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# **Determinants of the Distance between Sovereign Credit Ratings and Sub-Sovereign Bond Ratings: Evidence from Emerging Markets and Developing Economies**

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## **Abstract**

This paper explores factors that affect the distance between sovereign credit ratings and the ratings assigned to new foreign-currency bonds issued by sub-sovereign entities (such as private non-financial corporations, financial firms, and public sector enterprises) in 47 emerging markets and developing economies. Censored and double-hurdle regression models are used to estimate the relative contributions of bond-level, issuer-level, and macroeconomic factors that determine this distance, separately for those rated at or below the sovereign rating and those rated above. For the three-quarters or more of sub-sovereign bond ratings that are constrained by the sovereign rating ceiling, a Tobit regression model shows a smaller distance—suggesting stronger sovereign-corporate linkages—for public sector enterprises and financial firms relative to other firms. Riskier global financial conditions are also associated with sub-sovereign bonds being rated closer to the sovereign rating. For the small number of sub-sovereign bonds rated higher than the sovereign rating, a double-hurdle model shows that certain debt features—such as bonds backed by future-flow receivables or other collateral, or structured as Special Purpose Vehicles (SPV)—significantly raise the likelihood of piercing the sovereign rating ceiling and also increase the distance above the sovereign ceiling.

**Keywords:** Sub-sovereign rating, International debt markets, Spillover effect, Sovereign ceiling

**JEL Codes:** F21, F30, G10, G15.

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## 1. Introduction

The credit rating of an emerging market sovereign is a key factor influencing the ratings of sub-sovereign entities including non-financial corporations, banks, public sector enterprises, and local governments.<sup>1</sup> Several recent studies have demonstrated the impact of sovereign credit ratings on corporate ratings (Ferri and Liu, 2003; Borensztein, Cowan and Valenzuela, 2013), on bank credit ratings (Alsakka, ap Gwilym and Vu, 2014; Huang and Shen, 2014), on bank stock returns (Correa et al. 2014), and on real economic activities (Almeida et al., 2016). Other related studies have considered the implications of changes in sovereign yield spreads for corporate borrowing costs in developed countries (Bedendo and Colla, 2015) and in developing countries (Durbin and Ng 2005; Dailami, 2010; Dittmar and Yuan, 2008).<sup>2</sup> These suggest a significant spill-over impact of sovereign debt impairment on corporate performance, whereby corporates in emerging markets tend to be more exposed to sovereign rating changes than in developed countries (Ferri and Liu, 2003).

The sovereign rating often acts as a “ceiling” for the sub-sovereign ratings in most instances, although the ratings of the sub-sovereign entities have sometimes exceeded the sovereign rating. Historically, the likelihood of sovereign defaults and the default premia of firms in the same jurisdiction were highly correlated in emerging market economies, justifying the practice of “sovereign ceiling” as widely used by rating agencies (Grandes and Peter, 2006). Since 2001, however, rating agencies have relaxed this policy with a view that the correlation between the two has weakened (Moody’s, 2005; S&P, 2013). Following the 2008-09 global financial crisis, Standard and Poor’s (S&P) reconsidered its sovereign ceiling policy and redefined the maximum notch difference between non-sovereign entity’s rating and the sovereign rating depending on sector and region where the firm operates (S&P, 2013).

The sovereign rating often serves as a benchmark for the capital-raising activities of both the public and private sectors by affecting their borrowing spreads, particularly when they access international capital markets and issue debt denominated in foreign currencies. The past episodes in emerging market economies confirm significant negative externality from sovereign

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<sup>1</sup> In this work, the term “sub-sovereign” is used in a significantly broader sense compared to the term “sub-national”, which has often been used to refer only to provincial or local authorities.

<sup>2</sup> Durbin and Ng (2005) found that corporate bond spreads were often lower than the sovereign spread as investors do not always apply the “sovereign ceiling” policy, while Dailami (2010) found that sovereign debt problems tends to add additional capital cost for the corporate bond issuers in emerging economies.

downgrades to downgrades of public enterprises, banks and private sector entities, by raising their funding costs and potentially triggering covenants (Augustin et al., 2016; Chow, 2015; Williams, Alsakka and ap Gwilym, 2013). The deterioration in balance sheets of public enterprises and banks could negatively feed back to the sovereign via credit guarantees or other financial supports, augmenting their sovereign-corporate linkages.<sup>3</sup> Since the relaxation of sovereign ceiling policy, corporate ratings that “pierce” the sovereign ceiling has become more common (Almeida et al, 2016), and bonds issued by such sub-sovereign entities could be more sensitive to changes in the sovereign rating.

Despite a growing literature on sovereign-corporate linkages, there is very little evidence on how far the ratings of sub-sovereign bonds would be generally positioned *above* or *below* the corresponding sovereign rating. In particular, as the sovereign ceiling policy has recently been relaxed, further empirical analysis is needed to identify key factors that determine the strength of sovereign and sub-sovereign rating linkage when bond issuers are constrained or unconstrained by the sovereign ceiling.

This paper revisits the effect of sovereign creditworthiness on sub-sovereign ratings using data on foreign currency bonds issued by sub-sovereign entities in 47 emerging markets and developing economies (EMDEs) during 1990-2013. We use censored and double-hurdle regressions to estimate relative contributions of each factor to determine the “distance” between sovereign and sub-sovereign ratings, separately for bonds rated at or below the sovereign (*bounded bond ratings*) and above the sovereign (*non-bounded bond ratings*). We also merge the bond-level dataset with balance sheet data from Bloomberg to estimate the importance of firm’s financial situation in affecting the distance for a subset of matched debt issuers.

The results shed light on the asymmetry in factors which determine the distance between bounded and non-bounded bond ratings. For bounded bond ratings, their distance is mainly determined by bond issuers’ ownership structure, size of their assets, and sector of issuer. The distance tends to be narrower as the country’s trade linkages become stronger and global

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<sup>3</sup> In related work, Williams et al. (2013) and Huang and Shen (2014) found that the impact of sovereign credit ratings on bank credit ratings is significant but varies by countries’ macroeconomic and institutional factors. Correa et al. (2014) found that a downgrade of sovereign credit rating has a large negative effect on bank stock returns for those banks that would receive stronger support from their governments. Aęca and Celasun (2012) also outline channels through which higher public external debt (which is typically associated with lower sovereign credit ratings; see Cantor and Packer 1996 and S&P 2013) can raise corporate default premia.

financial condition gets riskier. A country's capital account openness and domestic credit market development also influence the distance. Debt characteristics, including whether the bond issue is callable and its maturity, matter for both bounded and non-bounded bonds, although the bond securitization and collateralization mainly determines whether and how high the corporates are rated above the sovereign for non-bounded firms. Finally, a Heckman selection estimation confirms the robustness of our main results to sample selection bias in debt issuance.

As emerging markets liberalize their capital accounts, firms from emerging countries have been raising a substantial financing through bond issuances in international markets since 1990s (Gozzi et al., 2015). However, the number of rated firms with access to international markets is still limited for lack of information in assessing prospective debtors' credit risk. Our results underscore the relative importance of bond-level and firm-level attributes in estimating their prospective bond ratings compared to country-level and global factors.

The paper is structured as follows. Section 2 describes the data and presents some descriptive statistics. Section 3 explains our empirical strategy, and sections 4 and 5 provide empirical results. Section 6 concludes.

## **2. Data Description**

### ***2.1 Sovereign ratings and sub-sovereign foreign currency bond ratings***

The sample includes 5,033 long-term foreign currency sub-sovereign bonds rated by the three major international rating agencies (S&P, Moody's and Fitch Ratings) for 47 EMDEs (see Appendix table 1a for country coverage). 2,185 bonds were issued by non-financial issuers and 2,848 bonds by financial firms. The largest numbers of sub-sovereign bonds by non-financial firms are in the oil & gas, telecommunications, utility & energy and real estate & property sectors (see Appendix 1b).

Bond ratings by the three major international agencies for sub-sovereign foreign currency debt and other bond characteristics were obtained from Dealogic. Sovereign credit ratings were obtained from Bloomberg and Thomson Reuters. Debt in default was excluded from the sample. The conversion from letter to numeric ratings on a 1-21 scale, with higher values indicating

better ratings, broadly follows Cantor and Packer (1996), Gande and Parsley (2005), and Hill, Brooks and Faff (2010) and is described in table 1.

*[Insert Table 1 around here]*

As capital markets of emerging economies mature, local currency debt issuance has also started to increase. We however do not include local currency debt in our analysis for three reasons. First, local currency sub-sovereign debt is typically not subject to sovereign risk, in particular to convertibility and transfer risks. Hence, the sovereign ceiling does not appear to apply to local currency bonds.<sup>4</sup> Second, local currency debt is typically not subject to the problem of ‘original sin’ typically faced by developing countries when they are unable to borrow abroad in their own currencies (Eichengreen, Hausmann, and Panizza, 2005).<sup>5</sup> Third, local currency debt is often rated by national rating agencies on rating scales that can differ substantially from those used by international rating agencies for foreign currency debt.

Figures 1a-1c show scatterplots of sovereign and sub-sovereign ratings, by public and private issuers and financial and non-financial issuers for the three rating agencies. These figures illustrate the constrained nature of the data, where most of sub-sovereign ratings are bounded by the sovereign rating, but with several bonds rated higher than the sovereign. These figures also illustrate the strong correlation between the sovereign and sub-sovereign debt ratings for public sector debt issuers, with ratings of public sector sub-sovereign issuers typically close to the sovereign rating (along 45 degrees line) compared to the private sector, and for financial issuers compared to non-financial issuers. These are consistent with the earlier discussion that public enterprises and sub-national authorities, as well as financial issuers, are likely to be closely related to the sovereign.

*[Insert Figure 1 around here]*

Summary statistics for ratings of foreign currency bond issues are presented in table 2. In general, the average sub-sovereign rating is lower than the average sovereign rating across the three rating agencies. There is considerable variation in the distribution of sub-sovereign ratings.

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<sup>4</sup> Grandes and Peter (2006) estimate the elasticity of corporate spreads with respect to sovereign spreads in South Africa, finding that the sovereign ceiling does not appear to apply to local-currency denominated corporate bonds.

<sup>5</sup> The *original sin* refers to the limited ability of poor countries to issue international debt in their own currencies. In consequence, these countries often resort to borrowing from international markets in the major foreign or “hard” currencies, such as the US dollar, euro, yen and British pound.

About 38-43 percent of sub-sovereign bonds had the same rating as sovereign rating and 36-46 percent had lower rating than the sovereign rating—adding up to 74-89 percent of sub-sovereign bonds rated *at or below* the corresponding sovereign rating. This confirms that the majority of sub-sovereign bonds are subject to a sovereign ceiling. The share of sub-sovereign bonds rated *above* the sovereign rating is relatively small at 11-26 percent of all bonds (12.3 percent for S&P, 25.9 percent for Moody’s and 11.0 percent for Fitch), with average distance above the sovereign rating of 2.4 to 4.0 notches on our rating scale.

*[Insert Table 2 around here]*

## **2.2 Control variables**

We use a range of global, country-level, and bond-level variables to account for the factors that can influence the sovereign and sub-sovereign rating relationship. The summary statistics for these are presented in table 3. The panel of charts in Figure 2 shows the evolution of the annual average of global and country-level macroeconomic variables since the early 1990s, together with the average distance between sovereign and sub-sovereign ratings. Pairwise correlations between the distance and macroeconomic variables are provided in the chart.

### *Global and country-level variables:*

Standard set of global and macroeconomic factors are included as determinants of the credit risk of sub-sovereign entities. First, the global financial environment affects the performance of sub-sovereign corporations by changing the financing cost for private firms. Riskiness of the global financial market is measured by the Chicago Board Options Exchange’s Volatility Index (VIX index), also known as the Fear Index (Whaley 2009). Higher global risk can narrow the distance as firms may become dependent on the sovereign during times of turmoil in global financial markets.

