How does sovereign bond market integration relate to fundamentals and CDS spreads?

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Abstract

We document significant heterogeneity in the degree and dynamics of sovereign bond market integration across 21 developed and 16 emerging countries at the market level and for five maturity segments. While political risk, credit quality, and inflation risk play an important role for integrating bond markets, the effect of illiquidity becomes large in crisis periods. This relationship is not subsumed by currency risk. Integration is negatively related to sovereign funding cost with a one percent increase in integration corresponding to an average decrease in the cost of funding of about 3% of 5-year CDS spreads across all developed bond markets.

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JEL Classification: G15, G12, E44, F31, C5.

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Abstract

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Introduction

Market integration is central to the study of international economics but has so far received less attention in the sovereign bond market literature. Yield spreads, and sovereign bond returns clearly depend on the degree of market integration and so is the funding cost faced by sovereigns. Hence, the main focus of this study is to examine the level and time evolution of sovereign bond market integration, their key determinants, and their relationship to sovereign countries' borrowing costs.

Scholars have primarily measured sovereign bond market integration based on the law of one price under the assumption that bonds with the same risk should command the same expected return regardless of the nationality of the sovereign issuer or the location of its listing. However, in addition to their exposure to the common global market risk, differences in country specific risks as well as differential explicit and implicit barriers that asymmetrically impact countries should be taken into account for estimating the degree of sovereign bond market integration.[1] Hence, we estimate market integration based on the theoretical international asset pricing model (IAPM) of Errunza and Losq (henceforth E-L, 1985). It is a two factor (global and conditional local factor) model that incorporates barriers to capital flows and is applicable to all types of financial assets. Under the model, integration is defined as the square of the correlation between the returns on the *Ith* country diversification portfolio of bonds and the *Ith* sovereign bond. The diversification portfolio is the return on a portfolio of bonds that is most highly correlated with the *Ith* sovereign bond.[2] Increasing integration implies increased globalization with the consequent increase (decrease) in the importance of the global (local) factors, and declining expected returns on the sovereign bond. Thus, an increasing degree of integration should,

[1] Explicit barriers include legal restrictions on ownership, foreign exchange controls that are imposed by the governments of borrowing and creditor countries as well as those related to institutional constraints/mandates, for example, investors may have limited funding capacity. Implicit barriers encompass risks related to political uncertainty, incomplete, inaccurate or asymmetric information, quality of governance, market size, illiquidity, and market regulation.

[2] The diversification portfolio of bonds includes all freely accessible bonds.

ceteris paribus, lead to declining sovereign funding cost. Hence, as discussed later, countries can pursue policy initiatives to increase globalization of their sovereign bond markets to lower their funding costs.

Our paper makes three important contributions. First, we examine the level and time variation in the degree of market integration for a large sample of sovereign bonds from both the developed markets (DMs) and emerging markets (EMs). In so doing and since currency risk is a non-trivial component of sovereign bond return' variability, we examine its impact on market integration. We further assess integration across the full maturity spectrum because investors are heterogeneous and target different maturity segments. Also sovereign funding costs are maturity specific and could be determined by different levels of integration of each maturity segment. For example, Duffie, Pedersen and Singleton (2003) discuss reasons why bonds issued by the same sovereign but of different maturities, could be priced using different discount factors.

Previous studies on sovereign bond market integration have focused on major DMs, European markets and on the impact of the Euro's introduction on regional and global integration. See, for example, Adam et al. (2002), Adjaouté and Danthine (2003), Baele et al. (2004), Barr and Priestley (2004), Diebold, Li and Yue (2008), Abad, Chuliá and Gómez-Puig (2010, 2014), and Christiansen (2012). Other studies measure market integration using correlations, [see, for example, Cappiello, Engle and Sheppard (2006), and Kumar and Okimoto (2011)].[3] Relative to these studies, we examine the dynamics of integration for a large set of DM and EM countries and explore the economic underpinnings of the integration dynamics

[3] Several studies examine the international bond market comovements and determinants of the yield spreads and CDS spreads. See for example, Mauro, Sussman, and Yafeh (2002), Codogno, Favero and Missale (2003), Geyer, Kossmeier, and Pichler (2004), Pagano and von Thadden (2004), Remolona, Scatigna and Wu (2008), Pan and Singelton (2008), Longstaff et al. (2011), Ehrmann et al. (2011), Bernoth and Erdogan (2012), and Aguiar et al. (2016). These studies document high comovement in sovereign spreads. Using principal component analysis, Volosovych (2011) document a J-shaped long-run trend in bond market integration for 11 developed markets over the 1875-2009 period. Dahlquist and Hasseltoft (2013) find an increase in the comovements of international bond risk premia.

based on the formal theoretical E-L model.[4] We would expect the tremendous increase in the trading of bond funds, closed-end bond funds and bond ETFs over the last few years, ceteris paribus, to more strongly integrate the international bond markets.[5] The time varying integration index (*II*) accounts for the role of such assets and spans the entire range from full integration (*II=1*) to complete segmentation (*II=0*). We estimate the level of integration for each sovereign bond market as a whole as well as for its different maturity segments.

Second, we investigate local factors that drive sovereign bond market integration. Indeed, a deeper understanding of these factors is critical for devising monetary policy in an increasingly global environment. For that purpose, we draw on the large body of literature on bond pricing, term structure models and the determinants of yield spreads to make a number of testable predictions regarding the main factors that could explain the level and dynamics of integration. We identify four primarily local factors, namely: (1) credit quality, (2) political risk, (3) macroeconomic factors, including, inflation, and real economic activity, and (4) liquidity. For example, we would expect countries with more illiquid bonds, lower credit quality and higher political risk to experience a lower level of integration compared to more liquid, higher credit quality and lower political risk countries. At the same time, countries with low and stable inflation should exhibit higher levels of comovement with each other. We propose a set of hypotheses to test these relationships. We assess the economic and relative importance of each of these factors in further integrating both the DM and EM bond markets.

Third, for a given maturity segment, we would expect countries with a lower level of integration to exhibit a higher borrowing cost (that is higher credit default swap spread or yield spread). Hence, we study the relationship between market integration and these two spreads, which proxy for the sovereign

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[4] Note that the literature on stock market integration shows that correlation may not be an appropriate measure of market integration, see for example, Carrieri, Errunza and Hogan (2007) and Pukthuatong and Roll (2009).

[5] As of 2011, there were 365 fixed-income ETFs with 217 billion USD of asset under management. Fixed-income ETFs represent 15% of total ETF assets under management. The greatest proportion of investment is concentrated in government bonds, comprising around 30% of fixed income ETFs (see Kosev and Williams, 2011).

country funding cost. Given a constant recovery rate, this should help infer a country's default probability [see, for example, Pan and Singleton 2008].

We first estimate the integration index for 21 developed markets from 1986 or later to 2012 and 16 emerging markets from 1998 or later to 2012. In view of the importance of domestic-currency bonds, which are extensive for advanced economies and growing rapidly for emerging economies, we conduct the analysis for local currency denominated sovereign bonds.[6] This is in sharp contrast with most existing studies that focus on foreign-currency denominated external debt for EMs. This also allows us to focus more on factors such as macroeconomic, credit and political conditions that are largely local in nature. Since most of the substitute assets are U.S. dollar denominated, we convert the local currency returns of the sovereign bonds in US dollar terms, i.e. we run the analysis with unhedged dollar returns from the perspective of a U.S. investor. The results show an upward trend in the integration of sovereign bond markets for many countries. Nevertheless, there are interesting differences across countries in the dynamics of integration. In general, the Eurozone countries are more integrated compared to European Union non-euro countries. However, there are clear differences between core and periphery countries in the Eurozone specifically after the European sovereign debt crisis. The integration of EMs sovereign bond markets is lagging behind DMs and is also more volatile. During the sample period, the average integration for the EM pool is 0.45 compared to 0.67 for DMs. Although in general there is a positive trend, we do observe reversals and negative trends among both DMs and EMs. For example, the recent Euro sovereign crisis has negatively affected bond market integration of both DMs and EMs and in particular of the Eurozone Periphery countries.

Next, we test a number of hypotheses regarding the predictions of integration patterns based on differences in credit quality, political risk, inflation rates and their volatility, and illiquidity across

[6] See Du and Schreger (2015, 2016) for the significant and growing size of the local currency sovereign debt for emerging markets. Reinhart and Rogoff (2011a and 2011b) provide evidence on the relevance of domestic debt and on the prevalence of domestic debt crises.

countries. We run panel regressions and find that more illiquid bonds from lower credit quality countries experience a lower level of integration compared to more liquid bonds from higher credit quality countries. Countries with low and stable inflation (with low inflation volatility) as well as low political risk exhibit higher levels of integration. Furthermore, the integration of the sovereign bond markets increases on average by about 8% for DMs to 20% for EMs, when a country moves from the 25th percentile to the 75th percentile as a result of higher credit quality, lower inflation and inflation risk, lower political risk and illiquidity. Although these different factors are correlated over time, credit quality is most important for the Eurozone sample, credit quality, political risk and illiquidity are important for the sample of DMs excluding Eurozone and political, inflation level as well as risk are relatively more important for EMs. The effect of illiquidity becomes large during crisis periods and among distressed countries.

Furthermore, we examine whether a lower global investment sentiment and reduced confidence in the global equity market could lead to higher integration of sovereign bond markets reflecting a "flight-to-safety" phenomenon (see, for example, Connolly, Stivers, and Sun 2005). We proxy global investor sentiment with the VIX-implied volatility measure, a higher VIX level implying a lower level of global investment sentiment. We find a positive association, although not robust, between VIX and the integration measure. Next, we test for maturity effects. We run the panel regressions by maturity segment or by pooling the estimated integration indices of the five maturity segments and interacting maturity with our key variables that proxy for political risk, credit risk, inflation level and risk, and liquidity level. We do not find significant differences or trends across maturities but political risk matter more for the longer maturity bonds. Additionally, we examine the impact of currency risk by running two tests. First, we control for foreign exchange (FX) changes and FX volatility in the panel regressions. Second, we repeat the panel regression analysis with integration indices constructed from currency-hedged dollar returns. The tests on currency effects show that part of the variability in the integration measure is due to FX variability. However, the association between integration and credit quality, political risk, inflation and illiquidity is not subsumed by FX volatility.

We conduct several robustness checks to the panel regressions. First, we add other controls such as public debt to GDP, and fiscal space. We also examine sub-periods, sampling frequency and outliers effects. We confirm that the results are robust to these variations.

Finally, we examine the relationship between our measure of integration and the CDS spreads across the Eurozone market for different maturities, as well as across DMs and EMs. For that purpose, we conduct panel regressions using changes in CDS spreads. After controlling for global and local factors such as the corporate yield spreads, VIX, and local stock market return, we find that changes in market integration are negatively and significantly associated with changes in the CDS spreads. A one percent increase in integration corresponds to an average decrease in the cost of funding of about 3% of the average 5-year CDS spreads across all developed bond markets. We obtain similar results with the 10-year yield spreads for the Eurozone bonds. Thus, higher market integration can significantly mitigate funding costs of sovereign bonds. For EMs, we find a positive but insignificant relationship between CDS spread changes and changes in market integration. This could be due to the difference in market structure between the CDS underlying bonds, which are dollar denominated, and the local currency denominated bonds. Indeed, we uncover the expected negative relationship if we measure integration for the dollar denominated EM bond indices.

The rest of the paper is organized as follows. Section I presents the integration measure and its empirical implementation. Section II discusses the data. Section III reports our integration estimates for DMs and EMs and characterizes their evolution over time. Section IV presents and tests the main hypotheses regarding factors that could drive the degree of integration over time, their economic significance, and provides robustness tests. Section V relates market integration to the sovereign cost of funding as proxied by CDS and yield spreads. Conclusions follow.

I- Bond market integration

Measurement of sovereign bond market integration is primarily based on the law of one price.[7] In accordance, Adam et.al. (2002) and Adjaoute and Danthine (2003) propose price-based measure such as interest rate convergence in the Euro area, and quantity based measures which take into account the differential explicit and implicit barriers that asymmetrically impact countries. The paper by Baele et al. (2004) extends their framework and investigates the impact of common versus country specific information on integration.[8] Empirically, the simplest price based measure would compare yields on identical maturity bonds issued by different sovereigns in the same currency denomination. If the bond market is fully integrated, the law of one price should hold, i.e. bonds with the same risk should command the same expected return regardless of the nationality of the issuer or the location of listing. Deviations could result from priced systematic (for example country specific) risk differences. Further, in an integrated market, for bonds with same risk characteristics, the priced common factor (for example the global factor) should be much more important than local factor suggesting the proportion of variance explained by the global factor as an alternate measure of integration. This measure is also sometimes referred to as a news-based measure of integration [see Baele et al. (2004)].

A- The integration measure

In this paper, we wish to measure the degree of integration of a wide sample of sovereign bonds from both developed and emerging markets. These markets are not similar in their risk characteristics with differences in terms of local economic risk factors, explicit and implicit barriers to investments etc. Since the law-of-one-price is difficult to test empirically for our sample, we operationalize the price,

[7] Although the law of one price cannot be tested for non-traded assets, it is widely used in developing measures of integration.
[8] See also, Kim, Lucey, and Wu (2005), Schulz and Wolff (2009), and Abad, Chuliá, and Gómez-Puig (2010).

news, and quantity based measures in a systematic manner that takes into account these differences. More precisely, we use the integration measure as defined in Errunza and Losq (1985) (henceforth, E-L) model to estimate a time-varying comprehensive integration index. E-L is a two factor (global and conditional local factor) model that incorporates barriers to capital flows and is applicable to all types of financial assets. It uses a two-country set-up and two sets of securities. All securities traded in the U.S. (domestic) market are eligible for investment by all investors whereas securities traded in the foreign (national) market are ineligible in the sense that they can only be held by national investors. This is a reasonable description of the world market structure since in most financial markets, cross-border capital flows encounter explicit and implicit barriers. The nature, extent and severity of these barriers vary widely among markets. Generally, they are not onerous among major developed markets during tranquil times but they may be prohibitive for markets that are not well developed, undergoing a financial/currency/political crisis or have defaulted in recent past.[9] Together, these barriers determine international investors' ability to access and willingness to invest in foreign securities either directly or indirectly through substitute assets such as different types of bond funds. The cross-border capital flows and the substitute assets play a major role in integrating the sovereign bond market. The E-L model states that,

$$E(R_i) = R_f + AMcov(R_i, R_W) + (A_u - A)M_I cov\left(R_i, R_I \middle| \underline{R_e}\right) \tag{1}$$

where $E(R_i)$ is the expected return on the *ith* bond in the *Ith* market that is accessible only to its nationals, R_f is the risk free rate, $A(A_u)$ is the aggregate risk aversion coefficient for all (*Ith*) market investors, $R_W(R_I)$ is the return on the world *(Ith)* sovereign bond portfolio, $M\ (M_I)$ is the market value of the world *(Ith)* sovereign bond portfolio, and $\underline{R_e}$ is the vector of returns on all eligible securities that can

[9] Their bonds may be more prone to fire sale risk, and therefore investors could abstain from investing in public bonds of such markets. The reluctance of foreign investors to buy sovereign bonds from Greece and Argentina is well documented.

be bought by all investors irrespective of their nationality. Thus, the expected return on the *ith* bond commands a global risk premium and a national risk premium that is proportional to the conditional market risk. At the market level, we can aggregate equation (1) across bonds in each *Ith* market to obtain,

$$E(R_I) = R_f + AMcov(R_I, R_W) + (A_u - A)M_I var\left(R_I \middle| \underline{R_e}\right) \quad (2)$$

The national bond market will be effectively integrated with the global market when her bonds only command the global risk premium determined by the common global price of risk. On the other hand, when her bonds only command the national risk premium determined by the national price of risk, the national bond market will be completely segmented from the global market. Analytically, the integration measure is equal to one minus the ratio of the variance conditional on the set of substitute assets, $var(r_{I,t} \,|\underline{r_e})$, to the total variance, $var(r_{I,t})$, where $r_{I,t}$ is the holding period return on *Ith* bond from time $t-1$ to time t and $\underline{r_e}$ is the vector of returns on all substitute assets that can be bought by all investors irrespective of their nationality. Let the diversification portfolio, DP, be the return on the portfolio (of $\underline{r_e}$) that is most highly correlated with the *Ith* sovereign bond. Note that under the null that $r_{I,t} = r_{DP,t} + u_{I,t}$, exposure to the global risk is the same for the Ith bond return and its DP. Thus, equation (2) implies that a sudden increase in global risk, or its price, will result in a joint drop in government bond and the DP prices with no effect on the level of the integration index. However, an increase in local risk, or its price, will affect government bond prices with no similar effect on DP. Thus, we should only capture the impact of the local factor on a given bond market integration measure if the local risk factor is priced.

