228	-0.0823	0.0471	-0.0724	0.0515	0.0914
New Zealand	7	-0.0004	0.0352	-0.0190	0.0167	0.0251	0.0684
Pakistan	1	-0.0086	-0.0158	-0.0129	0.0014	0.0139	-0.0457
Panama	6	-0.0197	0.0919	0.1179	-0.0086	0.0114	0.0511
Mexico	7	-0.1228	-0.0823	0.0471	-0.0724	0.0515	0.0914
New Zealand	7	-0.0004	0.0352	-0.0190	0.0167	0.0251	0.0684
Pakistan	1	-0.0086	-0.0158	-0.0129	0.0014	0.0139	-0.0457
Panama	6	-0.0197	0.0919	0.1179	-0.0086	0.0114	0.0511
Peru	1	0.0037	-0.0117	0.0086	-0.0007	-0.0042	0.0053
Philippines	6	0.0786	0.0176	0.1686	0.1941	0.3244	0.1997
Poland	2	0.0178	-0.0647	0.0688	0.3853	0.2769	0.0217
Portugal	2	-0.0192	0.0527	-0.0694	-0.0979	0.0488	0.0653
Qatar	3	-0.0071	-0.0065	-0.0068	-0.0065	-0.0075	-0.0074
Russia	11	-0.3385	-0.3419	-0.3884	-0.2566	-0.2181	-0.2182
Slovakia	2	-0.0564	-0.1893	-0.1685	0.0707	0.0982	0.0939
South Africa	2	0.0048	0.0355	0.0084	0.1496	0.1787	0.0023
Spain	4	-0.0729	-0.0682	-0.0823	0.0715	0.0959	-0.1266
Sweden	4	0.0215	0.0683	-0.0349	0.1456	0.1099	0.0336
Thailand	2	-0.2030	-0.1229	-0.2732	-0.4746	-0.4705	-0.3523
Turkey	9	0.1225	-0.0612	0.0590	-0.0848	0.0044	-0.2216
United Kingdom	1	0.0488	-0.2630	-0.0475	0.0505	-0.0229	0.2619
Uruguay	8	-0.0983	-0.0511	-0.0707	-0.1543	-0.1129	-0.1407
Venezuela	5	-0.1048	-0.0851	-0.1782	-0.2868	-0.2819	-0.2910
Raw Change							
Mean		-0.0276*	-0.0339**	-0.0282	0.0018	-0.0124	-0.0114
		(-1.80)	(-2.15)	(-1.33)	(0.06)	(-0.53)	(-0.41)
Percentage Negative		69%	63%	60%	56%	54%	48%
Excess Change							
Mean		-0.0402**	-0.04706**	-0.0469**	-0.0141	-0.0037	-0.0095
		(-2.77)	(-2.76)	(-2.23)	(-0.53)	(-0.14)	(-0.37)
Percentage Negative		67%	60%	60%	56%	52%	50%

Panel B. Change in Spread Adjustment Delay Sub-sample Analysis by Financial System Openness

Openness group	*N*	*INDEX*	*WORLD*	*ΔVOL*	*ΔYL*	*ΔYS*	*ΔYC*
High	20	-0.0135	-0.0315	-0.0007	0.0134	0.0118	0.0420
		(-0.61)	(-1.33)	(-0.02)	(0.33)	(0.33)	(0.85)
Mod	15	-0.0207	-0.0324	-0.0241	0.0409	0.0345	0.0137
		(-0.62)	(-0.93	(0.55)	(0.73)	(0.78)	(0.34)
Low	13	-0.0571**	-0.0392	-0.0754**	-0.0613	-0.1039***	-0.1227***
		(-2.33)	(-1.60)	(-2.22)	(-1.02)	(-2.94)	(-2.96)

Panel C. Change in Spread Adjustment Delay Sub-sample Analysis by Default Risk

Rating group	Grade	*N*	*INDEX*	*WORLD*	*ΔVOL*	*ΔYL*	*ΔYS*	*ΔYC*
1	AAA-AA	13	-0.0077	-0.0446	-0.0304	0.0110	0.0123	0.0297
			(-0.34)	(-1.61)	(-1.39)	(0.35)	(0.46)	(0.82)
2	A-BBB	14	-0.0047	0.0179	0.0213	0.1283	0.0431	0.0280
			(-0.15)	(0.60)	(0.41)	(1.73)	(0.80)	(0.38)
3	BB	10	-0.0293	-0.0468	-0.0115	-0.0448	-0.0135	0.0097
			(-1.24)	(-1.75)	(-0.30)	(-0.93)	(-0.25)	(0.23)
4	B-CCC	11	-0.0805*	-0.0617**	-0.1021**	-0.1108***	-0.0922**	-0.1249***
			(-1.96)	(-2.02)	(-2.37)	(-3.46)	(-2.76)	(-3.06)

Table VI

Price Informativeness Endogeneity Control Regressions

Table VI reports results for the endogeneity control regressions for the price informativeness analysis. The change in spread adjustment delay for each price factor (as described in Table V) is individually regressed on four factors found to predict CDS initiation likelihood: the volatility of the local country equity index (*VOL*), the volatility risk premium (*VOLPRM*), foreign currency reserves (*FORRES*) and the local currency USD exchange rate (*ER*). Standardized coefficient estimates are reported, followed by t-statistics in parentheses. Significance at 1, 5, and 10% level is denoted by ***, **, and *, respectively.