The first chart in figure 2 shows co-movement of global risk and the average distance between sub-sovereign and sovereign ratings, suggesting a negative relationship over time. The distance narrowed sharply during a period of high global risk and recurrent emerging market crises (Asian financial crisis in 1997-98, Russian debt default in 1998, and Argentinian crisis in 2000-2001). As global risk subsided during the boom years of 2002-2007, the average distance rose. It then fell sharply during the global financial crisis in 2008-09. In the post-crisis years, as global risk



fell together with extraordinary monetary easing in advanced economies, the average distance has risen again.

*[Insert Figure 2 around here]*

Second, the US 3-month treasury bill rate is used as the benchmark global interest rate, given that a majority of sub-sovereign bonds was issued in U.S dollars and the outsized importance of the U.S Federal Reserve in influencing global financial conditions (Rey 2015). A low global interest rate will lower the financing cost for firms to access capital, and hence may widen the distance between the sovereign and sub-sovereign ratings. The second chart in Figure 2 shows that the Fed Funds rate was high in the 1990s, fell during the early 2000s following the dot-com bust (Ferguson and Schularick 2007), rose again in the subsequent years, and was sharply lowered during the global financial crisis (Taylor 2009).

*[Insert Table 3 around here]*

Country-level cyclical factors such as GDP growth and CPI inflation would also directly affect the performance of sub-sovereign entities (Dailami 2010). In our sample, average growth rate at the bond issuance is positive at 4.6 percent, while average inflation is 5.9 percent with a range of -1.4 to 85.7 percent. Higher GDP growth is usually associated with better performance of the private sector, which would help sub-sovereign entities service their debt obligations. But improved cash flows may also reduce the dependence of a sub-sovereign on the sovereign credit rating. The third chart in Figure 2 shows a general co-movement between the rating distance and GDP growth. High inflation reduces the real value of future earning of firms and jeopardizes macroeconomic stability, thereby reducing the willingness of sub-sovereign entities to plan future investments. Higher inflation is expected to be associated with a greater dependence of sub-sovereign ratings on the sovereign. Average inflation for our sample of countries has fallen from double-digit levels in the 1990s to 5-7 percent in recent years (fourth chart in Figure 2), and appears to show a negative relationship with average distance over time.

The country's level of financial development and external openness affect corporate performance due to the difference in access to domestic and external financing. Domestic credit (as a share of GDP) is an indication of the depth of the domestic financial sector, and ranges from 3.9 to 192.7 percent. Despite the variation across countries, for the group of emerging market countries, average domestic credit as a share of GDP has risen almost steadily since the mid-1990s (fifth

chart in Figure 2). More mature domestic financial markets may weaken the sovereign-corporate linkage, but a large increase in domestic credit could also strengthen macro-financial linkages, thereby increasing exposure to external shocks (Lane and Milesi-Ferretti 2012).

Regarding external openness, we control for both openness in trade and capital account. Capital account openness (measured by the Chinn-Ito index (Chinn and Ito 2006, 2008)) exhibits significant variation across countries, but on average, increased in the years leading up to the global financial crisis, and then fell slightly in subsequent years (sixth chart in Figure 2). Greater capital account openness may weaken the sovereign-corporate linkage as it provides firms greater access to foreign capital to service foreign-currency debt obligations. Hence, the distance between the sovereign and corporates may widen when the capital account is relatively more open.

Trade openness (export and import values as a share of GDP) for the group of emerging market countries rose strongly in the years leading up to the financial crisis (seventh chart of figure 2). After a recovery from a steep fall during the 2008-09 global financial crisis, trade growth has slowed in the post-crisis years. Although exports provide foreign currency revenues, stronger trade linkage may tighten the sovereign-corporate linkage as the private sector (mainly tradable sector) is more exposed to changes in demand of the trading partners.

#### *Bond-level characteristics:*

Among the various factors which could affect the distance between sovereign and sub-sovereign ratings, perhaps the most relevant are bond issuers' ownership structure (public vs. private) and sector of issuer (financial vs. non-financial). As shown in table 3, financial firms and state-owned entities represent 57 percent and 37 percent of the overall sample respectively. Due to the relatively strong macro-financial linkages in emerging economies, banks and other financial firms (especially large institutions) typically benefit from explicit and implicit guarantees from the central bank or government in case of financial distress. Hence, debt issued by financial firms is likely to be rated closer to the sovereign rating, compared with debt of non-financial firms. Similarly, public enterprises in emerging markets and developing countries, even if nominally free of government control, tend to have privileged access to government support during times of distress, thus are also likely to be rated closer to the sovereign rating.

Similar to the findings of Gozzi et al. (2015), differences in bond characteristics (listed below) can affect the sovereign-corporate relationship:

- *Debt issue size:* The debt issue size captures the importance of the issuer in its market and its access to a broad range of financing sources. For the same borrower, though, a larger debt may carry higher risk and hence result in a lower rating. The average logarithm of issue size is 18.9, about 163 million in constant 2010 US dollars.
- *Maturity:* Bonds with longer maturity may receive a lower rating than shorter maturity debt as long-term bonds accompanies larger uncertainty than short-term bonds. Average maturity is about 7 years in the sample.
- *Fixed vs. floating rate:* Fixed rate bonds typically carry a higher yield than floating rate bonds to compensate the bond-holder for holding the debt to maturity at a given interest rate. Fixed rate notes account for the bulk (82 percent) of sub-sovereign bonds.
- *Callable bond:* Callable bonds allow the issuer to prepay the principal prior to the maturity of the bond. About 25 percent of bonds are callable.
- *Collateralization and securitization:* Bonds backed by collateral tend to have lower credit risk, which can potentially result in a weaker relationship with sovereign risk. About 5 percent of bonds are securitized by future-flow receivables. A further 3 percent of debt is issued by Special Purpose Vehicles (SPVs), typically backed by an existing asset. Bonds backed by other types of collateral, other than future-flow and SPV structures, constitute another 3 percent of the total.

*Firm balance-sheet variables:*

To test the robustness of our main results obtained from bond-level data to inclusion of balance sheet variables (see section 5), the data on international bond issuance was matched with firm-level balance sheet data from Bloomberg based on International Securities Identification Numbers (ISINs). The inclusion of balance-sheet data reduces the sample size to a subset of bonds for which such matched data are available. The balance sheet variables include the logarithm of total assets (in thousands of constant 2010 US dollars), net profit as a percent of assets, financial leverage (total assets to common equity ratio), and capital expenditure as a share of assets.

### 3. Empirical methodology

#### 3.1. Sub-sovereign bonds rated at or below the sovereign rating (bounded bond ratings)

In the first specification, we consider the sample of sub-sovereign bonds that are rated at or below the corresponding sovereign rating and consider the determinants of the distance of the sub-sovereign rating *below* the sovereign rating. The specification in equation (1) below is estimated using a Tobit model which is appropriate due to the clustering of a large number of observations with distance at zero.

$$DistanceBelow_{ijkt}^* = \alpha + \phi D_{ijkt} + \psi M_{jt} + \Theta G_t + \lambda_j + \eta_k + \theta_t + \varepsilon_{ijkt} \quad (1)$$

The dependent variable  $DistanceBelow_{ijkt}^* = (SovRating_{jt} - Subsov_{ijkt})$  is the difference between the sovereign and sub-sovereign ratings by the same rating agency.  $i$  refers to the debt issue,  $j$  refers to country,  $k$  refers to industry and  $t$  refers to time period. The dependent variable takes on a value of zero for sub-sovereign bonds rated *at* the corresponding sovereign rating and a positive value for bonds rated strictly *below* the sovereign rating.

The baseline specification (1) uses the sovereign and sub-sovereign ratings of the three rating agencies separately to account for the differences in the weights that rating agencies assign to the various explanatory variables.<sup>6</sup> Equation (1) includes a vector of sub-sovereign debt issue level controls ( $D_{ijkt}$ ), country-level factors ( $M_{jt}$ ), and global financial conditions ( $G_t$ ). Global factors are all at monthly frequency. Average marginal effects (AME) of each explanatory variables are calculated for the Tobit model. Country fixed effects ( $\lambda_j$ ), industry dummies ( $\eta_k$ ), and a time dummies ( $\theta_t$ ) were included in all specifications. The country fixed effects account for time-invariant country level institutional and other characteristics, and the industry dummies for unobserved industry-level factors. In order to account for possible correlation of sub-sovereign debt ratings within countries, the standard errors of the regression were clustered at the level of countries in all regressions.

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<sup>6</sup> Sovereign ratings by S&P are considered to be the most independent among the rating agencies (Alsakka and ap Gwilym, 2010) and S&P is typically more active in assigning ratings (Gande and Parsley 2005). In practice, the ratings assigned by the three major rating agencies tend to be highly correlated, with deviations usually restricted to within one or two notches on our rating scale (see Hill, Brooks and Faff 2010, and Ratha, De and Mohapatra 2011).

### 3.2 Sub-sovereign debt rated above the sovereign ceiling (non-bounded bond rating)

Borensztein et al. (2013) discuss the “sovereign ceiling lite hypothesis”, where corporates can be rated above the sovereign rating, and thus a ceiling does not impose an absolute constraint on corporate ratings (see also Almeida et al., 2016). In order to account for the corner solution properties of our bond rating data, we use a double-hurdle model (Cragg, 1971) for the determinants of the distance of the sub-sovereign bond rating *above* the sovereign ceiling. This distance is modeled as a function of debt characteristics, firm-level attributes, and country and global factors in a second-stage equation, *conditional* on a first stage equation for the probability that a bond is rated above the sovereign rating. An advantage of the double-hurdle model is that it allows the effect of the covariates to vary across the two stages.

The first stage equation investigates factors affecting the probability that a sub-sovereign bond rating is higher than the sovereign rating using the probit model defined in equation (2).

$$P(\text{Subsov}_{ijkt} > \text{Sovereign}_{jt}) = \Phi(\alpha + \phi D_{ijkt} + \psi M_{jt} + \Theta G_t + \lambda_j + \eta_k + \theta_t) \quad (2)$$

The dependent variable is a binary variable that takes on a value 1 when the sub-sovereign rating is higher than the sovereign rating and 0 otherwise. Using equation (2) as the first stage, the second stage of the double-hurdle model regresses the distance of the sub-sovereign bond rating above the sovereign rating on the same set of explanatory variables, as defined in equation (3) below:

$$\text{DistanceAbove}_{ijkt}^* = \tilde{\alpha} + \tilde{\phi} D_{ijkt} + \tilde{\psi} M_{jt} + \tilde{\Theta} G_t + \tilde{\lambda}_j + \tilde{\eta}_k + \tilde{\theta}_t + \varepsilon_{ijkt} \quad (3)$$

The dependent variable  $\text{DistanceAbove}_{ijkt}^* = (\text{Subsov}_{ijkt} - \text{SovRating}_{jt})$  is the notch difference of the sub-sovereign rating above the corresponding sovereign rating by the same agency. AMEs for the relevant groups are presented for both the first and second stage regressions.<sup>7</sup> The standard errors of the regression were clustered at the level of countries in all regressions.

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<sup>7</sup> The linear double-hurdle model was estimated using the *churdle* program in Stata version 14. Average marginal effects, also known as average partial effects, were calculated as the mean of partial effects across the full sample, instead of partial effect only at the sample means.

Additionally, we include an indicator for bonds backed by future-flow receivables, as such securitization structures may help to pierce the sovereign rating ceiling (Ketkar and Ratha 2008). We also include an indicator for Special Purpose Vehicle (SPV), which includes bonds involving securitization of assets other than future flow receivables, and an indicator for other collateralized bonds.

## **4. Discussion of results**

This sub-section discusses the results of the benchmark regressions as defined in equations (1)-(3) in the previous section.

### ***4.1 Results for bounded bond ratings***

The results for the bounded bond ratings are presented in columns (1)-(3) of table 3. The coefficient presents how much each covariates contribute to narrow or widen the distance between sovereign and sub-sovereign ratings from the average distance below the sovereign rating of 3.2 to 3.6 notches as shown in Table 2.