DP is constructed from the projection of the *Ith* sovereign bond return on the space of substitute assets returns, i.e. DP is the fitted value from the regression,

$$r_{I,t} = \beta'_{1,t} r_{W,t} + \beta'_{2,t} r_{UST,t} + \beta'_{3,t} r_{BF,t} + \beta'_{4,t} r_{ETF,t} + u_{I,t} \quad (3)$$

where $r_{W,t}$ is the return on the world sovereign bond index; $r_{UST,t}$ is the return on the US Treasury bonds, $r_{BF,t}$ and $r_{ETF,t}$ are the returns on the bond funds and ETFs, respectively; and $\beta'_{j,t}$ are time-varying portfolio weights, *j=1,..,4*. As in Carrieri, Errunza and Hogan (2007, CEH), we use dummies set to one at the introduction of new substitute assets to obtain time-varying weights.

Under the null that $r_{I,t} = r_{DP,t} + u_{I,t}$, we have $var(r_{I,t} \,|\underline{r}_e) = var(r_{I,t}) - var(r_{DP,t}) = var(r_{I,t}) - cov(r_{I,t}, r_{DP,t}) \;= var(r_{I,t})(1 - \rho_{I,DP}^2)$, where $\rho_{I,DP}$ is the correlation coefficient between the *Ith* sovereign bond and its DP. However, conditioning on time, the three different parameterizations are not equivalent. As in Carrieri, Chaieb and Errunza (2013), we use the correlation-based parameterization because it ensures that the integration index is bounded at every point in time *t* by 0 and 1. Our time-varying integration index is then given by,

$$II_{I,t} = \frac{cov_{t-1}(r_{I,t}, r_{DP,t})^2}{var_{t-1}(r_{I,t})var_{t-1}(r_{DP,t})} = \rho_{I,DP,t-1}^2 \qquad (4)$$

It is important to note that the integration index takes into account the globalization of markets as a result of substitute assets including global sovereign bond index returns, US Treasury bond returns, global bond funds, country bond funds, as well as exchange traded bond funds. Indeed, the construction of the diversification portfolio includes the bond funds as they come to market. If the *Ith* bond return can be fully spanned, the index takes on the value of one and the market is considered effectively integrated. In this case, only global factor shocks will determine excess returns on the foreign market, which will be very sensitive to contagion and crises spillovers. The *Ith* bond is completely segmented if none of the variation can be explained by the returns on substitute assets.[10]

[10]Pukthuatong and Roll (2009) propose the R-square of a regression of returns on common factors as a measure of integration. When the common factors are extracted from benchmark assets that include the substitute assets, the two measures are similar. Another measure is the Bekaert et al. (2011) segmentation index based on earnings yield differentials. Unfortunately, the construction of their index for sovereign bonds is not feasible.

Although the E-L framework is general in terms of its application to all types of financial assets, to-date, it has not been used in the context of sovereign bond pricing. The E-L model assumes purchasing power parity over the holding period. This is not likely for the markets we consider. In a recent paper, Chaieb and Errunza (2014) use a formal IAPM under barriers to portfolio flows and deviations from purchasing power parity to analytically and empirically investigate the impact of currency factor on stock market integration. They find that although currency risk is priced, it does not affect the level and the dynamics of the integration measure. Nonetheless, given the importance of the currency factor in bond returns, we examine the effect of currency risk on the integration measures and their determinants by controlling for FX changes and FX volatility in the panel regressions and by repeating the analysis using integration measures constructed from currency-hedged dollar bond returns as detailed in Sub-section IV-E. One could also argue that the E-L model does not consider stochastic short-term interest rates even though they determine the term structure of interest rates, and several other local factors, such as, inflation, liquidity or political risks.[11] Further, a country's integration index could decrease whenever idiosyncratic risk increases, irrespective of whether it is priced. However, these concerns are mitigated since we estimate the integration index that uses only second moments while we abstain from estimating the IAPM. We do so because, unlike the estimation of the integration index that is robust to model misspecification and method of estimation, asset pricing models are difficult to estimate and require long time series to provide reliable estimates which are typically not available for most EMs. Lastly, while the integration measure is based on a static model, we estimate a conditional version of the measure allowing the first and second moments to vary over time. Note however that introducing dynamics in the first and second moments would imply additional intertemporal state variables a la Merton (1973) and is thus internally inconsistent as argued by Dumas and Solnik (1995). As with most

[11]With respect to political and liquidity risks, formal IAPMs that explicitly model sovereign and liquidity risks to analytically demonstrate and empirically estimate (validate) the impact of these factors on equity or bond market integration are not yet available and their development is beyond the scope of this study. Hence, we follow Carrieri et al. (2013) and examine the relevance of these risk factors in the panel regressions in section IV.

conditional asset pricing tests, these are not considered in the estimation of the integration indices, however state variables that usually proxy for changes in investment opportunities - such as global and local term spread and interest rates- are used as conditioning variables as detailed in Sub-section II-C and in the panel regressions of Section IV.

B- Empirical methodology

Following Harvey (1991) and assuming sufficient distributional conditions that imply linear conditional expectations, we postulate that investors process information using a linear filter. There is also strong evidence for predictability of sovereign bond returns.[12] Thus, the predictable variation in bond returns and its corresponding DP is related to global and local information variables as follows,

$$r_{I,t} = \beta'_{I,n} Z_{t-1} + \varepsilon_{I,t}, \tag{5}$$

$$r_{DP,t} = \beta'_{DP,n} Z_{t-1} + \varepsilon_{DP,t} \tag{6}$$

where Z_{t-1} is a vector of global and local information variables at *t-1*, $\beta'_{I,n}$ and $\beta'_{DP,n}$ are time-invariant vectors of weights the investor uses to derive the conditional expected return of, respectively, the bond and its DP. The vector of residuals $\varepsilon_t = [\varepsilon_{I,t}, \varepsilon_{DP,t}]'$ follows a normal distribution with covariance matrix H_t.

We use the multivariate full BEKK GARCH to model the dynamics of bond returns.[13] Specifically,

[12] Excess bond returns are predictable by the yield spread (see, for instance, Fama and Bliss (1987) and Campbell and Shiller (1991), by a linear combination of forward spreads (Cochrane and Piazessi, 2005), by macroeconomic variables (Ludvigson and Ng, 2009; Cooper and Priestley, 2009. In the global context, Solnik (1993) forecasts long-term bond returns using the local term spread and Ilmanen (1995) finds evidence of predictability with global and local factors. More recently, Dahlquist and Hasseltoft (2013) find strong predictability for Germany, Switzerland, the UK, and the US excess bond returns by a global factor, which is a GDP-weighted average of the local factors constructed as in Cochrane and Piazzesi (2005).

[13] Cappiello, Engle and Sheppard (2006) find weak evidence of asymmetries in conditional volatility for bond returns.

$$H_t = CC' + A'\varepsilon_t \varepsilon_t' A + BH_{t-1}B' \quad (7)$$

where C is a lower triangular matrix, A and B are 2×2 matrices of coefficients. The full BEKK specification allows for cross-market dependences in conditional volatility.[14]

The integration index is estimated from,

$$II_t = \frac{h_{I,DP,t}^2}{h_{I,I,t} h_{DP,DP,t}}, \quad (8)$$

where $h_{i,j,t}$ are the elements of H_t, specifically, $h_{I,DP,t}$ the time-varying covariance, $h_{I,I,t}$ and $h_{DP,DP,t}$ the time-varying variances.

II. Data

The estimation of the integration indices requires three groups of data. First, returns data on the sovereign bond indices. Second, data on the substitute assets used to construct the diversification portfolios. Third, the global and local conditioning variables to derive the conditional expected returns (Eqs. (5) and (6)). The data used for the panel regressions is detailed in Appendix B and discussed in Section IV.

A. Sovereign bond indices

We use local currency-denominated government bond indices with maturity bands of 1-3, 3-5, 5-7, 7-10, and >10 years. Local currency debt is significant in developed markets and is increasingly important in emerging markets. As of 2013, EM local currency sovereign bond market represented 50% of the total EM bond market. Brandão-Marques et al. (2015) document that local-currency bond funds

[14]Alternatively, we could instead estimate the integration measure from realized volatilities and correlations (see, for example, Andersen et al., 2003). However, this would require using information from intraday returns, which is not available for many of the countries included in our sample. Furthermore, the estimation of realized correlations from non-synchronous intraday returns could result in high efficiency losses (see, for example, Barndorff-Nielsen et al., 2008).

have expanded more rapidly than hard-currency bond funds. For a sample of 14 emerging markets and over the past decade, Du and Schreger (2015) show that the average fraction of external sovereign debt in local-currency increased from around 15% to almost 60%.

To be included in the sample, we require that bond return data be available no later than December 2004. This criterion results in a total of 37 countries, where 21 are developed markets (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and UK) and 16 are emerging markets (Brazil, Chile, China, Colombia, Czech Rep., Hungary, India, Indonesia, Malaysia, Mexico, Poland, Korea, South Africa, Taiwan, Thailand, Turkey). Our sample of EMs encompass the largest issuers of local currency sovereign bonds. The bond indices of developed markets (DMs) are from Citigroup (CITI/SSS) except for Canada, Germany, Japan, and Portugal, we use the Bank of America Merrill Lynch (BOA ML) and for Singapore, we use J.P. Morgan because of longer historical span. For the emerging markets (EMs) bonds, we use J.P. Morgan GBI for the all-maturity indices. Only eight EMs have bond indices by maturities provided by CITI/SSS for Malaysia, Mexico and Taiwan, and J.P. Morgan for Czech Republic, Hungary, Korea, Poland, and South Africa. All bond indices are market cap-weighted and rebalanced monthly.[15]

The return data are available through Datastream. Since the substitute assets used to construct the DPs are in USD, the local currency bond returns are also expressed in USD and hence are unhedged dollar returns. The sample has different starting dates for each country and maturity, depending on when the data become available. All maturity segments are available except for Mexico’s 7-10. Since a substantial percentage of stale prices would prevent proper estimation of the diversification portfolio, and hence proper measurement of the integration index, we only use monthly return data to minimize

[15] Other providers include Barclays Capital, DataStream, FTSE, and the International index company who provides the Markit iBoxx indices. We use CITI/SSS and BOA ML because of their large cross-section and time series span.

the occurrence of stale prices. For example, if we detect three consecutive observations with zero returns we eliminate these observations. At the index level, this is essentially due to data discontinuity. In some maturity segments, we observed lengthy periods of consecutive monthly zero returns and had to exclude these segments. This has resulted in the removal of the 5-7 maturity segment of South Africa, >10 maturity segment of Norway, and >10 maturity segment of Korea. [16] The online Appendix (Panels A-G of Table A.1) reports the fraction of observations with no stale prices. It also presents summary statistics for sovereign bond returns across countries and maturities. In almost all cases and, as expected, both the average returns and the standard deviations increase with the maturity of the bond index and are generally higher for emerging markets. In the DM sample, the average all-maturity bond returns are highest for Australia and New Zealand and are lowest for Greece. Non-normality is present in the bond returns of DMs. In the EM sample, the average all-maturity bond returns range from 4% in Taiwan to 18% in Colombia. Among DMs and EMs, only China, Greece, Japan, Korea, New Zealand, Portugal, and UK show evidence of autocorrelation in their returns as indicated by the $Q(z)_{12}$ statistics. Furthermore, the Ljung-box test statistic for 12th-order serial correlations in the squared returns, $Q(z^2)_{12}$ strongly suggests the presence of time-varying volatility for half of the sample of DMs and EMs. The Engle–Ng test statistic indicates the presence of negative (positive) asymmetry in about 39% (40%) of the 183 country-maturity tests.

The bond returns are also highly correlated across maturities (see the online Appendix A.2). But the correlations are lower between the >10 and the other maturities for most DMs likely due to the lower liquidity of the long segment.

B. Substitute assets and the diversification portfolios

[16] Note that we do not exclude 1-3 and 3-5 maturity segments of South Africa, 5-7 maturity segment of Poland and Korea, and >10 maturity segment of Poland since they do not exhibit lengthy periods of consecutive monthly zero returns.

The substitute assets include the global bond world index proxied by the BOA ML Global Government Index, the US Treasury bonds, the open-end bond funds (OEFs), closed-end bond funds (CEFs), and the bond ETFs.[17] From the universe, we select funds that are classified as international or worldwide bond funds by Morningstar and Bloomberg with at least 80% exposure to government bonds. These include funds that invest only in foreign markets as well as those that invest in both foreign and US markets. According to the 2011 investment company's Factbook, bond funds were the largest segment of the Closed-End Fund market at the end of 2010. Nevertheless, the global bonds funds account for only 6% of the total CEFs i.e. about 14 billion dollars while the municipal and taxable domestic bond funds represent the largest fraction of CEFs.