	INDEX	*WORLD*	*ΔVOL*	*ΔYL*	*ΔYS*	*ΔYC*
VOL	0.0085	0.1605	-0.0616	0.2201	0.2336	0.0661
	(0.06)	(1.05)	(-0.40)	(1.40)	(1.48)	(0.41)
VOLPRM	0.1956	0.3201**	0.1323	-0.0368	0.0495	-0.0866
	(1.24)	(2.07)	(0.85)	(-0.23)	(0.31)	(-0.05)
FORRES	-0.1509	-0.2279	-0.1308	0.0641	0.0145	-0.0157
	(-0.98)	(-0.15)	(-0.86)	(0.40)	(0.09)	(-0.10)
ΔER	-0.0655	-0.0527	-0.2218	0.0699	-0.0369	-0.1485
	(-0.43)	(-0.35)	(-1.48)	(0.45)	(-0.24)	(-0.95)
R^2	0.07	0.10	0.10	0.06	0.05	0.03

Table VII

Risk Premium Analysis

Table VII reports the effect of CDS trading initiation on the excess risk premium of sovereign bonds. For each country, bond excess risk premiums (obtained by regressing bond stripped-spreads on the first three principal components of a series of Treasury bonds (as defined in Table V), the JP Morgan bond index spread, and the local currency USD exchange rate) are pooled and regressed on an indicator variable (*CDS*) that takes the value of one after CDS initiation and zero before. The estimation is performed on the [-3 month, +3 month] window around the start of CDS trading. Regressions include time and bond issue fixed-effects. Newey West (1987) robust standard errors are used. Results in Panel A are pooled at the country level and results in Panel B are pooled by default risk and financial market openness partitions (as defined in Table V). Significance at 1, 5, and 10% level is denoted by ***, **, and *, respectively.

Panel A: Aggregate Sample Analysis

Country (No. of bonds)	CDS Coeff.	t-stat	Country (No. of bonds)	CDS Coeff.	t-stat
Australia (1)	-0.9266***	-7.86	Lebanon (11)	0.0829**	2.11
Brazil (9)	0.0019	0.14	Malaysia (1)	-0.0736***	-3.65
Canada (4)	-0.6707***	-5.71	Mexico (7)	-0.1652***	-5.77
Chile (2)	-0.0591*	-1.76	New Zealand (6)	0.4492***	5.32
China (7)	0.0466	1.51	Pakistan (1)	0.1361***	4.37
Colombia (11)	-0.0070	-0.47	Panama (6)	0.0800***	4.36
Croatia (1)	0.2924***	4.74	Peru (1)	-0.0133***	-3.97
Denmark (9)	0.0748	0.73	Philippines (6)	-0.0218	-1.34
Dominican Rep (2)	-0.0177	-0.69	Poland (2)	0.1623	1.47
Ecuador (2)	0.0479**	2.04	Portugal (2)	-0.3141***	-4.07
Egypt (3)	0.0135*	1.79	Russia (12)	0.0718***	4.26
El Salvador (5)	0.0005	0.03	South Africa (2)	0.0573***	3.25
Finland (4)	0.1441***	2.68	Thailand (2)	-0.2535***	-3.10
Germany (2)	0.2529	0.99	Turkey (9)	-0.0743***	-3.03
Ghana (1)	0.0048	0.82	United Kingdom (1)	-1.8410**	-2.04
Greece (1)	0.1219***	3.52	Ukraine (1)	-0.0695***	-4.78
Hungary (1)	-0.1633***	-5.14	Uruguay (5)	0.5878***	5.32
Italy (11)	0.0723	1.45	Venezuela (5)	-0.0454***	-2.80

Panel B: Sub-sample Analysis

Rating group	Grade	N	CDS Coeff.	t-stat	Openness group	N	CDS Coeff.	t-stat
1	AAA-AA	9	-0.2673***	-3.89	High	16	-0.1509***	-3.87
2	A-BBB	10	0.0190	1.41	Mod	9	-0.0072	-0.79
3	BB	8	0.0270*	1.78	Low	11	0.0453***	3.28
4	B-CCC	9	-0.0044	-0.45				

Table VIII

Endogeneity Control Regressions for the Risk Premium Analysis

Table VIII reports results of the endogeneity control regressions for the risk premium analysis. The change in the excess risk premium from 3-months before and after CDS initiation (as defined in Table VII) is regressed on four factors found to predict CDS initiation likelihood: the volatility of the local country equity index (*VOL*), the volatility risk premium (*VOLPRM*), foreign currency reserves (*FORRES*) and the local currency USD exchange rate (*ER*). Standardized coefficient estimates are reported, followed by t-statistics in parentheses. Significance at 1, 5, and 10% level is denoted by ***, **, and *, respectively.

VOL	VOLPRM	ΔFORRES	ΔER	R^2
0.2015	3.3259	-0.0217	-0.2444	0.0109
(0.36)	(0.14)	(-0.04)	(-0.38)	