The indicator for public entities is statistically significant at 1 percent for all three agencies, with the coefficient ranging from -1.4 to -1.8 notches. This indicates that public enterprises are rated much closer to the sovereign ratings as observed in figures 1a-1c. The financial sector dummy is also negatively signed and highly statistically significant across the three agencies, with the coefficient in the range of -0.6 to -1.3 notches. This shows that the distance is smaller for financial firms than non-financial firms as observed in figures 1a-1c.

*[Insert Table 4 around here]*

Among the macroeconomic variables, the global risk VIX index is negatively signed and statistically significant for all rating agencies, showing narrower distance between sub-sovereign and sovereign ratings if bonds are issued during periods of riskier global financial conditions. Spikes in the VIX index have been associated with increased co-movement in sovereign credit spreads (Longstaff, Pedersen, and Singleton, 2011), likely reflecting increased information asymmetries and herding behavior of investors during global “risk off” episodes. In such circumstances, international investors are likely to pay more attention to sovereign

creditworthiness when investing in firms in emerging market economies, which may explain the tighter relationship between sovereign and corporate debt ratings.

The coefficient for capital account openness is positive and significant for S&P and Moody's. This suggests that corporate bonds tend to be rated closer to the sovereign when issued in countries with relatively closed capital accounts. This may reflect the lack of external financing sources for sub-sovereign entities in the closed economies, making their ratings more reliant on the sovereign. Conversely, greater capital account openness can widen the pool of available financing sources for firms and weaken the sovereign-corporate linkages.

The coefficient of domestic credit-to-GDP ratio is negatively signed, suggesting that bonds tend to be rated closer to the sovereign if the issuing country has higher credit as a share of GDP, thus entailing stronger macro-financial linkages. This is consistent with the findings of other studies that find that a large increase in credit is associated with greater likelihood of future crises (Gourinchas and Obstfeld 2012, Schularick and Taylor). We do not find robust relationships for other macroeconomic variables. The response of inflation (positive) and trade (negative) are along expected lines but statistically significant only for Moody's in the baseline Tobit model.

For the global and macroeconomic variables, in addition to the estimated coefficients, the response of distance between sovereign and sub-sovereign debt ratings to a one standard deviation change in each variable can help to understand the economic significance of these variables. These are presented in figure 3 for Standard & Poor's and Moody's ratings.<sup>8</sup> These suggest that a one standard deviation increase in domestic credit as a share of GDP has the largest effect on the distance (declines in distance by 0.92 rating notches for S&P and 0.81 notches for Moody's). The large size of this effect compared to the other macroeconomic variables reflects high variation in domestic credit, with the standard deviation of 50.9 percent of GDP, for our sample of emerging and developing countries.

*[Insert Figure 3 around here]*

A one standard deviation increase in the VIX index is associated with a reduction in the distance by 0.18-0.26 rating notches. This suggests that despite the strong statistical relationship to the distance in most specifications, the magnitude of this effect is smaller than domestic credit. Only

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<sup>8</sup> The coefficients of macroeconomic variables are mostly insignificant for Fitch, except for the VIX index, and hence excluded from the charts.

in a severe crisis situation when the VIX index spikes by the equivalent of three or four standard deviations, would the change in distance approach a change comparable in magnitude to that of domestic credit. The response of distance (0.3 rating notches increase) to a one standard deviation increase in capital account openness is slightly larger than VIX index. Going from a fully closed capital account to a fully open capital account would imply an increase in the distance by 1.2 rating notches for both S&P and Moody's. The response of distance to a one standard deviation increase in short-term US interest rate is 0.4 rating notches increase, larger than that for capital account openness and VIX, but is marginally significant only for S&P. The magnitude of response of distance to a one standard deviation increase in trade is larger but significant only for Moody's in the baseline model, as discussed earlier.

Among debt characteristics, log issue size is negatively signed for all three agencies, although statistically insignificant. The coefficient of debt maturity is negatively signed and statistically significant at 10 percent level for two out of the three agencies. On the other hand, the callable bond dummy is positive and statistically significant across *all* the specifications, indicating that they are typically rated with a greater distance. This "penalty" in terms of a larger distance may reflect the nature of the bond contract where the issuer has a right to prepay the bond prior to maturity.

There are concerns that a few countries where each represents more than 500 sub-sovereign bonds in the sample in Appendix table 1, drive the baseline results. Brazil, Russia, and South Korea account for more than half (54 percent) of our observations. The first three columns of Appendix table 2 shows results for the baseline Tobit model in columns (1)-(3) of table 4 excluding these three countries. The results for the macroeconomic variables and debt characteristics are similar to the baseline estimates, confirming that our main results are not driven by a few large countries. We also conducted a similar Tobit analysis for only the top three countries with the largest number of observations (columns (4)-(6) of Appendix table 2). The results for the key global and macroeconomic variables such as VIX, domestic credit-to-GDP and capital account openness are similar in sign and significance to the full sample.

We also consider the regional variations in the rating distance. We estimate the baseline regression with five regional dummies, taking the East Asia and Pacific region as the base category. The coefficient estimates and statistical significance of the regional dummies for S&P



and Moody's are reported in figure 4.<sup>9</sup> The results suggest that there are indeed differences across the regions, after controlling for differences in macroeconomic variables, ownership, sector, and debt characteristics. The Europe & Central Asia region exhibits the widest distance—suggesting relative lack of dependence on sovereign ratings—for both S&P and Moody's, while South Asia exhibits the smallest distance for S&P. The wider distance for emerging market countries in Europe & Central Asia may reflect their greater access to banks in Western European markets, particularly for the Eastern European countries that are part of the European Union. South Asia exhibits the smallest distance, likely due to relatively high state ownership and tight controls on capital for much of the sample period. Latin America also exhibits a lower distance than East Asia, and Sub-saharan Africa a larger distance, but both of them are marginally significant.

*[Insert Figure 4 around here]*

#### ***Inclusion of additional covariates for firm balance sheet characteristics***

In columns (4)-(6) of table 3, we add firm-level balance sheet variables to the benchmark regressions reported in columns (1)-(3). In general, the main baseline results remain robust to the inclusion of the balance sheet variables for the bounded firms. Total assets, profitability and capital expenditure are negatively related to the distance below the sovereign rating, while leverage is positively related. This suggests that larger and more profitable firms are rated closer to the sovereign rating. The issue size remains negatively signed and callable bonds remain positive as found in the benchmark regression. The public entity dummy is negatively signed and significant for all three agencies as in the benchmark specification. The financial sector indicator is negative for all three agencies, and statistically significant for Moody's. These suggest that the results from the benchmark regressions are fairly robust to the inclusion of firms' balance sheet characteristics.

#### ***4.2 Results for non-bounded bond ratings***

The results for the double-hurdle model in equations (2) and (3) are presented in table 6. The first three columns of table 5 provide the AMEs of the first-stage probit equation, while the next three

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<sup>9</sup> The regional coefficients for Fitch were insignificant and hence are not reported in the chart.

columns presents the AMEs of the second stage regression for distance above the sovereign rating.

*[Insert Table 5 around here]*

The results in table 5 suggest that securitization structures, such as future-flow receivables and SPVs, and collateralization, play an important role in achieving a sub-sovereign debt rating higher than the sovereign rating. The future-flow receivable securitization indicator shows significantly positive and large marginal effects on both the likelihood of being rated above the sovereign rating and the distance above the sovereign rating for all three rating agencies. The distance above the sovereign rating for sub-sovereign debt securitized by future-flow receivables is 1.6, 1.1 and 0.8 notches higher than other bonds for Moody's, S&P and Fitch respectively, after controlling for other determinants of the distance. The coefficients are statistically significant at the 1 percent level in both stages, indicating a robust relationship.

Bonds structured as SPVs, which are typically backed by existing assets, also tend to have a higher likelihood of being rated above the sovereign ceiling and to achieve a higher distance above the ceiling, although the AMEs are much smaller than that for future-flow securitizations. In the first-stage regression, the coefficients of the SPV indicator are statistically significant at least at 5 percent level in most cases, except for Moody's. A similar pattern is observed for other collateralized bonds, where the coefficients are positive and statistically significant at 1 percent for S&P and Moody's in the second-stage equation. However, the magnitude of the effect is smaller than the effects for the future-flow and SPV indicators.

Among the global variables, the 3-month U.S. policy interest rate is negatively signed across most specifications, while the VIX index is positively signed and statistically significant at 1 percent. These suggest that (a) a looser monetary policy in the U.S. allows debt issuers to achieve higher rating than the sovereign; and (b) the likelihood of sub-sovereigns rated above the sovereign is higher amidst riskier global financial condition. The country-specific variables such as capital account openness, the domestic credit-to-GDP ratio, GDP growth, and inflation don't exhibit consistent signs and are insignificant in most specifications.

The public entity dummy is negative and significant in the first stage equation, showing lower likelihood of being above the sovereign ceiling. As suggested by figures 1a-1c, bonds issued by

public entities tend to be rated close to the sovereign rating even when they pierce the sovereign ceiling. On the other hand, financial sector issuers tend to be rated above the sovereign rating, with greater distance above the sovereign ceiling, although statistically significant at 5 percent only for Moody's. As discussed earlier, this could reflect market expectations of implicit or explicit support from the country's central bank. Besides, the results suggest that debt-specific variables (issue size, maturity, fixed rate, callable) have relatively small marginal impacts or are insignificant in most cases for both margins.

As we did in sub-section 4.1, we exclude the top three countries and re-run the double-hurdle model with the remaining observations. The results are reported in Appendix table 3. The results for the macroeconomic variables and debt characteristics are very similar to those reported earlier in table 5, with future-flow securitization being highly significant across all specifications, confirming that the double hurdle model results are generalizable across the emerging markets and developing countries. The results for future flow securitization in the double hurdle model with *only* the top three countries are also similar to the baseline results (Appendix table 4).

#### ***Inclusion of balance sheet variables in double hurdle model***

Table 6 presents the double-hurdle estimates for non-bounded firms with balance sheet variables additionally included. Total assets, profitability and capital expenditure are found to increase the likelihood of crossing the sovereign ceiling and distance above the sovereign rating. The sign of leverage ratio is inconsistent and statistically insignificant in most cases. The sign and significance of future-flow receivables indicator and other collateralized indicator are positive and statistically significant in most cases—similar to the benchmark specification in table 5—although the "other SPV" variable cannot be estimated due to insufficient observations. The coefficient for the financial sector dummy is positive and statistically significant only for Moody's. These suggest that the results obtained in the benchmark regressions are fairly robust to the inclusion of balance sheet characteristics of firms.

[Insert Table 6 around here]

Overall, the double-hurdle estimation suggests that certain debt characteristics – in particular, a bond backed by future-flow receivables, SPVs, and collateralized bond – raise the probability of piercing the sovereign ceiling and increase the distance above the ceiling. The magnitude of the

effect of future-flow securitization structures is the largest compared to SPVs and other collateralized bonds. Other debt characteristics, country-level variables, and global variables serve the role of useful controls but are in most cases themselves not robustly related to the sovereign ceiling.

## **5. Robustness check**

In the analysis above, a large sample of sub-sovereign bonds was used to estimate the influence of sovereign ratings. However, as we only observe ratings when sub-sovereign bonds were issued, the sample may differ from the population of all bonds. In this section, we address the issue of possible sample selection bias using a two-step Heckman selection model to check the robustness of our baseline results.

Our identification strategy relates to Francis, Aykut, and Tereanu (2014) which reshaped loan and bond-level data into country-quarter panel to correct the selection bias by estimating the probability of corporate bond/loan issuance in the first stage using the average bond-level characteristics as an exclusion restriction. For running the selection regression, we similarly need to collapse the bond-level dataset at higher unit, at industry level for instance, to have observations for each month and country where a borrower did not issue any bonds. We decide to categorize bond issuers into eight industry types (based on their ownership type (public vs. private), industry (financial vs. non-financial), and the governing law they used for issuance, and take average sovereign and sub-sovereign ratings for each country-industry-month pairs to build a balanced panel. Should at least one firm in the same industry for each country issue bonds in a particular month using the same governing law, we observe the distance between the sovereign and sub-sovereign ratings for each country-industry-month pairs.