Sovereign bond returns and the substitute assets are available over different time periods (see Appendix A). We then create two cohorts of substitute assets. The 1986 set comprises the world bond, the US government bonds with different maturity bands and three bond funds. The 1994 set is augmented by eight more bond funds that became available after 1986 and no later than 1994. We run stepwise regressions of the return on the *n*-year bond segment on the matched sample of substitute assets to obtain initial diversification portfolio.

Next, we regress the *n*-year bond return on the initial diversification portfolio as well as on country, regional, and global ETFs for the two cohorts as they become available. The providers of the ETFs of our sample are iShares Barclays Term, iShares eb-rexx, PowerShares, and SPDR Barclays.[18] The first non-US incepted ETF is the iShares Canadian Universe Index Fund, which was introduced on 11/2000. The iShares eb.rexx® Government Germany Bond Index Fund became available on 02/2003. iShares eb.rexx 1.5-2.5, 2.5-5.5, 5.5-10.5, 10.5 and 10.5+ were introduced in 2005. We allow the

[17] Sovereign CDS are widely accessible to institutional investors. Nevertheless, data limitations preclude their inclusion among the substitute assets. This should not be consequential as the inception of bond funds precedes that of CDS contracts.

[18] All of these providers use a full physical (in-kind) replication. However, PowerShares does not purchase all of the securities in the underlying index; instead, the Fund utilizes a "sampling" methodology.

weights assigned to previous securities to vary upon the availability of new funds as in CEH. Specifically, we use three dummies for 2000, 2003 and 2005. The fitted value from this regression is the return on the corresponding diversification portfolio, *DP*, used in the estimation of the equations (5-8). Note that the set of substitute assets is common for all the sovereign bonds (DMs and EMs).[19] Notice also that the ETFs are only invested in sovereign bonds. Appendix A provides further details on the substitute assets.

The pairwise correlations between the world bond index, government bond indices, and their diversification portfolios are reported in the online Appendix A.3. The correlations between the sovereign bond indices and their respective diversification portfolios are high and on average higher for DMs than for EMs. Further, as expected, the correlation between DP and the world portfolio is higher than that between the local bond index return and the world portfolio return.

C. Global and local instruments

We follow the extant literature in specifying the instruments. The global instruments include: (1) the US term spread measured by the yield difference between the 10-year T-bond and the 3-month T-bill, (2) the US Fed Funds rate, (3) the US default spread measured by the yield difference between Moody's Baa and Aaa rated bonds, and (4) the excess return on the world bond index. The local instruments include: (1) the local short term interest rate [20] (2) the local stock market index proxied by the MSCI free index, (3) the change in (nominal or real) exchange rate. All instruments are one-month

[19] Between 2006 and 2007, eight more ETFs from Canada, UK, Euro Region and the World became available. We augment further the substitute assets with those ETFs. Because of limited degrees of freedom, we cannot include all of the eight additional ETFs. Instead, we run regressions on the previous securities augmented by one security of the 2006 and 2007 ETFs that yields the highest adjusted R-square. However, it does not improve on the correlation with the bond index returns. For the rest of the paper, we therefore use the *DP*.

[20] The short interest rate is proxied by the country's Treasury Bill, or if not available we use either the Central Bank policy rate, the money market rate, or the discount rate.

lagged. Additionally, the bond returns expressed in dollar terms are unhedged. Currency effects are discussed in the Sub-section IV-E.

III- Sovereign bonds' integration estimates

Figure 1 (Panel A) plots the cross-sectional averages (equally-weighted) of integration indices for the Eurozone, DM ex. Eurozone and EM. The shaded areas correspond to five key crises periods. They are the exchange rate mechanism (ERM) crisis of September 1992-August 1993, the East Asia crisis on June-December 1997, the January-December 1998 Russian Default and Long-Term Capital Management (LTCM) crisis, the August-September 2008 second stage of the subprime crisis, and the January 2010-December 2012 euro-sovereign debt crisis. The figure shows that the estimated level of integration varies over time. There is a general upward trend but reversals occur during the crises.[21] The negative impact of these crises is consistent with increased importance of the local factors. The Eurozone became the most integrated after 1994.

Panel B of Figure 1 shows the cross-sectional averages (equally-weighted across 29 countries – 21 developed markets and 8 emerging markets) of the integration indices for the five-maturity segments. On average, there is not much difference in integration across the five maturity segments. Nevertheless, unreported plots show different dynamics for the different maturity bands within each country.

[Insert Table 1 and Figure 1]

Table 1 provides descriptive statistics for the estimated integration indices by country and for different regions. The estimated integration measures are highest for Austria, Finland, and Denmark and

[21] The negative effect of ERM, Asian, LTCM and Euro sovereign crises on bond market integration is statistically significant with different intensities across maturity segments (results available upon request).

lowest for Australia, New Zealand, and UK, among the developed markets. We are puzzled by the low level of integration of UK sovereign bond market but Barr and Priestley (2004) and more recently Christiansen (2012) also find the UK to be the least integrated among their sample of five and 17 developed markets, respectively.[22] Note that based on interest rate convergence as a measure of sovereign bond market integration, Adam et al. (2002), Adjaoute and Danthine (2002) as well as Baele et.al. (2004) report increasing levels of integration for the Eurozone prior to the financial crisis. Baele et al. (2004) show that the proportion of local variance explained by benchmark (German) bond market increased significantly in the post-euro period for government bonds of 10-years, 5-years and 2-years to maturity. Similarly, we uncover upward trends following the implementation of the EMU and the Euro for the Eurozone and across all maturity segments. However, there are clear differences among core and periphery countries in the Eurozone specifically since 2010 following the European sovereign debt crisis. The integration for the core countries experienced a small decline while periphery countries witnessed a large drop in their integration. The reversals for the periphery countries could be explained by the "wake-up call" contagion (see Goldstein 1998, and Beirne and Fratzscher, 2013). These findings are consistent with the OECD 2009-2013 reports that show an upward trend in foreign holdings for Eurozone core countries, while buyers of government debt in peripheral markets are increasingly local investors (notably domestic banks) as risk-averse foreign investors – in light of the euro debt crisis – returned to their home or other safe markets.

The sovereign bond markets integration of EMs is lagging behind DMs. This is not surprising in view of the recent history of the EM local government bond market and the youth of its yield curve. The average integration for EMs is 0.45 compared to 0.67 for DMs. Emerging Europe stands as the most integrated among the EMs, while Emerging Asia is the least integrated.

[22] Barr and Priestley (2004) suggest that a sequence of large public sector surpluses in the 80s greatly reduced the volume of debt outstanding with consequent effects on liquidity. René Sieber, CEO of Dynagest, a Swiss asset management company specialized in fixed income, confirmed that UK sovereign bonds and especially the longer maturities are essentially held by local pension funds and insurance companies.

We also test for the presence of time trends. We regress each integration measure on a constant and a trend. The standard errors for the trend tests are heteroskedasticity and autocorrelation consistent obtained from the Newey-West (1987) correction with six lags. The trend coefficient for the sovereign bond index with all maturities included is positive and highly significant for 14 (7) DMs (EMs). Also, we run a panel regression of the integration measures, by region, on a trend and with country fixed effects. The standard errors are two-way clustered by country and time. Table 1 reveals an upward trend in integration of 1.37%, and 1.96% per annum for DMs and EMs, respectively. Among DMs, the largest trend is for Eurozone core countries and among EMs, the largest trend is for Asian countries. However, after the 2008 financial crisis, the trend becomes negative and significant for the long maturity segments and is about -1% per annum.[23] The inclusion of substitute assets such as ETFs did not help integrating the markets during the crisis. Interestingly, Drenovak, Urosevic and Jelic (2014) document a deterioration of ETF's tracking performance during the crisis period. Also on average, the difference in integration between DMs and EMs widens with maturity.

IV. Determinants of integration

We investigate the determinants of the level and dynamics of integration of sovereign bonds. If markets are fully integrated, only global risks are priced and sovereign bond expected returns are globally determined. In contrast, under partial integration sovereign expected returns have (at least) four additional local components; compensation for inflation (expected inflation and a risk premium associated with inflation risk), compensation for national default risk, and compensation for national market liquidity. All of these four components may vary across countries and variation in them could be related to maturity. Based on this decomposition, we would expect, for instance, that countries with more illiquid bonds, lower credit quality and higher political instability to experience a lower level of

[23] The integration estimates by maturity are reported in the online Appendix A.4.

integration compared to more liquid, higher credit quality and more politically stable countries. At the same time, countries with low and stable inflation should exhibit higher levels of comovement with each other. Thus, we identify four covariates that could potentially influence the sovereign bond integration, namely, (1) credit quality, (2) political stability, (3) macroeconomic conditions, and (4) illiquidity. These factors have a country specific and a global component and variation in them could in turn be maturity specific.

A- Hypothesis Development

Credit quality and political stability:

Duffie and Singleton (2003) model both the systematic and sovereign-specific components of sovereign credit risk. Geyer, Kossmeier, and Pichler (2004), Pan and Singleton (2008), Longstaff et al. (2011), Borri and Verdelhan (2012), Gilchrist, Yue, and Zakrajsek (2012), and Aguiar et al. (2016) show that a large part of sovereign credit risk is related to common global factors. Ang and Longstaff (2013) find that systemic credit risk constitutes about 31% of the total credit risk of the Eurozone sovereigns. Remolona, Scatigna, and Wu (2008) find that country-specific fundamentals drive sovereign risk while global risk aversion is the dominant determinant of time-variation in sovereign risk premia. Kallestrup, Lando and Mugoci (2016) find a link between sovereign spreads and the local financial sector. Augustin (2015) shows that the relative importance of global vs. local risk factors depends on the slope of the CDS term structure. To the extent that a large part of the sovereign credit risk is country specific and is locally priced, a higher country-specific credit risk implies lower level of integration. Our first hypothesis is,

H1: Higher country-specific sovereign credit quality is associated with higher level of market integration.

The role of the legal system and of political institutions on financial development and economic growth is well established in the literature (see among others La Porta et al. 1997, 1998; Rajan and Zingales, 2003; Stulz, 2005; Djankov, Liesh, and Shleifer, 2007). Past studies on the equity risk premiums and on the determinants of the integration of the stock markets uncover a significant role for political risk (see, for example, Bailey and Chung, 1995 and Carrieri et al., 2013). Political institutions affect corporate credit markets (see Qi, Roth, and Wald, 2010). Duffie, Pedersen and Singleton (2003) show that Russian yield spreads respond to political events. Foreign investors are attracted to safe countries with strong institutions. We conjecture that political stability should matter for the government bonds of any maturity and even more for the longer maturities held by long-term investors who pursue passive investment strategies. This leads us to hypothesize that,

H2: Greater political stability leads to higher integration with higher effect for the longer maturity sovereign bonds.

To proxy for country-specific credit quality when testing H1, we use the S&P credit rating (*RATING*) linearly transformed into a numerical format ranging from 1 (Default) to 21 (AAA). To test H2, we use the political risk index (*POL*) computed by the Political Risk Services' International Country Risk Guide (ICRG) by combining several components, such as quality of institutions, conflict, democratic tendencies, and government actions, which make a country less attractive to foreign investors. The range of the rating index goes from 0 to 1. A higher number indicates lower political risk.

Macroeconomic conditions:

Uncertainty about future inflation is often cited by financial market participants as an important source of risk in nominal bond returns. For the US, Ang and Piazzesi (2003) stress the role of macro factors (inflation and real economic activity) in explaining the yield curve dynamics specifically at the short end and middle of the yield curve.[24] Ludvigson and Ng (2009) show that real macroeconomic and inflation factors have important forecasting power for future excess returns on U.S. government bonds. Wright (2011) emphasizes the role of inflation uncertainty on term premia. Hilscher and Nosbusch (2010) find local macroeconomic fundamental's levels and volatility to be the dominant factors for emerging markets sovereign yield spreads. Baele, Bekaert and Inghelbrecht (2010) show that uncertainty about inflation and output are important in fitting bond return volatility. To the extent that real and nominal national macro factors affect the local risk premia, their level and volatility should negatively affect the level of integration.

H3a: Higher country-specific inflation and inflation risk lead to lower level of integration.

H3b: Weaker country-specific macroeconomic growth and higher level of country specific macroeconomic uncertainty lead to lower level of integration.

To capture the macroeconomic conditions of the sovereign bond issuing country, we use inflation (π, $\sigma(\pi)$), change in industrial production (ΔIP, $\sigma(IP)$), and change in unemployment rate ($\Delta UNEMPL$, $\sigma(\Delta UNEMPL)$). The inflation measure is based on the Consumer Price Index (CPI). All growth rates, including inflation, are measured as the difference in logs of the index at time *t* and *t-12*, *t* in months. For each country, we estimate the volatility dynamics of inflation, change in industrial production and change in unemployment rate time series by fitting an ARMA(p,q)-GARCH(1,1). We use the Bayesian Information Criterion (BIC) to select the best ARMA(p,q) specification.

<u>Illiquidity</u>

Illiquidity level and risk affect the pricing of bonds (Alquist, 2010) and are important determinants of yield spreads in period of crises. Beber, Brandt, and Kavajecz (2009) show that

[24] See also Diebold, Rudebusch, and Aruoba (2006), Joslin, Priebsch, and Singleton (2014), and Doshi, Jacobs, and Liu (2015) for the role of macro variables in explaining yield curve dynamics and bond risk premia.

sovereign yield spreads are mainly explained by differences in credit quality, while liquidity matters in times of heightened market uncertainty. We thus conjecture,

H4a: Illiquidity is negatively related to the level of integration.

H4b: The impact of illiquidity is more pronounced for distressed countries and during crises.

As liquidity measure, ILIQ, we use the quoted bid-ask spread. We construct the measure for each country from her individual local-currency denominated sovereign bonds (from Bloomberg) and build equally-weighted (E-W) and value-weighted (V-W) monthly averages across all maturities as well as for the five maturity bands in order to test H4a. In the panel regressions we only report results with the equally-weighted measure and refer to it as ILIQ.

To proxy for distressed countries, we use a dummy, D_{CDS}, equal to one when the slope of the term structure of CDS spreads is negative and 0 otherwise. The slope of the term structure is defined as the difference between the 10 and 1-year CDS spreads. Indeed, Lando and Mortensen (2005) have shown that the term structure of CDS spreads is closely linked with conditional default probabilities and this link suggests a downward sloping term structure of credit spreads for highly risky issuers. To test H4b, we interact D_{CDS} with ILIQ. H4b holds if the coefficient on $D_{CDS} \times ILIQ$ is negative.

We next examine if global investor sentiment could also affect bond market integration.

Global investor sentiment

Past studies show that investor sentiment is an important driver of emerging market bond spreads (see, for example, Eichengreen and Mody, 1998, Baek, Bandopadhyaya and Du, 2005, Diaz-Weigel and Gemmill, 2006). Borri and Verdalhen (2015) show that sovereign optimal defaults and bond prices depend not only on the borrowers' economic conditions, but also on the lenders' time-varying risk aversion. As investors lose their general appetite for risk or face higher volatility in the equity markets, they may reallocate to sovereign bonds reflecting a "flight-to-safety" phenomenon (see, for example, Connolly, Stivers, and Sun 2005). We thus conjecture that,

H5: Reduced confidence in the global equity market may lead to higher integration of sovereign bond markets.