In several of the emerging market countries covered in our sample, only a few foreign currency bonds were issued during 1990-2013. For this reason, we restrict our sample to 22 emerging countries where more than 30 foreign currency bonds were issued during the sample period to minimize sampling bias caused by a large number of censored observations.<sup>10</sup>

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<sup>10</sup> The sample for the Heckman selection model includes 22 emerging market countries, including Argentina, Brazil, Chile, China, Columbia, Czech Republic, Hungary, India, Indonesia, Kazakhstan, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russian Federation, South Africa, South Korea, Thailand, Turkey, and Ukraine.

In the selection equation, we use an institutional quality dummy (i.e., governing law is English common law or French civil law) as an exclusion restriction. La Porta et al. (1998) predict that common law system in the British tradition offers stronger investor protection than the system in the French civil law tradition, which in turn, promotes the development of market-based financial systems than bank-based financial systems (Levine and Demirguc-Kunt, 1999). Based on these works, English common law is expected to increase the probability of issuing a bond, but not directly affect the sub-sovereign rating itself.<sup>11</sup>

In tables 7 and 8, the Heckman selection model for distance both below and above the sovereign rating are estimated separately for S&P (in columns (1) & (4)), Moody's (in columns (2) & (5)), and Fitch (in columns (3) & (6)). The first stage of the selection model is reported in columns (1)-(3) of each table. The coefficient of our instrument (bond issued under English common law) is positive at around 0.6 for the distance below and above the sovereign, with both significant at the 1 percent level.

*[Insert Tables 7 and 8 around here]*

The second stage results in columns (4)-(6) present similar results to the benchmark specifications for each rating agency. The coefficient of public entity dummy is always negative and significant, while the coefficient of financial sector dummy is negative for those below the sovereign (table 7) and positive for bonds above the sovereign (table 8). For the sub-sovereign bonds rated below the sovereign ceiling, public enterprises and financial firms are always rated closer to the sovereigns than other types of firms. Well-developed financial market helps firms to issue foreign currency bonds (demonstrated by positive coefficient of domestic credit-to-GDP ratio in the first stage), while it tends to tighten the linkage with the sovereign as a result of stronger macro-financial linkage. As financial sector becomes intertwined into domestic economic structure, it will pose more systemic risk to the economy, which may require explicit support from the sovereign. Higher inflation, relatively closed capital accounts, and riskier global financial condition tend to constrain the issuance of international bonds in the first stage. For those rated below the sovereign, the linkage with the sovereign becomes stronger as the VIX index rises in the second stage, similar to what we found in the benchmark regression.

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<sup>11</sup> Of the sub-sovereign bonds that have information on governing law, about half were issued under English Law. The pairwise correlation of sub-sovereign debt ratings with English Law is 8 percent, which suggests that choice of governing law is not associated strongly with sub-sovereign debt ratings.

In all specifications, the selectivity effect lambda ( $\lambda$ ) is positively signed (and significant in many cases) suggesting positive selection, i.e. that the observed sample of sub-sovereign bonds is likely to be rated higher than a (counterfactual) random sample. However, the main results remain broadly unchanged, which suggests that selection issues do not materially change our earlier finding.

## **6. Conclusion**

This paper has investigated the relative contributions of bond-level, issuer-level, and macro-level conditions in determining how far sub-sovereign bond ratings would be generally positioned above or below the sovereign credit rating. The empirical results suggest that key determinants of the distance between the two are clearly different between the case when bond ratings are bounded and non-bounded by the sovereign rating ceiling. For non-bounded bond ratings, the analysis found that bonds are usually structured with some forms of securitization (future-flow securitization, SPV) or collateralization, which mainly determines how high the corporates are rated above the sovereign.

In most cases, however, sub-sovereign bond ratings are constrained by the sovereign ceiling. In this traditional case, our analysis suggests that the rating agencies are paying attention to corporate ownership structure and sectoral affiliation when evaluating the creditworthiness of sub-sovereign debt. The distance between the rating of sub-sovereign bonds issued by public enterprises and financial firms is closer to the sovereign rating, compared to other firms. This closer link suggests that public enterprises, banks and other financial firms benefit from the possibility of government support during times of financial stress. For bonds rated below the sovereign ceiling, riskier global financial conditions are also associated with international bonds being rated closer to the sovereign rating. Lack of capital account openness is associated with a smaller distance, reflecting reduced access to foreign financing. Well-developed domestic financial markets also tend to be related to a smaller distance, likely due to stronger macro-financial linkages.

The overall results remain stable when the three countries with the largest bond issuance are excluded from the sample. For a subset of firms for which we matched bond-level data to firms' balance sheet data, the main results are robust to the inclusion of balance sheet variables, with

firms having larger asset size and more profitable firms rated closer to the sovereign rating. Our main results are robust to possible sample selection bias in bond issuance.

Given the increasing access of emerging market sub-sovereign entities to global debt markets, it is important to note that their cost of foreign currency debt financing is influenced by sovereign credit ratings, especially for public enterprises and banks. In a similar spirit as the predictive model of “shadow” rating used to estimate the credit risk of unrated *countries* (Basu et al., 2013; Ratha, De and Mohapatra, 2011), the findings of this study could provide useful insights to evaluate the creditworthiness of unrated firms. Finally, this study calls for further careful assessment of the sub-sovereign rating decisions based on bond-level and corporate financial factors after incorporating the externality which stems from country and global risk factors.

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**Table 1: Conversion of credit ratings from letter to numeric scale**

	Standard & Poor's and Fitch Rating	Moody's rating	Numeric Grade
<u>Investment grade</u>			
<i>Highest credit quality</i>	AAA	Aaa	21
<i>Very high credit quality</i>	AA+	Aa1	20
	AA	Aa2	19
	AA-	A3	18
<i>High credit quality</i>	A+	A1	17
	A	A2	16
	A-	A3	15
<i>Good credit quality</i>	BBB+	Baa1	14
	BBB	Baa2	13
	BBB-	Baa3	12
<u>Speculative grade</u>			
<i>Speculative</i>	BB+	Ba1	11
	BB	Ba2	10
	BB-	Ba3	9
<i>Highly speculative</i>	B+	B1	8
	B	B2	7
	B-	B3	6
<i>High default risk</i>	CCC+	Caa1	5
	CCC	Caa2	4
	CCC-	Caa3	3
<i>Very high default risk</i>	CC	Ca	2
	C	..	1

Notes: Higher numeric values indicating better ratings. Credit ratings of sub-sovereign debt issues and of sovereigns that are in default (rating of "D" for S&P and Fitch and "C" for Moody's) are excluded.

Source: Standard & Poor's, Moody's, Fitch, Dealogic

**Table 2: Foreign currency sub-sovereign bond ratings below and above the corresponding sovereign ratings**

	<b>Standard &amp; Poor's</b>	<b>Moody's</b>	<b>Fitch</b>
Sub-sovereign rating = Sovereign rating (%)	41.6%	38.2%	42.8%
Sub-sovereign rating < Sovereign rating (%)	46.2%	35.8%	46.2%
Average distance below sovereign rating	3.3	3.6	3.2
Std. dev.(Distance below sovereign rating)	2.5	2.7	2.2
Sub-sovereign rating > Sovereign rating (%)	12.3%	25.9%	11.0%
Average distance above sovereign rating	4.0	3.0	2.4
Std. dev. (Distance above sovereign rating)	3.7	2.9	2.0

Notes: Both sovereign and sub-sovereign ratings are on a scale of 1 to 21, with higher values indicating better ratings (see table 1) for Standard & Poor's, Moody's and Fitch. The sample covers the 1990-2013 period.

**Table 3: Summary statistics for debt characteristics, macroeconomic and global variables, and balance sheet variables**

<b>Variable</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min.</b>	<b>Max.</b>
<b>Ownership and sector</b>				
Public entity	0.38	0.48	0.0	1.0
Financial sector	0.57	0.50	0.0	1.0
<b>Debt characteristics</b>				
Log issue size (const. USD mil.)	18.91	1.22	13.66	22.03
Maturity (years)	6.88	6.48	0.02	100.0
Fixed rate note	0.82	0.38	0.0	1.0
Callable bond	0.25	0.43	0.0	1.0
<i>Collateralization indicators:</i>				
Future-flow receivable	0.05	0.21	0.0	1.0
Special Purpose Vehicle (SPV) <sup>1/</sup>	0.03	0.17	0.0	1.0
Other collateralized	0.03	0.18	0.0	1.0
<b>Global &amp; macroeconomic variables</b>				
VIX index	18.63	6.26	10.8	62.6
US 3-month int. rate	1.96	2.10	0.01	6.17
GDP growth	4.55	3.21	-15.1	25.0
Inflation rate	5.93	5.76	-1.4	85.7
Domestic credit/GDP	88.85	50.90	3.9	192.7
Trade/GDP	69.87	33.62	14.9	220.4
Capital account openness	0.51	0.25	0.0	1.0
<b>Balance sheet variables</b>				
Log of Assets (const. USD thousand)	10.05	1.97	1.35	14.55
Net profit/Assets (%)	3.58	5.14	-27.78	35.79
Financial leverage (%)	7.79	7.50	1.12	111.75
Capital exp./Assets	0.05	0.06	0.00	0.52

Notes: The sample is for all sub-sovereign bonds rated by S&P, Moody's or Fitch during 1990-2013 that are included in the baseline specification in Table 4.

1/ Special Purpose Vehicles (SPVs) exclude future-flow receivables securitizations.

**Table 4: Results of the Tobit model for distance of sub-sovereign bond ratings *below* the sovereign rating ceiling (Bounded ratings)**

	(1)	(2)	(3)	(4)	(5)	(6)
	S&P	Moody's	Fitch	S&P	Moody's	Fitch
<i>Average marginal effects</i>						
Public entity	-1.445*** (0.141)	-1.453*** (0.215)	-1.843*** (0.194)	-0.511* (0.286)	-0.872** (0.415)	-1.146*** (0.222)
Financial sector	-0.880*** (0.155)	-1.301*** (0.264)	-0.602*** (0.170)	-0.685 (0.435)	-0.927** (0.419)	-0.571 (0.425)
Log Issue size	-0.089 (0.107)	-0.168 (0.108)	-0.21 (0.138)	-0.062 (0.094)	-0.029 (0.096)	-0.214 (0.142)
Maturity (years)	-0.014* (0.008)	-0.025** (0.010)	-0.017 (0.012)	-0.001 (0.009)	-0.015 (0.015)	0.002 (0.012)
Fixed rate note	0.333 (0.224)	0.605** (0.247)	0.534* (0.282)	0.103 (0.238)	0.461* (0.254)	0.493 (0.329)
Callable bond	0.915*** (0.128)	0.811*** (0.123)	0.700*** (0.109)	0.495*** (0.149)	0.565*** (0.178)	0.416*** (0.149)
VIX index	-0.029*** (0.007)	-0.041*** (0.008)	-0.022* (0.013)	-0.036** (0.017)	-0.054*** (0.014)	-0.018 (0.015)
US 3-month int. rate	0.191* (0.102)	0.117 (0.086)	0.049 (0.137)	0.082 (0.163)	-0.239 (0.206)	-0.062 (0.155)
GDP growth	-0.005 (0.036)	-0.015 (0.025)	0.012 (0.032)	0.010 (0.051)	-0.024 (0.036)	-0.007 (0.062)
Inflation rate	-0.028 (0.017)	-0.025** (0.012)	-0.006 (0.035)	-0.009 (0.023)	0.009 (0.030)	-0.038 (0.056)
Dom. credit/GDP	-0.018*** (0.006)	-0.016*** (0.005)	0.004 (0.006)	-0.011 (0.009)	-0.004 (0.012)	0.011 (0.009)
Trade/GDP	-0.010 (0.008)	-0.014** (0.007)	-0.001 (0.005)	-0.021* (0.011)	-0.025** (0.011)	-0.003 (0.007)
Cap. ac. openness	1.193** (0.556)	1.189*** (0.352)	-0.089 (0.754)	0.856 (0.855)	0.932 (0.780)	0.650 (0.933)
Log(Assets)				-0.361*** (0.068)	-0.350*** (0.081)	-0.412*** (0.068)
Net profit/Assets (%)				-0.032* (0.017)	-0.026 (0.017)	-0.029* (0.015)
Financial leverage				0.021 (0.014)	0.003 (0.013)	0.015 (0.014)
Capital exp./Assets				-1.125 (1.981)	-2.956 (2.023)	-0.871 (2.474)
Country, Ind. & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.198	0.252	0.191	0.175	0.275	0.190
Log likelihood	-4997.2	-3826.7	-2738.0	-2546.8	-1938.6	-1146.8
No. of obs. (countries)	3,431 (44)	2,898 (44)	1,925 (38)	1,464 (41)	1,308 (41)	716 (35)