We use the implied volatility of the S&P index (*VIX*) that proxies for market volatility and investor sentiment.

More detailed explanation of all the variables and their sources is provided in Appendix B. See also the online Appendix A.5 for the sources of data on real macro variables and variables used for robustness.

B- Descriptive statistics of the explanatory variables

Table 2 reports descriptive statistics for these explanatory variables for DM, Eurozone, and EM. The statistics by country and the cross-correlations are reported in the Panels A and B of the online Appendix A.6. There are significant heterogeneities in most variables across DMs vs. EMs.

On average, DM countries are rated AA over the period, while EM countries are rated BBB. The averages of political risk rating are, respectively, 0.83 and 0.69 for DM and EM confirming that DM are politically more stable and safer than EM. The average inflation rate and inflation volatility are higher in EM compared to DM. The volatility of real macro conditions is also higher in EM compared to DM. On an equally-weighted basis and for the all-maturity bonds, the DM and EM show similar average illiquidity levels but on a value-weighted basis EM bonds are more illiquid. Also illiquidity increases with maturity and the equally-weighted illiquidity by maturity segment is always higher for

EM compared to DM.[25] Except for the higher average CDS spread and higher equally-weighted illiquidity measure for all maturity bands in the Eurozone, the averages of the other variables are similar among Eurozone and the other DMs.

[Insert Table 2 and Figure 2]

The cross-sectional correlations (in the online Appendix A.6, Panel B) show the expected high correlation between political ratings and credit quality ratings. This implies that the significance of these variables could be altered in joint specifications. Except for the real macro variables - that is industrial production growth, and change in unemployment - the correlations between integration and the other explanatory variables are of the expected sign and are significant at the 10% level or less.

As a preliminary examination of the potential influence of these variables as conjectured in our set of hypotheses, we plot in Figure 2 the cross-country average over time of the integration indices for countries in the highest 75% and lowest 25% percentiles for each of *POL*, *RATING*, 5-year CDS, π, $\sigma(\pi)$, and ILIQ. At each time *t*, the countries with the highest political ratings and credit quality (lowest risk), plot above the countries with lowest political ratings and credit quality respectively. Similarly, countries with the lowest CDS spread, inflation, inflation volatility or illiquidity plot above the countries with the highest CDS spread inflation, inflation volatility or illiquidity respectively.

C- Panel regression results

Next, we test the null hypotheses developed above based on various specifications of the following panel regression,

[25] We notice a similar trend by looking at the first order serial correlation of bond returns as reported in Table A.1.

$$II_{i,t} = \alpha + \beta_1(Credit)_{i,t-1} + \beta_2(Political)_{i,t-1} + \beta_3(Macroeconomic)_{i,t-1} + \beta_4(Illiquidity)_{i,t-1} + \beta_5(Global\ sentiment)_{t-1} + X'_{i,t-1}\gamma + c_i + \delta_t + \varepsilon_{i,t} \quad (9)$$

Where X_{it} is the set of control variables, and c_i and δ_t are, respectively, country (C) and time (T) fixed effects. Obviously, the correlation patterns are subject to endogeneity and omitted variables critique. However, relying on lagged variables alleviates the former issue. Country fixed effects account for unobserved country characteristics that are constant over the sample period. We use double clustered robust standard errors by country and time to account for serial and cross-country correlations (see Petersen, 2009). The use of the estimated integration indices as dependent variables in the panel yields consistent estimates of the coefficients. However, the reported standard errors ignore the sampling error and hence likely understate the true standard errors.

We report the estimated coefficients and their p-values from the various specifications of equation (9) in Table 3. In the specifications 1-5, for the sample of all countries, we include time effects, an emerging country dummy and set $c_i = 0$, i.e. country fixed effects are not included. In the full model (6), we include the country fixed effects. To examine the role of global sentiment in models (5) and (6), we remove the time effects but include a trend. The country or time effects estimates are not reported to save space. We run model (6) for all countries (6a) as well as for DM (6b), DM ex. Eurozone (6c), Eurozone (6d), and EM (6e) separately. We also run model (6) for the five maturity bands that include 29 countries, where eight markets are emerging.[26]

[Insert Table 3]

In Column (1) of Table 3, we test H1 and find that sovereign bond markets with higher credit ratings are more integrated. The coefficient is statistically and economically significant. The economic

[26]Results from univariate regressions (see the online Appendix A.7) are overall consistent with the predicted signs of the explanatory variables.

significance is found by multiplying the coefficient estimate with the standard deviation of the explanatory variable (see Panel C of the online Appendix A.6) and relative to the average integration measure across countries. A one standard deviation increase in *RATING* which corresponds for example to a move from speculative grade BB+ to investment grade A- increases bond market integration on average by 15%. The coefficient on *POL* reported in column (2) is positive and highly significant supporting H2 and suggests that greater political stability is associated with higher level of bond market integration. A one standard deviation which, for example, corresponds to moving from the political rating of Brazil to that of Italy increases the bond market integration on average by 13%. Replacing political rating by its four subcomponents (see A1 in Panel A of the online Appendix A.8) delivers a positive and statistically significant association between Government Actions (*GOVACT*) and Democratic Tendency (*DEMTEN*) with bond market integration.[27]

In column (3), we test H3a. Countries with higher inflation and higher inflation uncertainty are less integrated. A joint one standard deviation increase in per annum inflation rate level and risk of 4.12% and 0.76%, respectively, is associated with a decrease of market integration by an average 12%. Online reported results (see A2 and A3 in Panel A of the online Appendix A.8) with real macro variables (industrial production growth, and change in unemployment) show a significant positive association between industrial production growth and integration. Also, the volatility of unemployment rate is negative and significant which provides further evidence to the importance of volatility of the fundamentals to sovereign bond integration.

In column (4) of Table 3, we report the tests of H4a and H4b. More illiquid countries are less integrated. A one standard deviation (of 28.26 basis points) increase in illiquidity is associated with a

[27] Following Bekaert et al. (2014) we group the 12 political risk subcomponents into four categories: (1) Quality of institutions (*QIS*), which include *Law and Order*, *Bureaucratic Quality*, and *Corruption*; (2) Conflict, which includes *Internal Conflicts*, E*xternal Conflicts*, R*eligious Tensions*, and *Ethnic Tensions;* (3) Democratic Tendencies (*DEMTEN*), which includes *Military in Politics* and *Democratic Accountability*; (4) Government Actions (*GOVACT*), which includes *Government Stability, Socioeconomic Conditions*, and *Investment Profile.*

decrease of market integration on average by 2%. The interaction term between the dummy for CDS negative slope and illiquidity is negative and significant. The negative relationship between bond market illiquidity and integration is larger for distressed countries as conjectured in H3b. A4 in Panel A of the online Appendix A.8 reports an additional specification on the role of illiquidity conditional on the business cycle. We find that although the recession dummy is negative and insignificant, illiquidity is more significant during recessions. If we use the value-weighted illiquidity measure, all of the results (available from the authors) remain unchanged.

In column (5) of Table 3, we test H5 and find that the lower the global investor sentiment, the higher the integration of the sovereign bond markets. Nevertheless, the specifications in model (6(a)-(e)) show that this result holds only for the EM sample. Running the regression over the pre-subprime period for all countries as well as by country groupings shows an insignificant effect of VIX. Hence, the positive association between VIX and the integration measure for the EM sample is due to the increase in correlations during the subprime crisis because of the heightened market volatility.[28]

Note that we include an EM dummy to ensure that we are not capturing an emerging country effect. Except for inflation volatility that loses its significance, all the coefficients from specifications 1-5 are unchanged when removing the emerging country dummy and adding the country effects. The emerging country dummy is not reported but is negative and significant in all of these regressions confirming that bond integration is significantly lower in emerging markets.

[28] Alternatively, we use the measure of US market sentiment (*SENT*) constructed in Baker and Wurgler (2007) and obtain similar results.

The explanatory power of a baseline model with only time effects and emerging country dummy is 35.7%. We compare the explanatory power of the four specifications to the baseline. Credit quality, political risk, inflation level and risk, and illiquidity add, respectively, 2%, 5%, 8%, and 0.3%.[29]

The full multivariate specification reported in model (6a) of Table 3 confirms our hypotheses. Countries with better credit quality, less political risk, lower inflation and inflation risk and higher liquidity exhibit higher integration levels.[30] The size of the coefficient on *POL* is reduced because of the high correlation between *RATING* and *POL*. Bekaert et al. (2014) show that, on average, one third of the sovereign spread reflects political risk. Relative to a baseline specification with only country effects and a trend that shows an adjusted R^2 of 58.5%, model (6a) adds 7% in terms of explanatory power.

Furthermore, we run model (6) for different country groupings. We consider the DM, DM ex. Eurozone, Eurozone and the EM samples. The results are reported in (6b)-(6e) of Table 3. In all cases, credit quality is positively associated with the level of integration but the coefficient *RATING* loses its significance for the DM ex. Eurozone and EM groups. Political stability is positively significantly associated with the level of integration for all country groupings except the Eurozone. High inflation is significantly associated with low market integration for the four country groups. Inflation risk is negative and significant only for EM. Illiquidity is significantly and negatively related to the level of integration in all cases.

We use model (6) with the different country groupings for further analysis of the economic significance of our results. We combine the estimated coefficients with the corresponding cross-sectional distribution of the explanatory variables and assume a joint increase from the 25th percentile to the 75th percentile in the variables proxying for credit quality, political stability, inflation (level and

[29] As the sample is not the same in the different specifications, the direct comparison of adjusted R^2 is not exact. We do not report the global sentiment as it has only time series variation.

[30] We obtain similar results if we run model (6) with the five maturity classes allowing for interaction between country and maturity fixed effects. The discussion of maturity effects follows in the next Sub-section.

risk) and illiquidity. We examine the economic significance for the three-country groupings: DM ex. Eurozone, Eurozone, and EM. As reported in Panel A of Figure 3, we find that the sovereign bond market integration increases by about 8%, 11%, 20% for DM ex. Eurozone, Eurozone, and EM respectively. What is more interesting, the contribution of each covariate varies by country grouping. For DM ex- Eurozone, illiquidity, political risk and credit quality are quite significant while for Eurozone, credit quality is dominant. For EM, political risk is the most significant factor followed by inflation.

[Insert Figure 3]

D- Maturity effects

We run model (6) by maturity segment. Results are in the last five columns (6f)-(6j) of Table 3. Credit quality is associated with higher integration across all maturities except the >10 maturity segment where the link between *RATING* and II is partially subsumed by *POL*. Political stability is statistically and economically significant for the medium-long (5-7, 7-10) and long maturities (>10). This result supports our conjecture that political stability should matter more for the longer maturity bonds held by long-term investors who pursue passive investment strategies.

Inflation level and risk are uniformly negative for all maturities but are only significant for the short and medium segments. Although longer maturities are more illiquid than shorter maturities, long-term investors buy longer maturity bonds to hold them until maturity since it provides them with higher long-run returns than more liquid short term bonds. Our results show that illiquidity is negative and significantly related to market integration across the five maturities with similar economic magnitudes.[31]

[31] In untabulated results available upon request, we run specifications 1-5 with the pooled integration measures of the five maturities as dependent variables and interacting each of the explanatory variables with the maturity effects. We get similar results.

E- Currency effects

To examine the effect of currency risk on our results, we run two tests reported in the Panel B of the online Appendix A.8. First, we control for the monthly percentage change in exchange rate expressed as US dollar per foreign currency (ΔFX) and FX volatility ($\sigma(FX)$) in model 6 (a), (b) and (e). FX volatility is measured by cumulating daily squared changes in foreign exchange rate (see Andersen et al., 2003). We then take a 12-month moving average of the monthly FX volatility measures. FX volatility is positively and significantly related to integration, while changes in FX is insignificantly related to integration. However, they have no impact on our results. Second, we repeat the analysis with bond returns when currency hedging is undertaken from the perspective of a US investor (by selling the foreign currency forward). The integration measures of the hedged returns for some countries (e.g. Australia or New Zealand) are quite similar, while for Eurozone and EM countries, we obtain on average, lower measures (see online Appendix A.9). We then run the model 6 (a), (b), and (e) using as dependent variable the integration measures constructed with the hedged returns. The results show that significance of credit political stability, inflation, and illiquidity are unaltered, however, inflation volatility loses its significance. (See Panel B of the online Appendix A.8)

To summarize, the tests on currency effects show that part of the variability in the integration measure is due to FX variability. However, the association between integration and credit quality, political stability, inflation and illiquidity are not subsumed by FX volatility.

F- Robustness checks

We further examine the robustness of our findings to sub-periods, additional control variables, choice of sampling frequency, and outlier effects. Overall, these additional analyses support our main results.

[Insert Table 4]

Sub-period analysis

We examine two interesting sub-periods, 01/1987-01/1999 before the launch of the euro and 01/2001-12/2012 after euro adoption. The first sub-period is also characterized by higher inflation compared to the second sub-period. The cross DMs average of inflation rates over the first sub-period is 4%, while it is only 2% over the second sub-period. In these analyses, we focus on DMs as no data is available for EMs over the first sub-period. *POL* and *RATING* are positive and significant for the two sub-periods for DM. However, for the Eurozone and DM ex. Eurozone, during the first sub-period, only one of the coefficients is of the right sign and significant because of the high correlation between *POL* and *RATING*. During the second sub-period, neither is significant for the DM ex Eurozone but both are significant for the DM and Eurozone. Inflation level and risk are statistically and economically significant for the Eurozone countries before Euro-adoption but the size of the coefficient for inflation is significantly reduced after Euro-adoption and the inflation risk becomes insignificant. Illiquidity is significant over the second sub-period but not for the first sub-period. This could be due to the paucity of bid-ask spread data pre-1999.

Additional controls

We consider additional local, global and bond characteristic variables that have been used as determinants of yield spreads and CDS spreads in past studies. The online Appendix A.5 details the additional control variables and their data sources. Sovereign risk measures are related to fiscal space and leverage measures (see, for example, Edwards, 1986 on the positive association between yield spread and the ratio of debt to GDP). We then control for the level of debt in the country proxied by the public debt to GDP ratio (*PD/GDP*). Following Aizenman, Hutchison, and Jinjarak (2013), we use the fiscal space (*FS*) measured as the inverse of tax-years it would take to repay the public debt as proxy for fiscal fragility. We also add the local stock market return as a proxy for the state of the local economic conditions. Additionally, we control for duration constructed as the equally weighted average of individual bonds durations from Bloomberg. As global variables, we add the US stock market excess return, the investment-grade corporate bond spread and the high-yield corporate bond spread. These US stock and fixed market based variables are used to proxy for the state of the global economy. The investment-grade spread is the spread between five-year BBB- and A-rated bonds. The high-yield spread is the spread between five-year BB- and BBB- rated bonds. We report the results for the full sample and for DM and EM separately.

Overall, our results do not change but inflation loses its significance for DM and illiquidity becomes insignificant for EM. Higher bond integration is associated with lower level of debt through the coefficient on public debt to GDP, however, it is significant for only EM. The coefficients on fiscal space, local stock market return, US stock market excess return, and duration are insignificant. Interestingly, US investment grade spread is positively and significantly associated with market integration of DM countries, while US high yield spread is negatively and significantly related to market integration of DM and EM.

Sampling frequency, and outliers' effects

We time aggregate the monthly integration indices for each country by taking an average over each year. Much information is potentially lost with the time series aggregation, but the aggregation should potentially reduce the effects of sampling variation. Also, we now measure annual inflation volatility from realized volatility by cumulating monthly squared inflation shocks. As seen in the last column of Table 4, our main conclusions continue to hold. Credit quality is positively and significantly associated with sovereign bond integration. Market integration is negatively and significantly related to local inflation and to bond illiquidity. However, inflation volatility loses its sign and significance.

In unreported results, we re-run model (6a) removing one country at a time and show that no single country is driving the explanatory power of the full sample. Finally, to make sure that we are not capturing outlier effects, we re-run model (6a) after winsorizing extreme values that fall in the upper and lower 1% of the distribution of the integration measure. The explanatory power of model (6a) is the same as the one observed for the non-winsorized model.

V- Implications for sovereign funding cost

To examine how market integration relates to the cost of sovereign funding, we study the link between bond market integration and CDS as well as yield spreads.

The sovereign CDS spreads are quoted in US dollars on foreign currency sovereign debt for the 2-, 3-, 5-, 7-, and 10-year maturities.[32] The average premiums across Eurozone countries are 1.50%, 1.43%, 1.34%, 1.28%, 1.22% for 2-, 3-, 5-, 7-, and 10-year CDS spreads respectively.[33] Over the full sample of DM and EM countries, the average CDS spread on the most liquid 5-year contracts varies widely from 14 basis points for Norway to 700 basis points for Greece. For half of the sample countries, the CDS spread is highly skewed with a mean more than double the median. There is also significant variation over time of the CDS spreads.

The yield spread is measured as the difference in yield between the benchmark bond of maturity *m* and the German bond with same maturity for all countries within the Eurozone since the Euro inception. The average yield spreads across Eurozone countries are 1.64%, 1.20%, 0.96%, 0.65%, 0.95%, for 2, 3, 5, 7, and 10-year bonds respectively. The average values range widely across countries. For example, the lowest 3-year average spread is 5 basis points for Finland; the highest 3-year average spread is 666 basis

[32] CDS data are from Markit. We use CDS quoted in US dollar on foreign currency sovereign debt. Restructuring clauses vary by region. For each country, we select the most common restructuring clauses that ensures the highest liquidity and longest time span. We then select Cumulative Restructuring (CR) clause for Europe, North America, Asia, and Emerging Markets. For Australia and New Zealand, we select the Modified Restructuring (MR). There are occasionally missing observations in the monthly time series of the Markit CDS data for the emerging countries. We use linear interpolation techniques to obtain a complete set of monthly estimates of credit quality for all countries at different maturities.

[33] This downward sloping term structure of credit spreads on average is driven by Greece.

points for Greece. The lowest 10-year average spread is 16 basis points for Finland; the highest 10-year average spread is 383 basis points for Greece.

[Insert Figure 4 here]

Panels (a) - (e) of Figure (4) plot the time series averages for the *m*-year CDS spread, yield spread and integration measure of bond returns in maturity class *m* for the 11 Eurozone countries. Note that the yield spread data for the 7-year benchmark bond is not available for Greece. For brevity, Panels (f)-(h) only plot the 5-year CDS spread and the integration measure of all-maturity bond returns for the DM, DM ex. Eurozone and EM respectively. As expected CDS and sovereign bond average yield spreads are very close for most Eurozone countries. Basis risk and cash flow differences between bonds and CDS contracts induce differences in spreads (see for example, Duffie and Singleton, 2003). This is particularly the case for Greece. Interestingly, we observe that the countries with the largest spreads are also the ones with the lowest levels of integration. As integration measures are constructed from bond return indices while the yield and CDS spreads are based on benchmark bonds and US dollar-denominated sovereign issues respectively, the cash flow characteristics and bond specific liquidity effects will affect the correlation between integration measures, yield spreads and CDS spreads.

Longstaff et al. (2011) argue that the dependence of funding cost on global factors could become increasingly more important as the trend towards globalization continues. We examine how changes in market integration relates to CDS spread changes for the Eurozone[34] across the five maturity segments after controlling for the global and local factors as reported by Longstaff et al. (2011).[35] Specifically,

[34] We exclude Greece in view of the high basis risk and discrepancy between yield spread and CDS spread as shown in Figure 4 (a-e). Besides, it joined the Eurozone a year later.

[35] Several papers examine the determinants of the yield spread and the CDS spread for developed and emerging markets. See for example, Remolana, Scatigna, and Wu (2008), Pan and Singleton (2008) and Longstaff et al. (2011). More recently, Aguiar et al. (2016) examine the spreads on sovereign debt of 20 emerging market economies and show that country-specific fundamentals, in the form of the debt-to-GDP ratio and the growth rate of output, explain a modest amount of the variation in the spreads. A large component of the spread movements is captured by common latent factors. Jeanneret (2015) shows that sovereign spreads in emerging markets vary with

we run a panel regression with country fixed effects and a time trend of monthly CDS changes ($\Delta CDS_{i,t}$) on the corresponding changes in the integration measure ($\Delta II_{i,t}$) after conditioning on local ($X_{i,t}$) and global factors (Z_t) to examine the significance of changes in market integration. We also examine the relationship between the integration measure constructed form all-maturity bond returns for DM and EM and the 5-year CDS spreads. Specifically,

$$\Delta CDS_{i,t} = \alpha + \beta_1 \Delta II_{i,t} + X'_{i,t}\beta_2 + Z'_t\beta_3 + c_i + \theta \times Trend + \varepsilon_{i,t} \qquad (10)$$

The local factors include the change in sovereign credit quality (*ΔRATING*), the change in political risk (*ΔPOL*), the local equity return denominated in local currency, and the percentage change in exchange rate expressed as US dollar per foreign currency (*ΔFX*). The global factors include the change in CBOE S&P 500 volatility index (*ΔVIX*), the U.S. equity market excess return (US Market Excess Ret), and the investment-grade (Invest Grade) and high-yield (High Yield) corporate bond spreads.

Table 5 reports the coefficients, their p-values from double clustered standard errors, and adjusted R^2. We also report the baseline adjusted R^2 from a regression with only time and country fixed effects.

[Insert Table 5 here]

Notwithstanding the high co-movement in the CDS spreads across the maturity spectrum as shown in Pan and Singleton (2008), the results vary across the five maturities. The integration measure is negatively and statistically significantly associated with the changes in CDS spreads for all maturities and for the DM countries indicating that the higher the market integration the lower the sovereign

U.S. market uncertainty, while European spreads depend on Eurozone bond factors. Aizenman, Hutchison, and Jinjarak (2016) find evidence for macroeconomic fundamentals, specifically trade openness, in explaining the CDS spreads of emerging markets. See Augustin (2014) for a review of the literature on sovereign CDS.

country's funding cost. Across the developed markets, a one percent increase in integration corresponds to an average decrease in the cost of funding of about 3% of the average 5-year CDS spreads, which is economically sizeable.[36] Note that we are using local-currency denominated bonds while CDS spreads are dollar denominated nonetheless we find significant relationship between bond market integration and CDS spread changes. We find a positive but insignificant relationship between CDS spread changes and change in market integration for the EM sample. This could be due to the significant difference in market structure between the CDS underlying USD denominated sovereign bonds and the local currency denominated bonds that we use for constructing the integration measure. As a robustness check, we construct the integration measure for the USD denominated EM sovereign bond indexes proxied by J.P. Morgan EMBI index.[37] We uncover a negative but insignificant coefficient on the integration measure.

RATING is negative as expected but only significant for three maturities while *POL* is not. This is due to the collinearity between credit rating and political rating respectively with the integration measure. Interestingly integration is significant after controlling for credit and political rating. The local stock market is uniformly negatively and statistically significantly associated with the changes in CDS spreads. Changes in foreign exchange are negatively associated with the CDS spread across all maturities indicating that the sovereign credit spread decreases as the country's currency appreciates against the US dollar. US market excess return and VIX are only significant for EM. The coefficient on the high-yield is positive and significant for DM and the four maturity segments of the Eurozone. Except for Portugal, which was downgraded during the euro sovereign crisis to BB, all of the nine Eurozone countries are investment grade sovereigns. This is interesting and confirms earlier findings of Longstaff

[36] The large economic impact on the short maturity CDS spread could result from the higher illiquidity of these contracts (see Pan and Singleton, 2008, and Rubia, Sanchís-Marco, and Serrano, 2016).
[37] J.P. Morgan EMBI includes U.S. dollar denominated Brady bonds, loans, and Eurobonds issued or guaranteed by emerging market governments.

et al. (2011), namely that the high yield variable is significant for investment grade sovereigns with rather low CDS spreads. The adjusted R^2s range between 17% and 30%.

In unreported specifications for the Eurozone, the regressions with the benchmark 10-year yield spread changes show similar results. Controlling for macroeconomic fundamentals such as inflation, public debt to GDP, fiscal space used to examine the determinants of sovereign bond integration do not alter any of our results. Specifically, for the emerging market sample and consistent with Aizenman, Hutchison, and Jinjarak (2016), we find a positive and significant coefficient for inflation and public debt to GDP.

Conclusion

We estimate the time-varying integration of 21 developed and 16 emerging sovereign bond markets. We also examine the level of integration across maturity bands of 1-3, 3-5, 5-7, 7-10, and >10 years for a sample of 29 countries that include 8 EMs with maturity data. Our integration measure accounts for the role of substitute assets such as bond funds, closed-end funds, and ETFs that play a major role in integrating bond markets. We next examine the economic importance of four important factors, namely the credit quality, the political stability, the macro-economic conditions, and the illiquidity of the sovereign bonds that may explain the differences in the level and dynamics of integration at the market level as well as by maturity.

Our results indicate a general upward trend in the integration for most countries and across different maturities. Nevertheless, there is substantial heterogeneity in the level and dynamics of integration across maturities and countries. The integration of EMs sovereign bond market is lagging behind DMs and is also more volatile. The average market level integration for the EM pool is 0.45

compared to 0.67 for DMs. We do observe reversals and negative trends especially during the financial crisis. Furthermore, the integration of the sovereign bond markets increases on average by about 8% for DMs to 20% for EMs, when a country moves from the 25th percentile to the 75th percentile as a result of higher credit quality, lower inflation and inflation risk, and lower political risk and illiquidity. These findings hold in the presence of currency risk, global investor sentiment, and maturity effects. Finally, we perform robustness checks considering additional controls, sub-periods, sample frequency and outliers.

It is interesting to observe that credit (and institutional) quality, and macroeconomic stability that enhance bond market integration and consequently lower their funding cost, are largely under the control of each sovereign country unless the latter belongs to a monetary or economic union and is thus faced with regional monetary, macro-economic and even credit ratings' spillovers. This set of results can thus guide domestic fiscal and monetary policies and in parallel help us understand their limitations given the observed trend of a higher integration level of the international bond market.

We finally examine the relationship between market integration and the changes in CDS and yield spreads. We find that across the developed markets, a one percent increase in integration corresponds to an average decrease in the cost of funding of about 3% of the average 5-year CDS spreads, which is economically sizeable. Thus, a higher level of bond market integration is associated with a lower cost of sovereign borrowing.

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Appendix A - List of substitute assets

Fund name	Market	Start date	Type	Exchange
		Bond Index		
BOFA ML GLOBAL GVT INDEX Total Return	World	31.12.1985	Index	
BOFA ML US TRSY 1-3Y	US	31.12.1975	Index	
BOFA ML US TRSY 3-5Y	US	31.12.1975	Index	
BOFA ML US TRSY 5-7Y	US	30.03.1973	Index	
BOFA ML US TRSY 7-10Y	US	30.03.1973	Index	
BOFA ML US TRSY 10+Y	US	31.03.1976	Index	
BOFA ML US TRSY 10-15Y	US	31.01.1978	Index	
		Bond Funds		
Fideuram Rendimento (FIDIMRE IM Equity)	Eurozone	31.12.1985	OEF	
Aberdeen Asia-Pacific Income Fund Inc (FAX)	Asia-Pacific	17.04.1986	CEF	AMEX
Fideuram Liquidita (FIDIM20 IM Equity)	Eurozone	31.10.1986	OEF	
SEB Invest - SEB Zinsglobal (BINZINS GR Equity)	world	31.10.1988	OEF	
Templeton Global Bond Fund (GIM)	world	15.06.1988	CEF	NYSE
Aberdeen Global Income (FCO)	world	12.03.1992	CEF	NYSE
(EMD)	EM Region	18.06.1993	CEF	NYSE
Global High Income (GHI)	world	30.09.1993	CEF	NYSE
Morgan Stanley Emerging Markets Debt Fund (MSD)	EM Region	16.07.1993	CEF	NYSE
Templeton Emerging Markets Income Fund (TEI)	EM Region	23.09.1993	CEF	NYSE
Palatine Asset Management - Palatine Premiere	Europe	31.01.1994	SICAV	
iShares Canadian Universe Bond Index	Canada	20.11.2000	ETF	T.S.E
iShares eb.rexx® Government Germany	Germany	06.02.2003	ETF	D.B.
iShares eb.rexx® Government Germany 5.5-10.5	Germany	31.01.2005	ETF	D.B.
iShares eb.rexx® Government Germany 1.5-2.5	Germany	31.01.2005	ETF	D.B.
iShares eb.rexx® Government Germany 2.5-5.5	Germany	31.01.2005	ETF	D.B.
iShares eb.rexx® Government Germany 10.5	Germany	28.09.2005	ETF	D.B.
iShares eb.rexx® Government Germany 10.5+	Germany	28.09.2005	ETF	D.B.
iShares Canadian Government Bond Index Fund	Canada	06.11.2006	ETF	T.S.E
iShares FTSE UK All Stocks Gilt	UK	01.12.2006	ETF	L.S.E
iShares Barclays Capital Euro Government Bond 1-3	Euro Region	05.06.2006	ETF	L.S.E
iShares Barclays Capital Euro Government Bond 3-5	Euro Region	08.12.2006	ETF	L.S.E
10	Euro Region	08.12.2006	ETF	L.S.E
30	Euro Region	08.12.2006	ETF	L.S.E
PowerShares Emerging Mkts Sovereign Debt	EM Region	30.11.2007	ETF	NYSEArca
SPDR Barclays Capital International Treasury Bond	World	05.10.2007	ETF	NYSEArca

Appendix A presents the list of government bond findices, funds and ETFs used as substitute securities, returns start date, underlying market, and the exchange where they trade if applicable. The list of closed-end bond funds (CEF) is from Lipper, and Barron's. The list of open end funds (OEF) is from Bloomberg (fund strategy: Government). The list of ETFs is from Morningstar, Bloomberg, and official websites of ETFs. Given that the Euro region ETFs are listed on multiple exchanges, we use the listings with the longest time series. Hoding period returns data on these securities are from CRSP, Bloomberg, and Datastream. D.B. stands for Deutsche Börse, T.S.E for Toronto stock Exchange, and L.S.E for London Stock Echange.