Notes: The dependent variable is the distance of the sub-sovereign debt rating below the sovereign rating. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 5: Results of the double-hurdle model for sub-sovereign bond ratings *above* the sovereign rating ceiling (Unbounded ratings)**

	<i>Prob(Subsov. above Sov. Ceiling)</i>			<i>Distance above Sov. Ceiling</i>		
	(1) S&P	(2) Moody's	(3) Fitch	(4) S&P	(5) Moody's	(6) Fitch
<i>Average marginal effects</i>						
Public entity	-0.023 (0.017)	0.039 (0.048)	-0.080** (0.037)	-0.376*** (0.102)	0.109 (0.146)	-0.131 (0.095)
Financial sector	0.016 (0.029)	0.165*** (0.035)	0.053 (0.044)	0.136 (0.147)	0.436*** (0.158)	-0.015 (0.103)
Log Issue size	0.008 (0.008)	0.026* (0.013)	0.005 (0.010)	0.047* (0.025)	0.057 (0.041)	0.008 (0.022)
Maturity (years)	0.001* (0.001)	0.003*** (0.001)	0.002 (0.001)	0.008*** (0.003)	-0.001 (0.005)	0.002 (0.002)
Future-flow receivable	0.263*** (0.025)	0.342*** (0.081)	0.262*** (0.042)	1.089*** (0.078)	1.620*** (0.213)	0.817*** (0.118)
SPV	0.090** (0.039)	0.064 (0.074)	0.086** (0.039)	0.552*** (0.119)	0.851*** (0.316)	0.457*** (0.129)
Other collateralized	0.049* (0.028)	0.187*** (0.056)	-0.031 (0.052)	0.286*** (0.106)	0.693*** (0.167)	0.089 (0.108)
Fixed rate note	-0.028** (0.013)	-0.030 (0.020)	-0.025 (0.026)	-0.195*** (0.058)	-0.103 (0.068)	-0.032 (0.065)
Callable bond	-0.005 (0.026)	-0.031 (0.030)	0.030* (0.018)	-0.036 (0.053)	-0.148*** (0.046)	-0.002 (0.039)
VIX index	0.002** (0.001)	0.006*** (0.002)	0.001 (0.002)	0.007 (0.005)	0.015*** (0.005)	0.000 (0.007)
US 3-month int. rate	-0.022 (0.014)	-0.057*** (0.018)	0.000 (0.011)	-0.101* (0.053)	-0.166*** (0.050)	0.009 (0.025)
GDP growth	0.004 (0.003)	0.010 (0.006)	-0.006** (0.003)	0.008 (0.013)	-0.006 (0.019)	-0.022** (0.008)
Inflation rate	-0.001 (0.001)	0.000 (0.004)	-0.004 (0.004)	-0.004 (0.003)	-0.004 (0.008)	-0.004 (0.006)
Dom. credit/GDP	0.001* (0.000)	0.001 (0.001)	0.000 (0.000)	0.001 (0.001)	0.001 (0.003)	0.000 (0.001)
Trade/GDP	-0.002*** (0.000)	-0.003*** (0.001)	0.000 (0.001)	-0.007*** (0.002)	-0.011*** (0.004)	-0.001 (0.001)
Cap. ac. openness	0.006 (0.039)	-0.134* (0.077)	0.089 (0.084)	-0.210 (0.137)	-0.348 (0.228)	0.186 (0.181)
Country, Ind. & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.307	0.239	0.292	0.307	0.239	0.292
Log likelihood	-1812.1	-3280.9	-853.2	-1812.1	-3280.9	-853.2
No. of obs. (countries)	3,914 (45)	3,807 (44)	2,167 (40)	3,914 (45)	3,807 (44)	2,167 (40)

Notes: The two stages of the double-hurdle model presented in columns (1)-(3) and in columns (4)-(6) are estimated simultaneously. The dependent variable in columns (1)-(3) is an indicator that the sub-sovereign debt rating is higher than the sovereign rating. The dependent variable in columns (4)-(6) is the distance between the sub-sovereign debt rating and sovereign rating, conditional on being above the sovereign rating. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.



**Table 6: Double-hurdle model results with firm-level balance sheet variables (Unbounded ratings)**

	<i>Prob(Subsov. above Sov. Ceiling)</i>			<i>Distance above Sov. Ceiling</i>		
	(1) S&P	(2) Moody's	(3) Fitch	(4) S&P	(5) Moody's	(6) Fitch
<i>Average marginal effects</i>						
Public entity	-0.043* (0.026)	-0.032 (0.042)	-0.141** (0.057)	-0.025 (0.051)	-0.066 (0.109)	-0.075 (0.114)
Financial sector	-0.031 (0.043)	0.112** (0.054)	-0.025 (0.059)	-0.117 (0.113)	0.368*** (0.109)	-0.113 (0.121)
Log Issue size	0.005 (0.005)	0.010 (0.015)	0.005 (0.014)	0.047** (0.019)	0.055 (0.037)	0.010 (0.026)
Maturity (years)	0.000 (0.001)	-0.001 (0.001)	-0.002 (0.001)	0.002* (0.001)	-0.003 (0.003)	-0.003 (0.003)
Future-flow receivable	0.347*** (0.067)	0.356** (0.139)	0.474*** (0.088)	1.121*** (0.225)	1.760*** (0.298)	1.280*** (0.238)
Other collateralized	0.077 (0.053)	0.449*** (0.113)	0.022 (0.081)	0.420*** (0.108)	1.113*** (0.202)	0.118 (0.105)
Fixed rate note	-0.019 (0.023)	0.014 (0.032)	-0.055 (0.039)	-0.088 (0.057)	0.04 (0.063)	-0.136** (0.060)
Callable bond	0.006 (0.025)	0.068 (0.045)	0.070** (0.029)	-0.006 (0.043)	0.088 (0.115)	0.100 (0.066)
VIX index	0.003** (0.002)	0.006*** (0.002)	-0.007** (0.003)	0.004 (0.004)	0.012** (0.006)	-0.011 (0.007)
US 3-month int. rate	-0.028 (0.025)	-0.061** (0.025)	-0.009 (0.028)	-0.063 (0.052)	-0.109 (0.069)	-0.017 (0.049)
GDP growth	0.006 (0.004)	0.019** (0.009)	-0.003 (0.007)	-0.002 (0.013)	-0.014 (0.023)	0.007 (0.010)
Inflation rate	-0.005*** (0.001)	0.003 (0.005)	0.001 (0.008)	-0.011* (0.007)	0.000 (0.015)	0.017 (0.013)
Dom. credit/GDP	0.001* (0.000)	-0.002** (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.004* (0.002)	-0.001 (0.002)
Trade/GDP	-0.002*** (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.003*** (0.001)	-0.006** (0.003)	0.002 (0.001)
Cap. ac. openness	0.036 (0.032)	-0.177 (0.160)	0.092 (0.136)	-0.053 (0.098)	-0.538* (0.298)	0.247 (0.226)
Log(Assets)	0.028*** (0.006)	0.131*** (0.013)	0.061*** (0.015)	0.054*** (0.018)	0.209*** (0.021)	0.099*** (0.032)
Net profit/Assets (%)	0.007*** (0.002)	0.004 (0.004)	0.007** (0.003)	0.022*** (0.007)	0.004 (0.007)	0.002 (0.010)
Financial leverage	-0.002 (0.002)	-0.010*** (0.003)	0.003 (0.002)	0.001 (0.008)	-0.026*** (0.010)	0.005* (0.003)
Capital exp./Assets	0.348* (0.178)	0.318 (0.369)	0.956** (0.458)	1.107** (0.475)	2.173** (1.108)	2.602*** (0.992)
Country, Ind. & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.370	0.292	0.394	0.370	0.292	0.394
Log likelihood	-483.8	-1197.5	-354.7	-483.8	-1197.5	-354.7
No. of obs. (countries)	1,429 (32)	1,504 (34)	882 (31)	1,429 (32)	1,504 (34)	882 (31)

Notes: The two stages of the double-hurdle model presented in columns (1)-(3) and in columns (4)-(6) are estimated simultaneously. The dependent variable in columns (1)-(3) is an indicator that the sub-sovereign debt rating is higher than the sovereign rating. The dependent variable in columns (4)-(6) is the distance between the sub-sovereign debt rating and sovereign rating, conditional on being above the sovereign rating. All regressions include the full set of control variables in the baseline model in tables 5A and 5B. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Table 7: Heckman selection model results controlling for whether sub-sovereign debt is issued (Bounded ratings)**

	<u>Prob. below ceiling</u>			<u>Distance below ceiling</u>		
	(1) S&P	(2) Moody's	(3) Fitch	(4) S&P	(5) Moody's	(6) Fitch
<u>Average marginal effects</u>						
Public entity	-0.404*** (0.026)	-0.474*** (0.028)	-0.354*** (0.035)	-1.768*** (0.117)	-2.084*** (0.133)	-2.400*** (0.131)
Financial sector	-0.128*** (0.025)	-0.057** (0.027)	0.152*** (0.034)	-0.549*** (0.097)	-1.165*** (0.101)	-0.209* (0.121)
VIX index	-0.044*** (0.004)	-0.051*** (0.004)	-0.040*** (0.005)	-0.028* (0.015)	-0.056*** (0.018)	-0.027 (0.017)
US 3-month int. rate	0.011 (0.038)	0.046 (0.042)	0.084 (0.055)	0.148 (0.144)	0.057 (0.172)	0.266 (0.196)
GDP growth	0.012** (0.006)	0.012** (0.006)	0.020** (0.009)	0.000 (0.023)	-0.014 (0.024)	-0.03 (0.034)
Inflation rate	-0.005** (0.002)	-0.002 (0.002)	0.000 (0.001)	-0.017 (0.010)	-0.010 (0.012)	0.051* (0.030)
Dom. credit/GDP	0.003*** (0.001)	0.006*** (0.001)	-0.001 (0.002)	-0.024*** (0.004)	-0.004 (0.006)	-0.025*** (0.009)
Trade/GDP	0.003** (0.001)	0.001 (0.001)	0.005** (0.002)	-0.010** (0.005)	-0.015*** (0.005)	0.001 (0.008)
Cap. ac. openness	0.265*** (0.087)	0.499*** (0.098)	-0.263 (0.193)	1.130*** (0.324)	0.726* (0.385)	-1.361** (0.624)
Lambda (Inverse Mills ratio)				0.117 (0.205)	0.389* (0.217)	0.622*** (0.233)
<u>Excluded variable</u>						
Governed by English common law	0.593*** (0.027)	0.593*** (0.029)	0.623*** (0.036)			
Country & Year dummies	Y	Y	Y	Y	Y	Y
Chi <sup>2</sup>	1,260.2	1,477.6	832.9	1,227.4	1,477.6	832.9
Prob > Chi <sup>2</sup>	0	0	0	0	0	0
No. of obs.	43,905	43,632	43,074	43,905	43,632	43,074