Appendix B - Definition of the variables used in the main panel regressions (Sections IV and V of the paper)

Variable	*Name*	Description
Sovereign variables and spreads		
Credit Quality	*RATING*	S&P sovereign ratings of long term foreign bond transformed linealry into a numerical format ranging from 1 (Default) to 21 (AAA). Frequency: Monthly. Source: Bloomberg and Standard&Poor's.
Political Ratings	*POL*	Political risk ratings based on the sum of 12 weighted variables covering both political and social attributes. The index has 100 points. It is scaled to range from 0 (high risk) to 1 (low risk). Frequency: Monthly. Source: International Country Risk Guide (ICRG).
CDS spread	*CDSn*	Sovereign Credit Default Spread for *n* -year maturities, *n = 2, 3, 5, 7, 10* expressed in bps per month. Frequency: Monthly. Source: Markit.
Yield Spread	*YSn*	Redemption yield on n-year benchmark domestic sovereign bonds from the eurozone minus redemption yield on n-year German sovereign bonds expressed in percentage per month, n = 2, 3, 5, 7, 10 . Frequency: Monthly. Source: Datastream.
Inflation		
Inflation	*CPI*	Inflation rate measured as difference in logs of the Consumer Price Index (CPI) at time t and t-12, t in months. Frequency: Monthly. Source: IFS
Inflation Volatility	σ*(CPI)*	Inflation volatility measured by fitting a GARCH(1,1) to the shocks to monthly inflation rates. Inflation rate shocks are estimate from the ARIMA(p,q). We use the BIC to select the best ARMA(p,q) specification.
Iliquidity		
Bid-ask spread	*ILIQ*	Equally-weighted quoted bid-ask spread expressed relative to mid price in basis points. The measure is constructed from individual sovereign local currency-denominated bonds with at least one year to maturity and no special features (that is bonds with options or floating rates or inflation-indexed bonds are eliminated). The measure is winsorized at the first and 99th percentile to limit the influence of outliers. Frequency: Monthly. Source: Bloomberg
Global investor sentiment		
VIX	*VIX*	VIX is the option volatility index from Chicago Board Option Exchange. VIX exhibit only time-series variation. Frequency: Monthly.
Local variables		
Local stock market return		Local stock market total return denominated in local currency. Frequency: Monthly. Source: Datastream Indexes
Change in FX	ΔFX	Percentage changes in the exchange rate, expressed as US dollar units per local currency. Frequency: Monthly. Source: Datastream
Global variables		
US market excess return		Total return US index minus the one-month T-bill retun. Frequency: Monthly. Source: Datastream Indexes
Corporate yield spread-Investment grade	*Invest Grade*	change in basis point yield spread between BBB and A industrial bond indexes. The indexes represent the average yields of non-callable A and BBB rated bonds with maturities about five years. Frequency: Monthly. Source: Bloomberg (fair market curves).
Corporate yield spread-High yield	*High Yield*	change in basis point yield spread between BB and BBB industrial bond indexes. The indexes represent the average yields of non-callable BBB- and BB- rated bonds with maturities about five years. Frequency: Monthly. Source: Bloomberg (fair market curves).

Table 1 - Summary statistics of the sovereign bond integration measures

	Start date	Mean	SD	Trend (×1200)	t-stat		Start date	Mean	SD	Trend (×1200)	t-stat
	Panel A- Developed Markets						***Panel B- Emerging Markets***				
Australia	Jan-86	0.49	0.18	**1.82**	8.20	Brazil	Jan-02	0.44	0.25	1.65	1.16
Austria	Sep-92	0.85	0.03	**0.14**	4.42	Chile	Nov-02	0.42	0.19	0.58	1.53
Belgium	Dec-90	0.82	0.03	-0.04	-0.72	China	Dec-03	0.14	0.20	-0.42	-0.60
Canada	Jan-86	0.65	0.29	**3.60**	11.89	Colombia	Jan-03	0.47	0.22	0.49	0.92
Denmark	Mar-89	0.83	0.03	-0.02	-0.38	Czech Rep.	Dec-00	0.77	0.05	-0.01	-0.13
Finland	Dec-94	0.84	0.09	**1.69**	16.37	Hungary	Dec-00	0.63	0.15	**1.52**	4.14
France	Jan-86	0.67	0.21	**2.56**	20.70	India	Dec-01	0.28	0.22	**5.09**	5.89
Germany	Jan-86	0.79	0.06	**0.22**	2.53	Indonesia	Jan-03	0.30	0.27	2.77	1.85
Greece	Apr-00	0.65	0.13	0.60	0.87	Korea	Dec-00	0.53	0.08	**0.27**	1.95
Ireland	Sep-92	0.69	0.14	0.52	1.08	Malaysia	Dec-01	0.43	0.30	**7.44**	6.38
Italy	Jan-86	0.53	0.27	**2.75**	10.00	Mexico	Dec-01	0.42	0.29	**5.34**	4.58
Japan	Jan-86	0.57	0.11	**0.48**	2.84	Poland	Sep-98	0.54	0.15	**2.45**	5.51
Netherlands	Jan-86	0.67	0.22	**2.77**	21.71	South Africa	Aug-00	0.49	0.17	-0.47	-0.82
New Zealand	Sep-92	0.51	0.16	**2.03**	6.42	Taiwan	Jun-00	0.52	0.07	**1.34**	3.82
Norway	Dec-94	0.68	0.07	**0.68**	3.49	Thailand	Dec-01	0.33	0.12	0.36	0.72
Portugal	Sep-93	0.69	0.19	-0.45	-0.66	Turkey	Apr-04	0.45	0.20	-0.83	-0.97
Singapore	Sep-03	0.65	0.07	0.04	0.31						
Spain	Dec-90	0.77	0.08	**0.70**	2.75						
Sweden	Dec-90	0.62	0.11	**1.37**	6.46						
Switzerland	Jan-86	0.57	0.11	**1.11**	7.91						
UK	Jan-86	0.50	0.06	0.06	0.93						

Table 1 - Continued

Averages across regions											
	# countries	Mean	SD	Trend (×1200)	t-stat		# countries	Mean	SD	Trend (×1200)	t-stat
DM	21	0.67	0.11	**1.37**	4.66	EM	16	0.45	0.15	**1.96**	3.30
DM ex. Eurozone	10	0.61	0.10	**1.24**	3.25	Emerging Europe	4	0.65	0.11	**1.55**	2.58
Eurozone	11	0.72	0.10	**1.50**	3.49	Latin America	4	0.44	0.02	**2.21**	2.07
Eurozone Core	6	0.77	0.08	**1.56**	2.92	Emerging Asia	8	0.35	0.15	**2.60**	2.25
Eurozone Periphery	5	0.67	0.09	**1.39**	1.94	DM and EM	38	0.56	0.17	**1.41**	5.15

The table reports start date, mean, standard deviation, trend coefficient and its t-stat for the integration measures of the all-maturity bond indices for Developed markets (Panel A) and Emerging markets (Panel B) estimated from the E-L model of Section I. The standard errors for the trend tests of the individual regressions are heteroskedasticity and autocorrelation consistent and are obtained from the Newey-West (1987) correction with six lags. For the trend tests by region, we run panel regressions with country fixed effects and a trend. The standard errors are clustered by country and time. We report the trend coefficient and t-stat of these tests. The number of countries in the different pools is reported in the first column of each Panel.

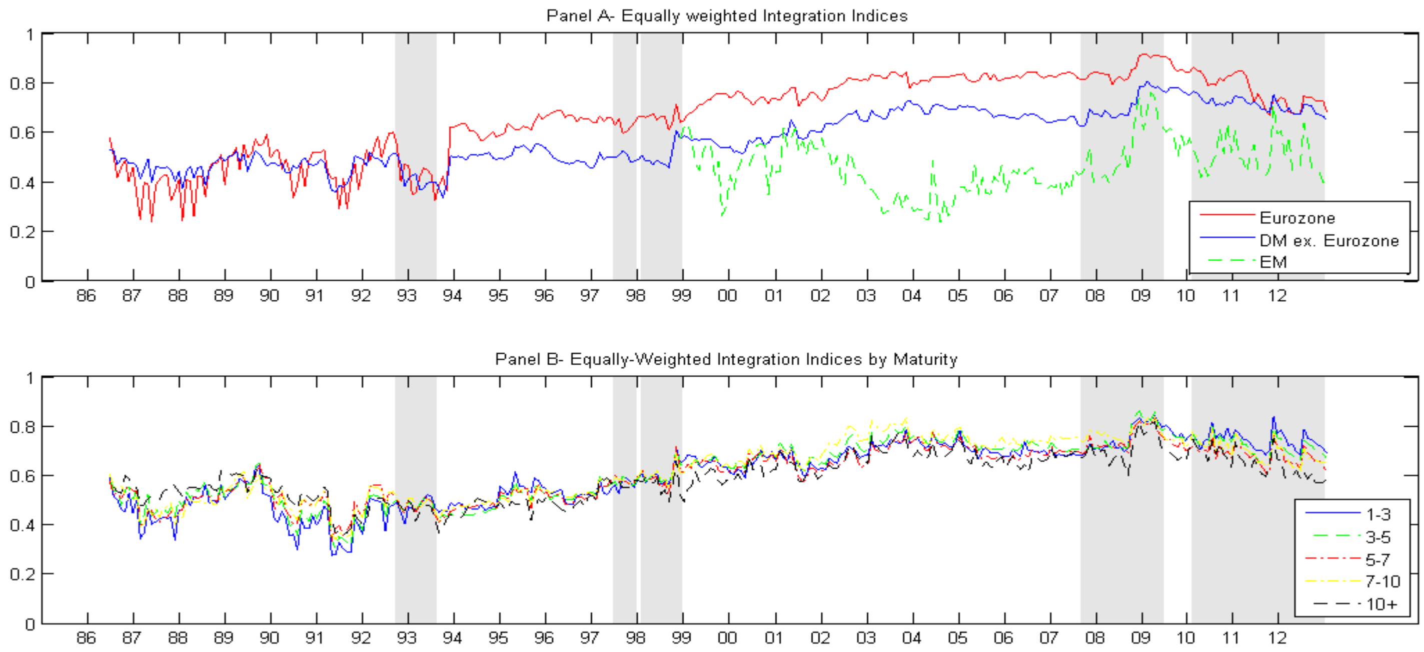

Figure 1. Average Integration indices by country and by maturity bands

Panel A plots the equally-weighted averages across a group of 11 Eurozone countries (solid red line), 10 developed markets ex. Eurozone (solid blue line) and 16 emerging markets (dashed green line) at each point in time of the estimated integration measures of the all-maturity bond indices from the E-L model of Section I. Panel B plots the equally-weighted averages across 29 countries (21 developed markets and 8 emerging markets) of the estimated integration measures for the five maturity classes. Shaded areas are the crises periods. The crises are the exchange rate mechanism (ERM) crisis of September 1992-August 1993, the East Asia crisis on June-December 1997, the January-December 1998 Russian Default and Long-Term Capital Management (LTCM) crisis, the August-September 2008 subprime crisis, and the January 2010-December 2012 euro sovereign debt crisis.

Table 2 - Emerging vs Developed Markets

	DM &EM	DM	DM ex. Eurozone	Eurozone	EM
II	0.57	0.67	0.61	0.72	0.45
RATING	16.87	19.82	20.48	19.22	12.99
5-year CDS (bps)	121.60	85.60	32.58	133.79	168.85
POL	0.77	0.83	0.85	0.81	0.69
π *(% p.a)*	4.17	2.77	2.36	3.15	5.99
$\sigma(\pi)$ *(% p.a)*	1.61	1.31	1.37	1.25	2.01
Δ*IP (% p.a)*	2.49	1.89	1.96	1.83	3.27
σ*(IP) (% p.a)*	8.53	7.14	7.33	6.97	10.36
Δ*UNEMPL (% p.a)*	0.20	1.21	0.04	2.28	-1.12
σ*(UNEMPL) (% p.a)*	10.64	8.77	11.97	5.86	13.09
ILIQ (E-W) (bps)	20.87	21.00	11.14	29.96	20.70
ILIQ (V-W) (bps)	3.53	2.33	2.40	2.26	5.11
DUR	4.46	5.07	5.62	4.57	3.61
PD/GDP	0.56	0.66	0.61	0.71	0.42
FS	3.74	4.25	4.83	3.72	3.02
Δ*FX (% p.a)*	0.22	1.76	2.07	1.48	-1.80
σ*(FX) (% p.a)*	10.06	9.73	9.55	9.89	10.49
Local stock market return	9.67	8.26	9.01	7.58	11.51
Subcomponents of POL					
QIS	0.74	0.88	0.93	0.83	0.56
CONFLICT	0.85	0.90	0.91	0.89	0.77
GOVACT	0.85	0.95	0.96	0.94	0.73
DEMTEN	0.68	0.71	0.72	0.69	0.65
ILIQ (bps) by maturity class					
ILIQ13	10.84	8.37	6.56	9.85	13.93
ILIQ35	13.60	10.43	9.19	11.55	17.76
ILIQ57	16.44	11.56	9.41	13.52	23.28
ILIQ710	21.39	13.38	12.58	14.12	32.60
ILIQ>10	35.20	18.38	15.41	21.08	60.43

This table lists average values of the regressors and regressands (integration indices, II) for the group of DM & EM (37), DM (21), DM ex. Eurozone (10), Eurozone (11), and EM (16) economies. The values by country are reported in the online Appendix A.6 (Panel A). Appendix B and online Appendix A.5 detail the set of regressors and their sources.

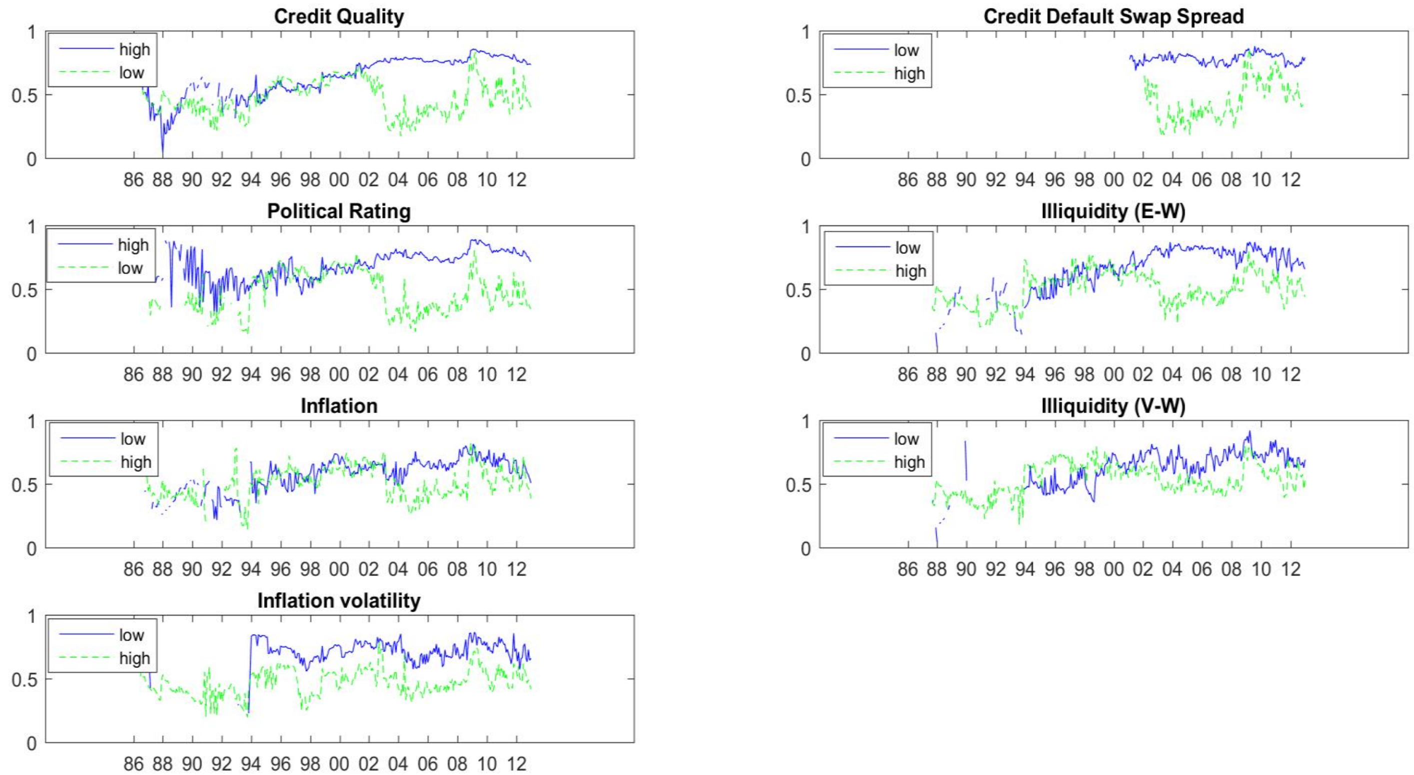

Figure 2. Average integration indices by percentiles

For the variables credit quality (RATING), 5-year CDS, political risk (POL), inflation (π), inflation volatility ($\sigma(\pi)$), Illiquidity (ILIQ) (equally-weighted E-W and value-weighted V-W) used in the main panel regressions we plot an equally-weighted sum of the integration indices for countries in the 75% and 25% percentiles of the distribution of each of these variables. See Appendix B for details on these variables and their sources.

Table 3- Determinants of sovereign bond market integration

	(1) Credit	**(2) Political**	**(3) Inflation**	**(4) Illiquidity**		**(5) Sentimen**	**(6) Full Model (by region and maturity)**									
	H1	H2	H3a	H4a	H4b	H5	(a) DM& EM	(b) DM	(c) DMex. Euro.	(d) Euro-zone	(e) EM	(f) Mat. 1-3	(g) Mat. 3-5	(h) Mat. 5-7	(i) Mat. 7-10	(j) Mat. >10
RATING	**0.02**						**0.02**	**0.03**	0.04	**0.03**	0.00	**0.01**	**0.02**	**0.02**	**0.02**	0.00
	(0.00)						*(0.01)*	*(0.02)*	*(0.31)*	*(0.02)*	*(0.74)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.14)*
POL		**0.72**					**0.48**	**0.47**	**0.77**	0.18	**0.82**	0.03	0.02	**0.33**	**0.29**	**0.17**
		(0.00)					*(0.02)*	*(0.01)*	*(0.06)*	*(0.19)*	*(0.01)*	*(0.68)*	*(0.79)*	*(0.00)*	*(0.00)*	*(0.05)*
π $(\times 10^2)$			**-0.23**				**-0.14**	**-0.21**	**-0.11**	**-0.44**	**-0.15**	**-0.64**	-0.17	**-0.54**	-0.23	-0.26
			(0.01)				*(0.08)*	*(0.06)*	*(0.02)*	*(0.01)*	*(0.08)*	*(0.00)*	*(0.26)*	*(0.00)*	*(0.25)*	*(0.17)*
$\sigma(\pi)$ $(\times 10^2)$			**-7.38**				**-5.94**	-6.90	0.80	-26.24	**-8.72**	-1.16	-1.92	**-5.92**	-2.57	-4.27
			(0.00)				*(0.01)*	*(0.67)*	*(0.97)*	*(0.41)*	*(0.00)*	*(0.68)*	*(0.47)*	*(0.05)*	*(0.45)*	*(0.34)*
ILIQ $(\times 10^4)$				**-3.84**	-0.79		**-2.02**	**-1.44**	**-35.7**	**-1.59**	**-10.96**	**-5.82**	**-5.68**	**-4.38**	**-7.48**	**-2.07**
				(0.00)	*(0.50)*		*(0.02)*	*(0.04)*	*(0.00)*	*(0.02)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
CDS Dummy					0.06											
					(0.40)											
$D_{CDS} \times ILIQ$					**-8.99**											
					(0.00)											
VIX $(\times 10^2)$						**0.95**	**0.25**	0.03	-0.03	0.08	**0.63**	**0.19**	**0.18**	**0.12**	**0.17**	**0.12**
						(0.00)	*(0.01)*	*(0.63)*	*(0.58)*	*(0.27)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Trend (×1200)						**2.63**	**1.31**	**1.32**	**1.41**	**1.27**	**2.57**	**2.01**	**1.74**	**2.15**	**1.49**	**1.77**
						(0.00)	*(0.00)*	*(0.00)*	*(0.01)*	*(0.02)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
FE	T	T	T	T	T		C	C	C	C	C	C	C	C	C	C
# obser.	7122	7377	5701	7016	4240	7043	5337	3736	1690	2046	1601	4383	4336	3752	3995	3633
Adjusted R^2	37.7%	41.0%	43.6%	36.0%	41.8%	14.5%	65.5%	60.9%	63.4%	51.8%	45.2%	60.9%	60.5%	63.1%	57.5%	61.4%

The table reports the estimated coefficients from panel regressions of the sovereign bond integration measures on proxies for credit quality, political risk, inflation, illiquidity, and global sentiment. The estimated models are based on the general equation below,

$$II_{i,t} = \alpha + \beta_1(Credit)_{i,t-1} + \beta_2(Political\ )_{i,t-1} + \beta_3(Inflation)_{i,t-1} + \beta_4(Illiquidity)_{i,t-1} + \beta_5(Global\ sentiment)_{i,t-1} + c_i + \delta_t + \varepsilon_{i,t}$$

where c_i are country fixed effects (C) and δ_t are time fixed effects (T). In models (5) and (6) (a)-(j) we remove the time fixed effects and add a time trend, *Trend*. We run unbalanced regressions as not all the explanatory variables are available for all the cross-sectional units. All explanatory variables are lagged. p-values in parentheses are clustered by country and time. The sample period is from 01/1986 to 12/2012. Definition of variables and data source are in Appendix B. Numbers in bold represent significance at 10% level or lower.

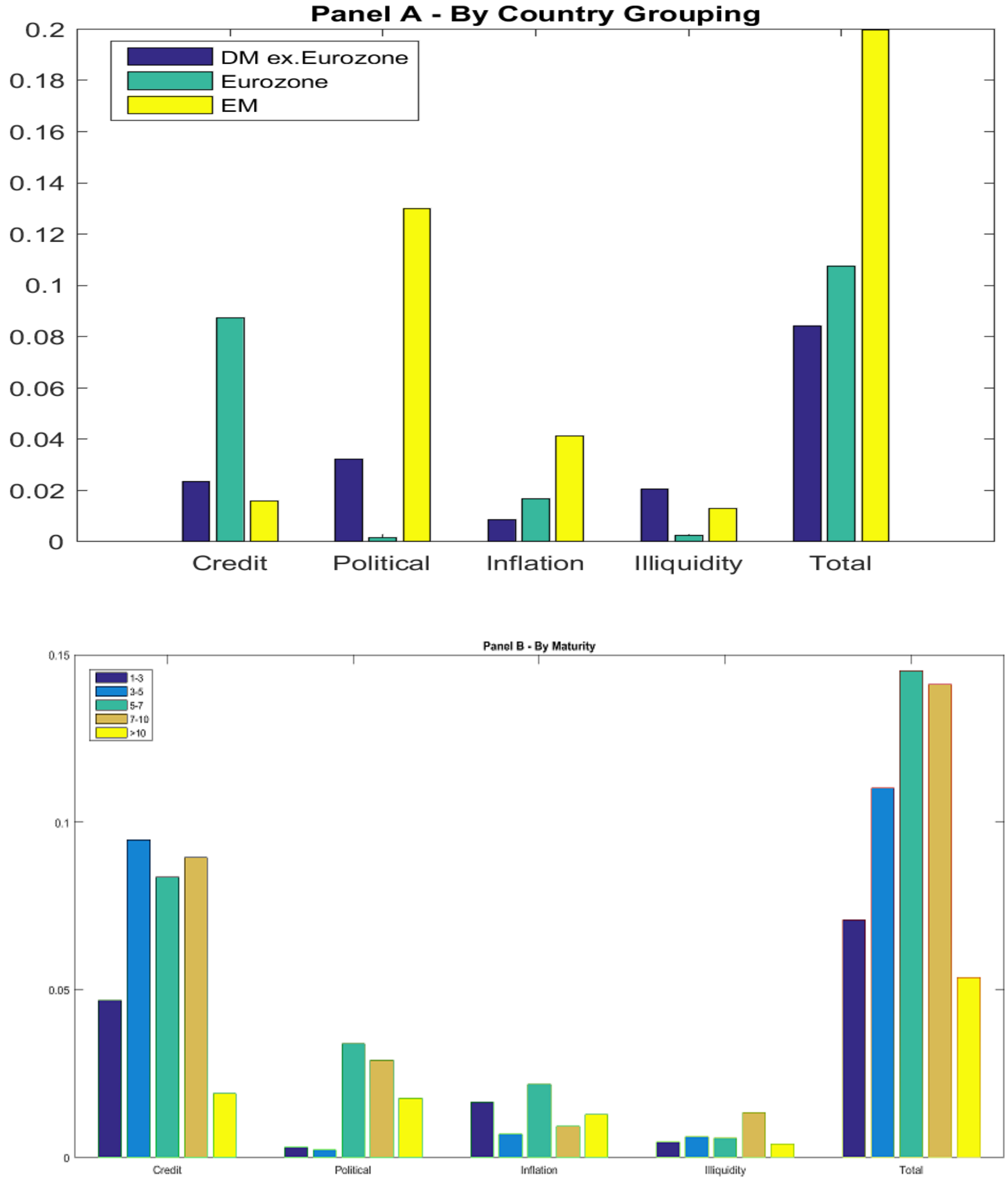

Figure 3. Economic Significance

We combine the estimated coefficients with the corresponding cross-sectional distribution of the explanatory variables and assume a joint increase from the 25th percentile to the 75th percentile in the variables proxying for credit quality, political stability, inflation (level and risk) and illiquidity.We plot the economic impact on bond market integration of credit quality (RATING), political ratings (POL), inflation, and Illiquidity (ILIQ). Inflation is the sum of inflation level (π). and risk ($\sigma(\pi)$). Definition of the variables and data source are in Appendix B. Panel A plots for three country grouping; DM ex. Eurozone (10), Eurozone (11) and EM (16), in parenthesis the number of countries in each group. Panel B plots by maturity (1-3, 3-5, 5-7, 7-10, and >10) for the 29 countries (21 developed markets and 8 emerging markets).

Table 4
Robustness tests

	1987-1999			2001-2012			Additional Controls			Year Frequency
	DM	**DM ex. Euro.**	**Eurozone**	**DM**	**DM ex. Euro.**	**Eurozone**	**DM& EM**	**DM**	**EM**	**DM& EM**
RATING	**0.03**	**0.24**	-0.02	**0.03**	0.03	**0.03**	**0.03**	**0.02**	-0.04	**0.02**
	(0.02)	*(0.00)*	*(0.23)*	*(0.02)*	*(0.51)*	*(0.04)*	*(0.01)*	*(0.02)*	*(0.13)*	*(0.00)*
POL	**0.20**	-0.06	**0.38**	**0.46**	0.03	**0.65**	**0.79**	**0.50**	**1.06**	**0.76**
	(0.02)	*(0.62)*	*(0.00)*	*(0.08)*	*(0.89)*	*(0.09)*	*(0.00)*	*(0.03)*	*(0.01)*	*(0.00)*
$\pi\ (\times 10^2)$	**-0.40**	**0.86**	**-0.76**	-0.05	-0.02	**-0.19**	-0.06	0.06	**-0.32**	**-0.42**
	(0.00)	*(0.00)*	*(0.00)*	*(0.25)*	*(0.72)*	*(0.02)*	*(0.45)*	*(0.19)*	*(0.03)*	*(0.09)*
$\sigma(\pi)\ (\times 10^2)$	-2.62	-10.84	**-15.98**	-1.11	-6.14	-1.91	**-4.00**	-0.02	**-6.02**	0.70
	(0.63)	*(0.15)*	*(0.06)*	*(0.93)*	*(0.73)*	*(0.91)*	*(0.00)*	*(0.87)*	*(0.00)*	*(0.55)*
$ILIQ\ (\times 10^4)$	-1.37	**-28.56**	0.83	**-1.12**	**-29.34**	**-1.10**	**-0.92**	**-0.93**	-13.25	**-4.86**
	(0.90)	*(0.01)*	*(0.94)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.25)*	*(0.03)*
Public Debt to GDP							-0.09	-0.06	**-1.43**	-0.08
							(0.25)	*(0.27)*	*(0.06)*	*(0.12)*
Fiscal Space							0.00	0.00	0.18	0.00
							(1.00)	*(0.99)*	*(0.16)*	*(0.97)*
Duration							-0.01	0.01	0.00	-0.01
							(0.48)	*(0.37)*	*(0.71)*	*(0.43)*
Local Stock Market Return							-0.01	0.03	-0.12	-0.06
							(0.93)	*(0.42)*	*(0.28)*	*(0.84)*