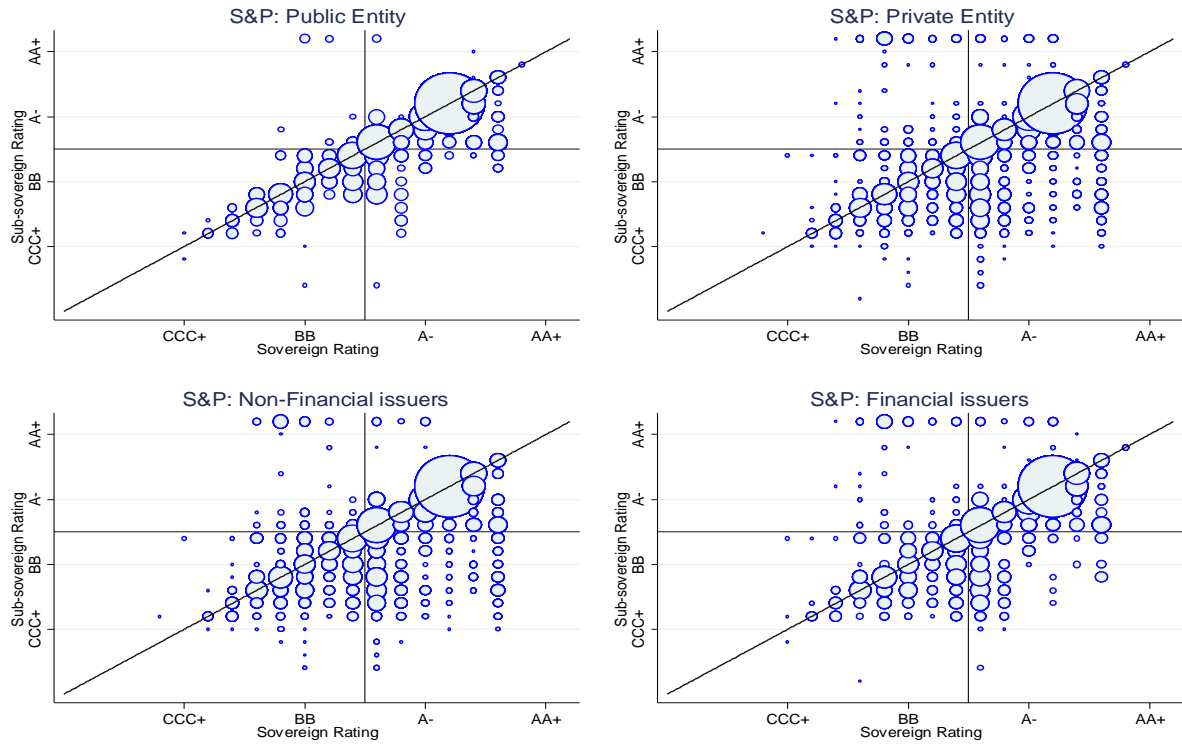
Notes: The regression is estimated using a two-step Heckman procedure. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 8: Heckman selection model results controlling for whether sub-sovereign debt is issued (Unbounded ratings)**

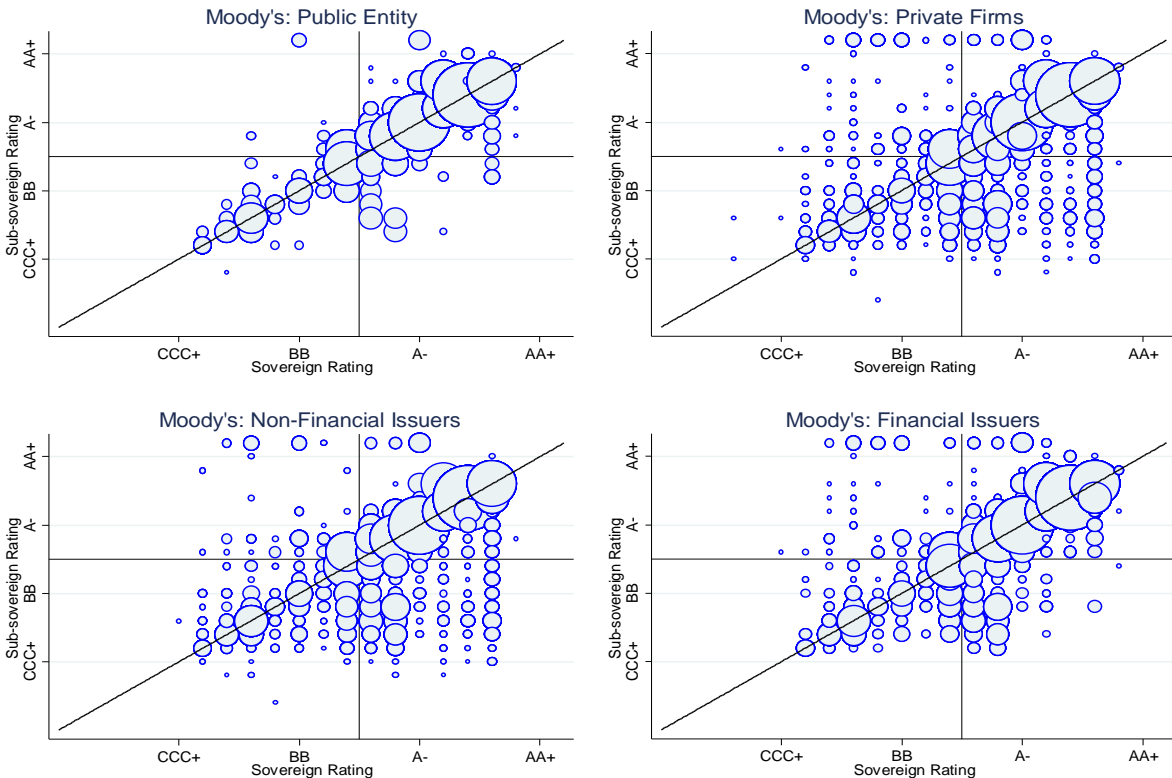
	<u>Prob. above ceiling</u>			<u>Distance above ceiling</u>		
	(1) S&P	(2) Moody's	(3) Fitch	(4) S&P	(5) Moody's	(6) Fitch
<u>Average marginal effects</u>						
Public entity	-0.448*** (0.025)	-0.503*** (0.026)	-0.437*** (0.034)	-0.522*** (0.096)	-0.349*** (0.109)	-0.246*** (0.075)
Financial sector	-0.126*** (0.024)	0.03 (0.024)	0.190*** (0.033)	0.313*** (0.077)	0.550*** (0.080)	0.193*** (0.064)
VIX index	-0.044*** (0.004)	-0.046*** (0.004)	-0.040*** (0.005)	-0.006 (0.012)	0.002 (0.013)	0.003 (0.009)
US 3-month int. rate	-0.015 (0.036)	0.009 (0.036)	0.114** (0.053)	-0.283*** (0.109)	-0.345*** (0.120)	0.172* (0.102)
GDP growth	0.013** (0.005)	0.015*** (0.005)	0.019** (0.009)	0.022 (0.017)	-0.003 (0.019)	-0.038** (0.018)
Inflation rate	-0.005*** (0.002)	-0.002 (0.002)	0 (0.001)	-0.004 (0.007)	0.017** (0.009)	0.019 (0.016)
Dom. credit/GDP	0.004*** (0.001)	0.006*** (0.001)	-0.001 (0.002)	0.004 (0.003)	-0.001 (0.004)	-0.002 (0.005)
Trade/GDP	0.003** (0.001)	0.002 (0.001)	0.005** (0.002)	0.004 (0.004)	0.006 (0.004)	0.004 (0.004)
Cap. ac. openness	0.310*** (0.081)	0.443*** (0.088)	-0.143 (0.184)	0.361 (0.251)	-0.104 (0.294)	0.527 (0.326)
Lambda (Inverse Mills ratio)				0.432*** (0.165)	0.467*** (0.178)	0.148 (0.124)
<u>Excluded variable</u>						
Governed by English common law	0.581*** (0.026)	0.581*** (0.026)	0.619*** (0.035)			
Country & Year dummies	Y	Y	Y	Y	Y	Y
Chi <sup>2</sup>	432.5	568.8	229.8	432.5	568.8	229.8
Prob > Chi <sup>2</sup>	0	0	0	0	0	0
No. of obs.	43,884	43,819	42,913	43,884	43,819	42,913

Notes: The regression is estimated using a two-step Heckman procedure. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

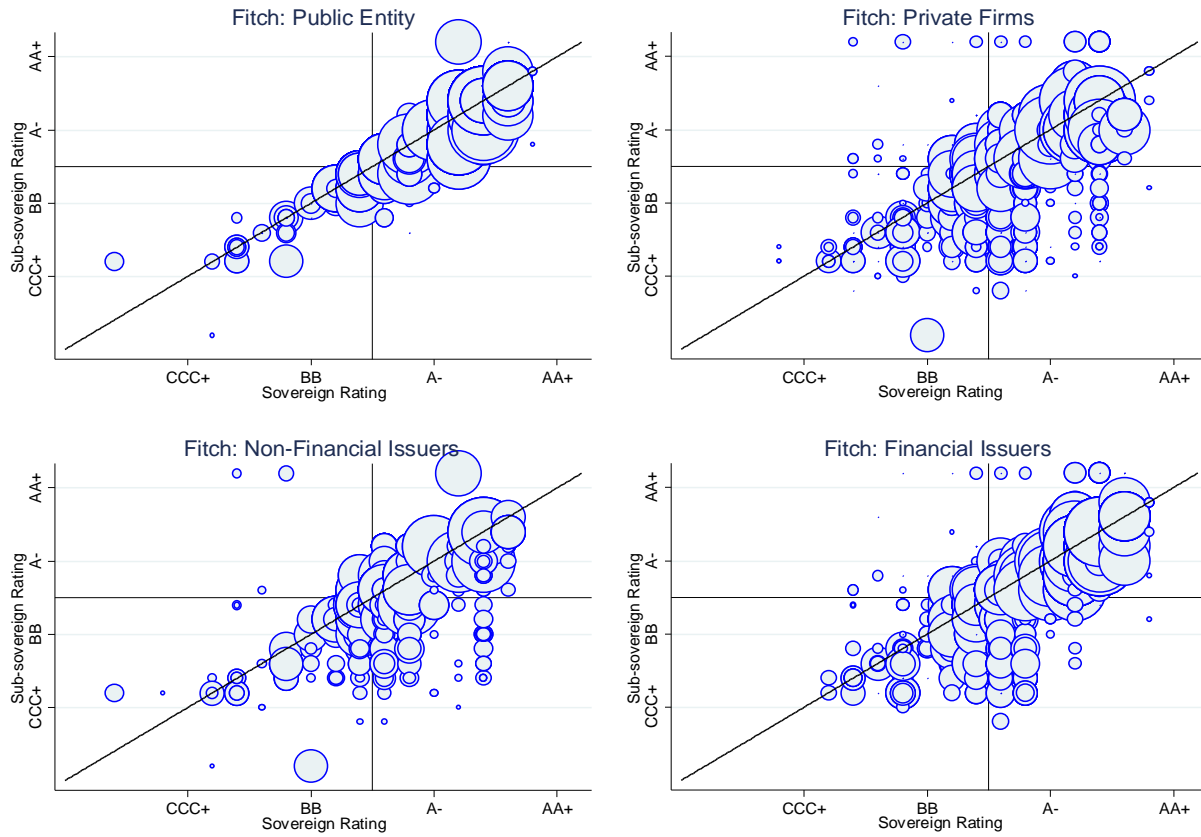
**Figure 1a: Sovereign credit ratings and sub-sovereign bond ratings for Standard & Poor's**



**Figure 1b: Sovereign credit ratings and sub-sovereign bond ratings for Moody's**

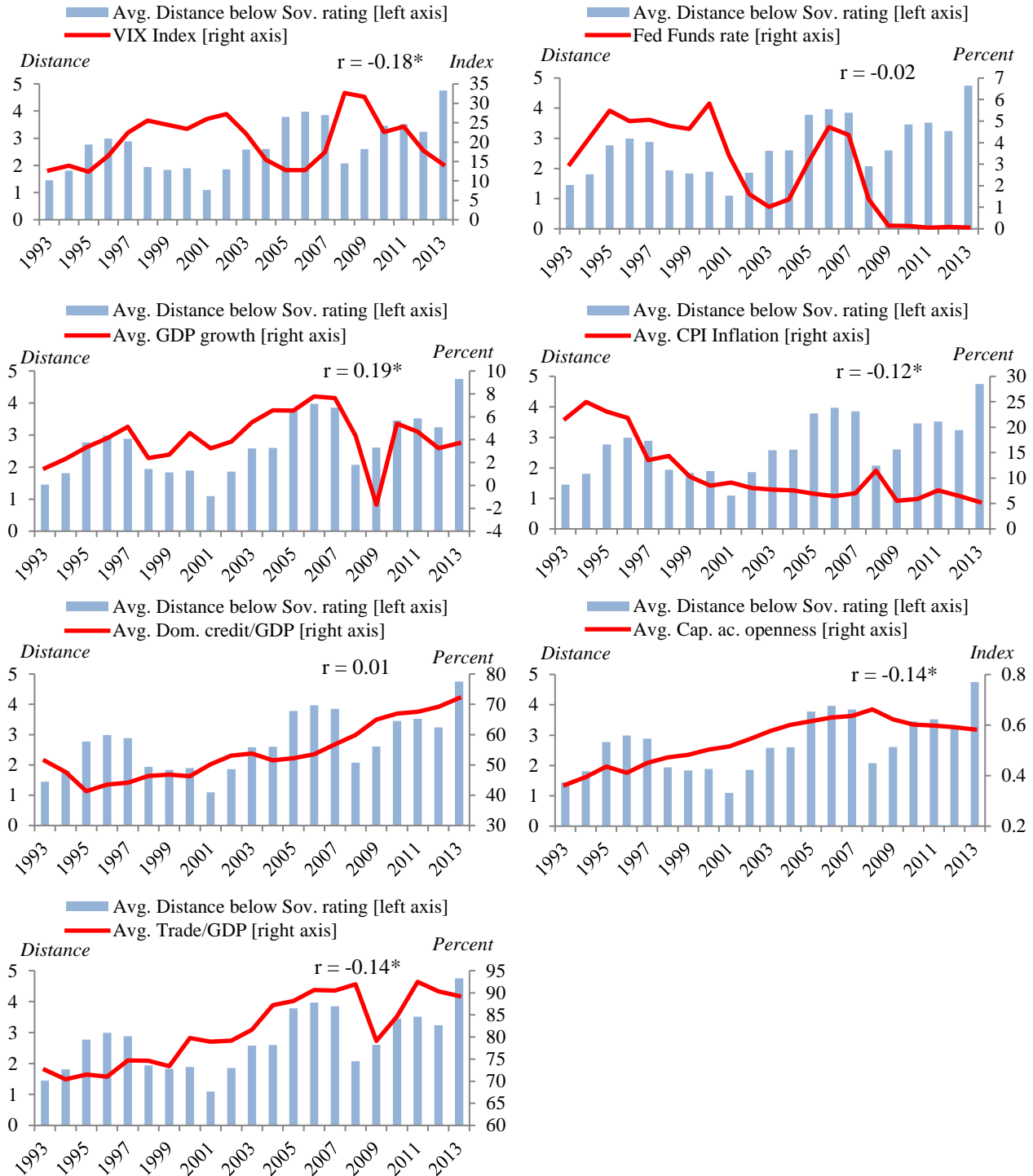


**Figure 1c: Sovereign credit ratings and sub-sovereign bond ratings for Fitch**



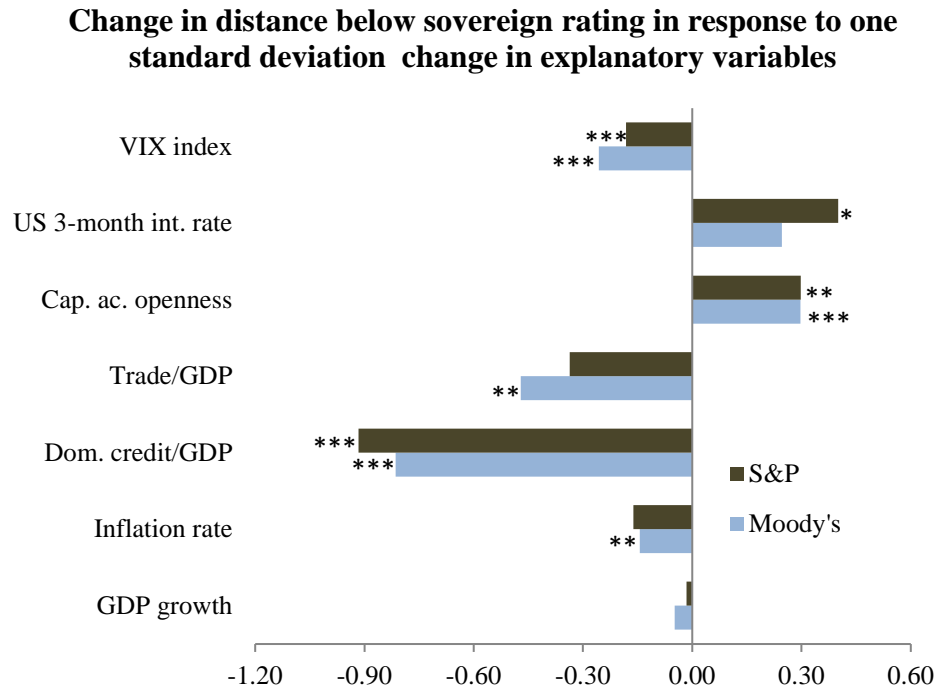
Notes to Figures 1a-1c: The scatterplots show the sovereign credit ratings and ratings of foreign currency sub-sovereign bonds in 47 EMDEs during 1990-2013, separately for S&P, Moody's and Fitch. The charts in the top panel of each figure compare public and private bond issuers, and the charts in the bottom panel of each figure compare non-financial and financial firms. The size of each bubble in the scatterplots corresponds to the number of observations.

**Figure 2: Average distance of sub-sovereign bond ratings below sovereign ratings and macroeconomic variables over time**



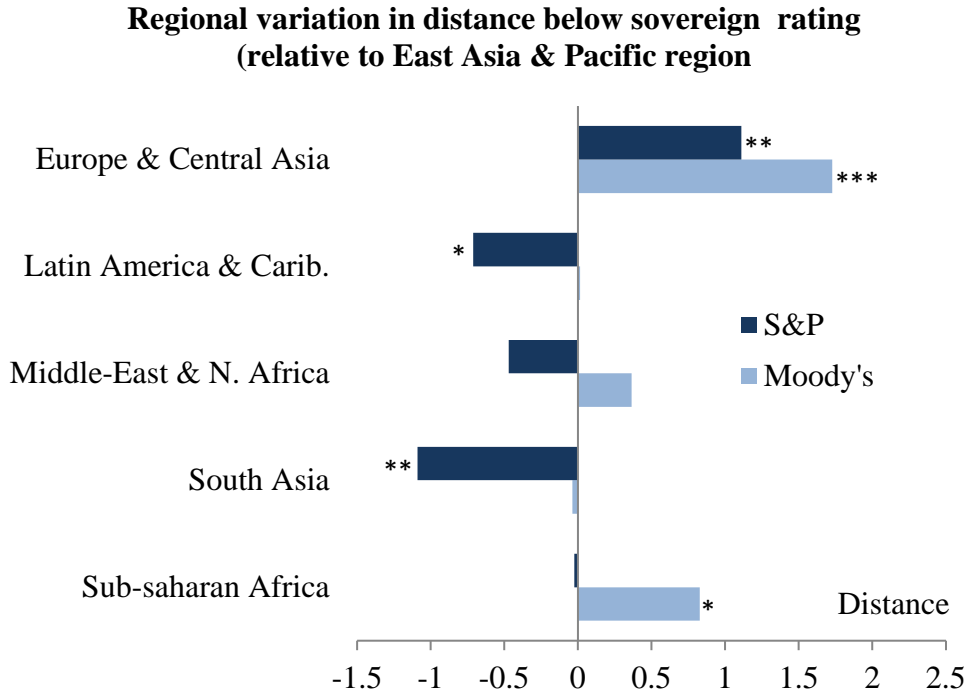
Notes: Average distance of Standard & Poor's, Moody's and Fitch ratings for all sub-sovereign bonds rated at or below the corresponding sovereign rating. Global variables are annual averages. Macroeconomic variables are annual averages for all 47 countries in the sample. Cross-correlation coefficient  $r$  with the significance level is also shown (\* significant at least at 5 percent).

**Figure 3: Response of distance below sovereign ratings to global and macroeconomic variables**



Note: Standardized coefficients obtained using baseline Tobit regression in table 4 (see text). Statistical significance of standardized coefficients (\* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent) indicated next to the bars

**Figure 4: Regional variation in distance below the sovereign rating obtained from baseline Tobit regression**



Note: Coefficients obtained from baseline Tobit regression in table 4 with inclusion of regional dummies. East Asia & Pacific region is taken as the base region. Statistical significance of regional coefficients (\* significant at 10 percent; \*\* significant at 5 percent; \*\*\* significant at 1 percent) indicated next to the bars



## Appendix

Our sample covers 47 emerging markets and developing economies based on the IMF, MSCI and World Bank's country classifications (Appendix table 1a). This includes some countries that are currently high income but considered as emerging markets.<sup>12</sup> We exclude countries that have less than three sub-sovereign debt issues rated by at least one of the three rating agencies for the sample period.

**Appendix table 1a: Rated sub-sovereign foreign currency bonds issued by firms in 47 emerging markets and developing economies (EMDEs) during 1990-2013**

Country	Obs.	Country	Obs.	Country	Obs.	Country	Obs.
Argentina	162	Dominican Rep.	9	Lithuania	6	Slovenia	14
Azerbaijan	6	Egypt	9	Malaysia	88	South Africa	67
Belarus	5	Estonia	13	Mexico	405	South Korea	1,534
Botswana	3	Georgia	6	Mongolia	5	Sri Lanka	4
Brazil	578	Guatemala	11	Nigeria	7	Thailand	50
Bulgaria	13	Hungary	65	Paraguay	3	Trinidad & Tobago	5
Chile	148	India	110	Peru	61	Turkey	125
China	254	Indonesia	107	Philippines	52	Ukraine	72
Colombia	48	Jamaica	18	Poland	54	Uruguay	5
Costa Rica	6	Kazakhstan	132	Romania	18	Venezuela	32
Croatia	18	Latvia	4	Russia	579	Vietnam	3
Czech Rep.	98	Lebanon	12	Slovak Rep.	9	<b>Total obs.</b>	<b>5,033</b>

Note: Foreign currency sub-sovereign bonds rated by S&P, Moody's or Fitch.

We use a more comprehensive definition of sub-sovereign issuers than earlier studies (Mizen and Tsoukas, 2012) which classifies all entities other than those classified as central government and supranational organizations as sub-sovereign entities. These include the non-financial private sector, financial firms, public enterprises and local government authorities (Appendix table 1b).

**Appendix table 1b: Composition of rated sub-sovereign foreign currency bonds issued during 1990-2013**

Industry	Obs.	Industry	Obs.	Industry	Obs.
Aerospace	10	Food & Beverage	114	Oil & Gas	486
Agribusiness	20	Forestry & Paper	57	Professional Services	2
Auto/Truck	23	Healthcare	4	Real Estate/Property	123
Chemicals	59	Holding Companies	21	Retail	34
Computers & Electronics	31	Insurance	7	Telecommunications	312
Construction/Building	132	Leisure & Recreation	4	Textile	3
Consumer Products	19	Machinery	12	Transportation	110
Defense	1	Metal & Steel	111	Utility & Energy	297
Dining & Lodging	11	Mining	97	Local Government	85
<b>Total non-financial</b>	<b>2,185</b>	Other Financial	1,433		
Banks	1,415				
<b>Total financial</b>	<b>2,848</b>				
<b>Total obs.</b>	<b>5,033</b>				

Note: Foreign currency sub-sovereign bonds rated by S&P, Moody's or Fitch.