Table 4- Continued

	1987-1999			2001-2012			Additional Controls			Year Frequency
	DM	**DM ex. Euro.**	**Eurozone**	**DM**	**DM ex. Euro.**	**Eurozone**	**DM& EM**	**DM**	**EM**	**DM& EM**
VIX $(\times 10^2)$	0.02	0.03	0.02	**0.08**	0.04	**0.10**	**0.30**	**0.15**	**0.75**	**0.51**
	(0.77)	*(0.70)*	*(0.81)*	*(0.08)*	*(0.52)*	*(0.05)*	*(0.00)*	*(0.10)*	*(0.01)*	*(0.00)*
US market excess return							0.00	0.02	-0.01	**0.47**
							(0.99)	*(0.69)*	*(0.98)*	*(0.06)*
Invest Grade							**0.06**	**0.05**	0.03	**0.05**
							(0.00)	*(0.00)*	*(0.47)*	*(0.03)*
High Yield							**-0.02**	**-0.01**	**-0.05**	**-0.04**
							(0.04)	*(0.08)*	*(0.05)*	*(0.00)*
Trend (×1200)	**-0.51**	**0.96**	**-1.02**	**0.80**	**0.80**	**1.01**	**1.32**	**0.44**	**3.97**	**1.13**
	(0.02)	*(0.00)*	*(0.01)*	*(0.00)*	*(0.01)*	*(0.00)*	*(0.02)*	*(0.09)*	*(0.02)*	*(0.00)*
FE	C	C	C	C	C	C	C	C	C	C
# obser.	960	533	427	2431	1001	1430	2809	1893	916	313
Adjusted R^2	86.0%	80.0%	91.0%	65.8%	71.1%	59.5%	72.8%	71.5%	45.5%	85.3%

The table reports the estimated coefficients from panel regressions of the bond integration indices on proxies for credit quality, political risk, inflation, illiquidity, global investor sentiment and other global (Z_t) and local ($X_{i,t}$) factors. The estimated models are based on the general equation below,

$$II_{i,t} = \alpha + \beta_1(Credit)_{i,t-1} + \beta_2(Political\ )_{i,t-1} + \beta_3(Inflation)_{i,t-1} + \beta_4(Illiquidity)_{i,t-1} + \beta_5(Global\ sentiment)_{i,t-1} + X'_{i,t-1}\gamma + Z'_{t-1}\delta + c_i + \theta \times Trend + \varepsilon_{i,t}$$

where c_i are country fixed effects. We run unbalanced regression as not all the explanatory variables are available for all the cross-sectional units. All explanatory variables are lagged. P-values in parentheses are clustered by country and time. The sample period is from 01/1986 or later to 12/2012. Definition of the variables and data source are in Appendix B and the online Appendix A.5. Numbers in bold represent significance at least at the 10% level.

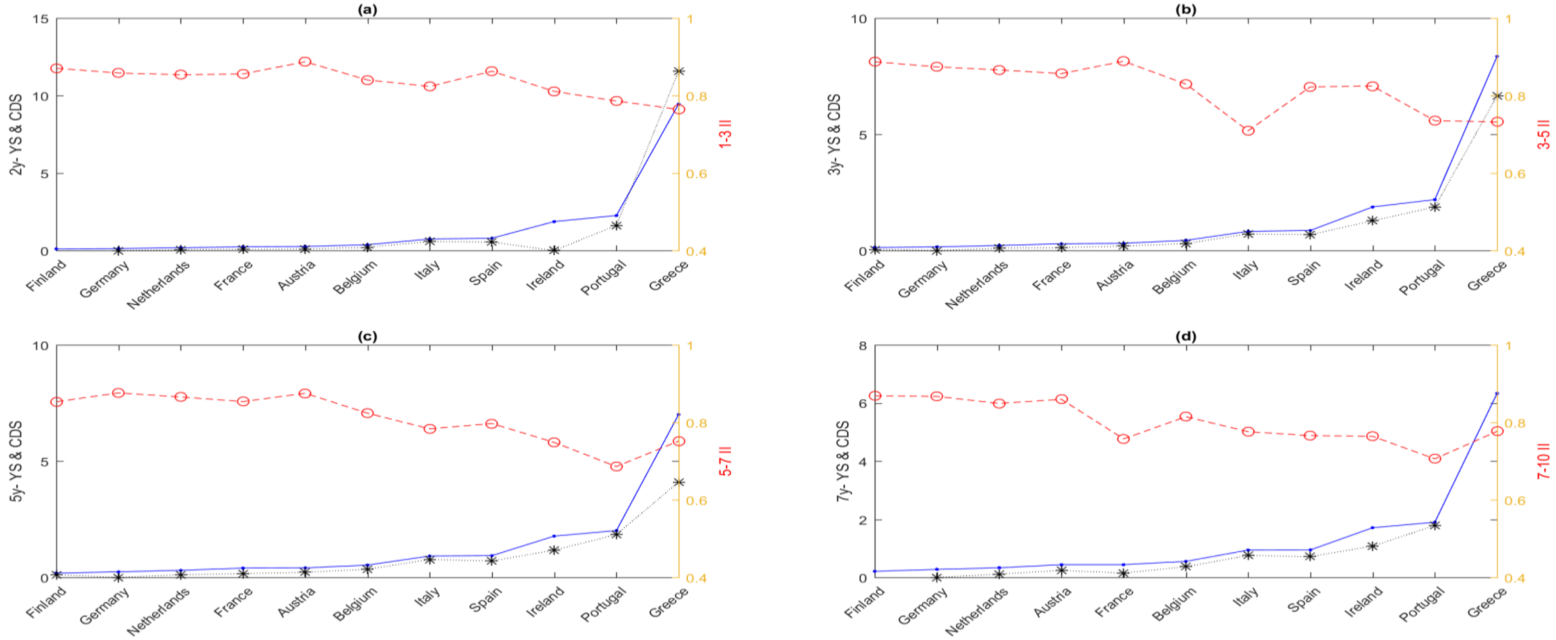

Figure 4. Average CDS spread, Yield Spread, and Integration Index

The graphs show the time series averages for the CDS spread (solid blue line), yield spread (dotted black line), and integration index (dashed red line) of the 11 Eurozone countries. In Panels (a)-(e), averages are computed over the sample period since Euro inception 02/1999-12/2012 and the integration indices are 1-3, 3-5, 5-7, 7-10, and >10 years class. Panels (f)-(h) plot the averages of 5-year CDS and of the integration indices for the all-maturity indexes and for respectively, DM (21), DM ex. Eurozone (10) and EM (16) countries. The integration indices are computed for bond returns as detailed in Section I of the paper. For Greece, data on bond returns by maturity and hence integration indices stop on 2/2012 also its 7-year benchmark yield is not available. The yield spreads (YS) on benchmark bonds of maturity 2-, 3-, 5-, 7-, and 10- years are computed against Germany and are in percent per annum. The 2-, 3- , 5-, 7- and 10-years sovereign CDS spreads are in percent per annum.

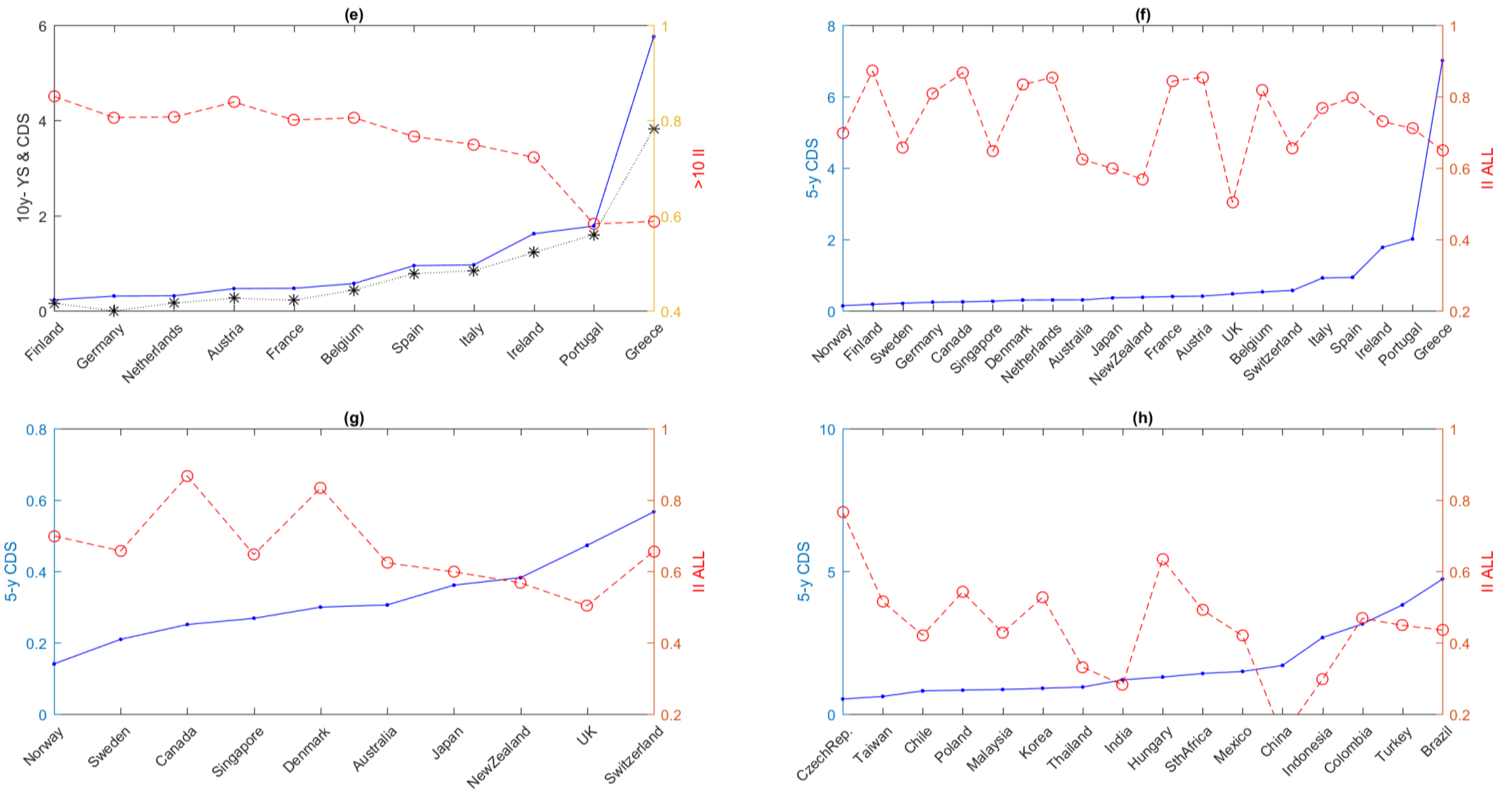

Figure 4- continued

Table 5 - CDS spread determinants

Country region	Eurozone					DM	EM
Maturity (m)	**1-3**	**3-5**	**5-7**	**7-10**	**> 10**	**All**	**All**
Δ II (m)	**-2.25**	**-0.41**	**-0.35**	**-0.43**	**-0.39**	**-0.27**	0.03
	(0.10)	*(0.01)*	*(0.00)*	*(0.08)*	*(0.00)*	*(0.01)*	*(0.36)*
Δ RATING	**-0.48**	**-0.41**	-0.34	**-0.27**	-0.21	-0.30	-0.04
	(0.03)	*(0.05)*	*(0.14)*	*(0.07)*	*(0.20)*	*(0.15)*	*(0.20)*
Δ POL	1.49	0.94	-0.04	0.56	0.38	0.90	-4.70
	(0.56)	*(0.66)*	*(0.98)*	*(0.71)*	*(0.79)*	*(0.43)*	*(0.13)*
Local Stock Market Ret.	**-2.31**	**-2.10**	**-1.73**	**-1.65**	**-1.57**	**-1.11**	**-0.79**
	(0.01)	*(0.01)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.01)*	*(0.01)*
Δ FX	**-2.48**	**-2.51**	**-2.25**	**-2.04**	**-1.99**	**-1.37**	**-3.06**
	(0.02)	*(0.02)*	*(0.00)*	*(0.02)*	*(0.00)*	*(0.00)*	*(0.02)*
US Market Excess Ret.	1.22	1.11	0.91	0.65	0.60	-0.04	**-2.23**
	(0.30)	*(0.33)*	*(0.22)*	*(0.46)*	*(0.27)*	*(0.93)*	*(0.00)*
Invest Grade	**-0.12**	**-0.12**	**-0.12**	**-0.11**	**-0.10**	**-0.08**	**-0.17**
	(0.06)	*(0.06)*	*(0.00)*	*(0.03)*	*(0.00)*	*(0.00)*	*(0.00)*
High Yield	0.06	**0.06**	**0.06**	**0.05**	**0.05**	**0.04**	0.02
	(0.13)	*(0.10)*	*(0.00)*	*(0.06)*	*(0.00)*	*(0.00)*	*(0.22)*
Δ VIX	0.00	0.00	0.00	0.00	0.00	0.00	**0.01**
	(0.69)	*(0.67)*	*(0.31)*	*(0.72)*	*(0.50)*	*(0.81)*	*(0.05)*
Trend	**-0.01**	-0.01	**-0.01**	-0.01	**-0.01**	**-0.01**	0.01
	(0.10)	*(0.11)*	*(0.01)*	*(0.20)*	*(0.02)*	*(0.01)*	*(0.31)*
# observations	1217	1204	1184	1224	1178	2302	1668
Adj-R^2	15.2%	15.3%	16.7%	17.2%	19.5%	15.7%	29.7%
Adj- R^2 baseline FE	17.0%	21.9%	26.2%	28.1%	29.5%	21.5%	20.8%

The table shows the estimated coefficients from panel regressions of changes in sovereign CDS spreads on the changes in integration indices (II), local variables ($X_{i,t}$) and global factors (Z_t) used as controls. The estimated models are based on the general equation below,

$$\Delta CDS_{i,t} = \beta_1 \Delta II_{i,t} + X'_{i,t}\beta_2 + Z'_t\beta_3 + c_i + \theta \times Trend + \varepsilon_{i,t}$$

where c_i are country fixed effects. We run unbalanced regressions of the dependent and explanatory variables. P-values in parentheses are clustered by country and time. The sample period is from 01/2001 or later to 12/2012. The 2-, 3-, 5-, 7-, and 10- years CDS spreads are in percent per annum. Integration indices by country and maturity classes (1-3, 3-5, 5-7, 7-10, >10) are estimated as detailed in Section I of the paper. The Eurozone, DM and EM samples include, respectively, 10, 20 and 16 countries. Definition of the variables and data source are in Appendix B. Numbers in bold represent significance at least at the 10% level.