<sup>12</sup> The sample broadly corresponds to the World Bank's classification of low- and middle-income countries, combined with the set of countries included in the MSCI Emerging Markets (EM) Index. We exclude high-income members of the Gulf-Cooperation Council from the sample. Bahamas and Barbados, considered as offshore financial centers and tax havens, were also excluded. Several high-income countries (Israel, Macao, Singapore, Hong Kong SAR (China), and Cyprus) that are not part of the MSCI EM Index were also excluded.

**Appendix table 2: Baseline Tobit model results with exclusion of top three countries and only top three countries (Bounded ratings)**

	<i>Excluding top 3 countries</i>			<i>Only top 3 countries</i>		
	(1) S&P	(2) Moody's	(3) Fitch	(4) S&P	(5) Moody's	(6) Fitch
<i>Average marginal effects</i>						
Public entity	-1.405*** (0.346)	-0.945*** (0.244)	-1.595*** (0.190)	-1.372*** (0.124)	-1.545*** (0.159)	-1.858*** (0.154)
Financial sector	-1.000*** (0.187)	-2.157*** (0.183)	-0.553* (0.311)	-0.062 (0.063)	-0.728 (0.486)	-0.413*** (0.147)
Log Issue size	-0.494*** (0.167)	-0.369*** (0.125)	-0.320** (0.128)	-0.011 (0.099)	-0.067 (0.118)	-0.145 (0.165)
Maturity (years)	-0.019 (0.014)	-0.031* (0.016)	-0.026* (0.016)	-0.019 (0.012)	-0.008 (0.007)	-0.01 (0.020)
Fixed rate note	0.531 (0.357)	0.794*** (0.272)	0.537* (0.276)	0.204 (0.276)	0.396 (0.338)	0.529 (0.460)
Callable bond	1.151*** (0.220)	1.090*** (0.195)	0.983*** (0.172)	0.678*** (0.213)	0.443*** (0.142)	0.476*** (0.157)
VIX index	-0.036** (0.017)	-0.060*** (0.023)	-0.014 (0.027)	0.106*** (0.040)	0.082 (0.095)	0.113 (0.072)
US 3-month int. rate	0.236 (0.309)	0.123 (0.192)	-0.211 (0.280)	-1.572*** (0.518)	-1.138* (0.624)	-3.426*** (1.114)
GDP growth	-0.034 (0.038)	-0.02 (0.044)	-0.032 (0.041)	-0.577 (0.376)	-0.296 (0.382)	-0.411 (0.271)
Inflation rate	-0.043*** (0.014)	-0.038*** (0.014)	-0.025 (0.052)	0.045 (0.035)	-0.052 (0.054)	-0.025* (0.015)
Dom. credit/GDP	-0.007* (0.004)	-0.011* (0.006)	-0.018*** (0.006)	-0.109** (0.043)	-0.096 (0.084)	-0.164*** (0.040)
Trade/GDP	0.003 (0.004)	-0.013 (0.010)	0.01 (0.008)	-0.019*** (0.002)	-0.035*** (0.005)	-0.022*** (0.002)
Cap. ac. openness	1.174** (0.572)	1.914*** (0.457)	0.071 (1.096)	0.018*** (0.004)	0.007 (0.019)	0.020*** (0.003)
Country, Industry & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.175	0.275	0.190	0.217	0.250	0.254
Log likelihood	-2546.8	-1938.6	-1146.8	-2369.3	-1765.7	-1452.2
No. of obs. (countries)	1,464 (41)	1,308 (41)	716 (35)	1,967 (3)	1,590 (3)	1,209 (3)

Notes: The dependent variable is the distance of the sub-sovereign debt rating below the sovereign rating. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Appendix table 3: Baseline double-hurdle model results with exclusion of top three countries (Unbounded ratings)**

	<i>Excluding top three countries</i>					
	<i>Prob(Subsov. above Sov. Ceiling)</i>			<i>Distance above Sov. Ceiling</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	S&P	Moody's	Fitch	S&P	Moody's	Fitch
<i>Average marginal effects</i>						
Public entity	-0.047** (0.020)	-0.065 (0.040)	-0.173*** (0.055)	-0.531*** (0.146)	-0.180 (0.161)	0.005 (0.178)
Financial sector	0.031 (0.041)	0.225*** (0.037)	0.136** (0.059)	0.389* (0.199)	0.902*** (0.228)	0.298* (0.158)
Log Issue size	-0.003 (0.015)	0.039*** (0.011)	0.017 (0.017)	0.032 (0.066)	0.036 (0.057)	0.019 (0.046)
Maturity (years)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.007* (0.004)	-0.004 (0.008)	0.000 (0.003)
Future-flow receivable	0.334*** (0.040)	0.478*** (0.103)	0.287*** (0.062)	1.438*** (0.115)	1.938*** (0.203)	0.954*** (0.149)
SPV	0.05 (0.042)	-0.042 (0.047)	0.05 (0.057)	0.391* (0.209)	0.304 (0.211)	0.699*** (0.137)
Other collateralized	0.04 (0.047)	0.126** (0.052)	-0.044 (0.072)	0.162 (0.157)	0.405** (0.158)	0.018 (0.208)
Fixed rate note	-0.071*** (0.020)	-0.041 (0.026)	-0.109*** (0.035)	-0.405*** (0.137)	-0.180** (0.088)	-0.200** (0.101)
Callable bond	-0.054* (0.029)	-0.070** (0.034)	-0.034 (0.031)	-0.144** (0.072)	-0.202*** (0.046)	-0.156** (0.070)
VIX index	0.004*** (0.001)	0.007*** (0.002)	0.003 (0.002)	0.018** (0.009)	0.015* (0.009)	0.006 (0.008)
US 3-month int. rate	-0.011 (0.014)	-0.061*** (0.019)	-0.012 (0.023)	-0.066 (0.067)	-0.120* (0.064)	-0.012 (0.051)
GDP growth	0.009** (0.004)	0.018*** (0.005)	-0.009 (0.006)	0.03 (0.020)	0.010 (0.013)	-0.025 (0.016)
Inflation rate	-0.001 (0.002)	0.000 (0.003)	0.002 (0.005)	-0.002 (0.004)	-0.002 (0.007)	0.008 (0.010)
Dom. credit/GDP	0.001** (0.001)	0.000 (0.001)	0.000 (0.001)	0.003 (0.003)	-0.002 (0.002)	0.001 (0.002)
Trade/GDP	-0.004*** (0.001)	-0.003*** (0.001)	-0.001 (0.001)	-0.014*** (0.003)	-0.012*** (0.004)	-0.003* (0.002)
Cap. ac. openness	0.073 (0.058)	-0.119* (0.070)	0.211** (0.099)	-0.201 (0.245)	-0.104 (0.177)	0.400 (0.253)
Country, Ind. & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.426	0.359	0.404	0.289	0.26	0.318
Log likelihood	-482.0	-664.0	-239.3	-1142.9	-1540.2	-449.0
No. of obs. (countries)	1,784 (42)	1,785 (42)	855 (37)	1,784 (42)	1,785 (42)	855 (37)

Notes: The two stages of the double-hurdle model presented in columns (1)-(3) and in columns (4)-(6) are estimated simultaneously. The dependent variable in columns (1)-(3) is an indicator that the sub-sovereign debt rating is higher than the sovereign rating. The dependent variable in columns (4)-(6) is the distance between the sub-sovereign debt rating and sovereign rating, conditional on being above the sovereign rating. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

**Appendix table 4: Baseline double-hurdle model results for only top three countries (Unbounded ratings)**

	<i>Only top three countries</i>					
	<i>Prob(Subsov. above Sov. Ceiling)</i>			<i>Distance above Sov. Ceiling</i>		
	(1)	(2)	(3)	(4)	(5)	(6)
	S&P	Moody's	Fitch	S&P	Moody's	Fitch
<i>Average marginal effects</i>						
Public entity	-0.001 (0.035)	0.111 (0.083)	-0.004 (0.026)	-0.179 (0.226)	0.388*** (0.124)	-0.059 (9.281)
Financial sector	-0.008 (0.011)	0.135 (0.085)	-0.026*** (0.005)	-0.032 (0.047)	0.238 (0.186)	-0.273 (41.003)
Log Issue size	0.008 (0.011)	0.015 (0.017)	-0.003 (0.008)	0.022 (0.025)	0.067 (0.057)	-0.045 (11.816)
Maturity (years)	0.003*** (0.000)	0.006* (0.003)	0.003*** (0.000)	0.010*** (0.003)	0.008 (0.013)	0.008 (0.290)
Future-flow receivable	0.207*** (0.028)	0.247*** (0.090)	0.215*** (0.071)	0.786*** (0.101)	1.388*** (0.334)	0.682 (46.807)
SPV	0.083** (0.041)	0.081 (0.168)	0.060* (0.032)	0.494*** (0.138)	0.973 (0.645)	0.241 (22.515)
Other collateralized	0.042 (0.030)	0.226 (0.176)	.. ..	0.260*** (0.072)	0.754** (0.382)	.. ..
Fixed rate note	-0.008 (0.014)	-0.023 (0.027)	-0.015 (0.017)	-0.093* (0.052)	-0.070 (0.073)	0.010 (7.782)
Callable bond	0.012 (0.013)	0.011 (0.031)	0.022*** (0.008)	-0.006 (0.068)	-0.051 (0.039)	-0.057 (19.081)
VIX index	0.000 (0.002)	0.007** (0.003)	-0.002 (0.002)	0.003** (0.001)	0.017* (0.010)	-0.007 (0.594)
US 3-month int. rate	-0.007 (0.007)	-0.008 (0.039)	0.029*** (0.007)	-0.056* (0.031)	-0.048 (0.107)	0.058 (0.077)
GDP growth	-0.007*** (0.002)	0.007 (0.010)	-0.020** (0.009)	-0.039*** (0.010)	-0.039 (0.035)	-0.036 (0.830)
Inflation rate	0.000 (0.003)	0.028* (0.015)	-0.003 (0.012)	-0.003 (0.004)	0.072** (0.035)	0.007 (2.397)
Dom. credit/GDP	0.002*** (0.000)	0.003** (0.001)	0.001 (0.002)	0.005** (0.002)	0.009*** (0.003)	0.002 (0.139)
Trade/GDP	-0.004*** (0.000)	-0.006** (0.003)	0.000 (0.002)	-0.010*** (0.001)	-0.018** (0.008)	0.001 (0.177)
Cap. ac. openness	0.110** (0.045)	0.125 (0.121)	0.025 (0.167)	0.273** (0.121)	0.279 (0.496)	-0.058 (20.478)
Country, Ind. & Year dummies	Y	Y	Y	Y	Y	Y
Pseudo R-square	0.507	0.396	0.519	0.382	0.308	0.407
Log likelihood	-273.5	-722.2	-152.2	-580.2	-1563.7	-296.4
No. of obs. (countries)	1,889 (3)	2,123 (3)	1,194 (3)	1,889 (3)	2,123 (3)	1,194 (3)

Notes: The two stages of the double-hurdle model presented in columns (1)-(3) and in columns (4)-(6) are estimated simultaneously. The dependent variable in columns (1)-(3) is an indicator that the sub-sovereign debt rating is higher than the sovereign rating. The dependent variable in columns (4)-(6) is the distance between the sub-sovereign debt rating and sovereign rating, conditional on being above the sovereign rating. All regressions include additional controls for current account balance and U.S. 10-year government bond yield. Heteroscedasticity-consistent robust standard errors are clustered at the country level. \* Significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.