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We investigate the role of "country risk" in determining the default risk of firms in emerging markets. In particular, we study the relationship between the secondary market spreads (over hard-currency government bond yields) of bonds issued by emerging market firms and bonds issued by their home governments over the past 3 $\frac{1}{2}$years. Our results indicate that market participants do not strictly apply the "sovereign ceiling," under which no firm is more creditworthy than its government. We do find that the spreads of emerging market corporate and government bonds over hard-currency government bonds are highly correlated. The correlation is higher for some industries than for others, and we find no evidence that banks face greater country risk.

Keywords: Country risk, credit rating, sovereign ceiling, default risk, emerging markets

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In April 1997, the credit rating agency Standard & Poor's made a controversial announcement. It upgraded the debt of fourteen Argentinian firms, including three banks, to a rating higher than that accorded to Argentina's sovereign debt. This decision ran counter to a long-standing policy of the credit rating industry to observe the "sovereign ceiling," that is, the rule that no corporate debt can carry a rating higher than that of the firm's home government. Moody's, S&P's principal competitor, argued that the move was irresponsible, and many market participants agreed. One emerging market analyst stated, "It's a can of worms that S&P has opened up. They've blown their credibility." (Euromoney 1997).

Thinking about this debate leads to natural questions. First, why does Moody's think that the Argentinian government should borrow at a lower rate than an Argentinian telephone company? Second, why should an Argentinian telephone company borrow (dollars) at a higher rate than a similarly run phone company in a more developed country like Singapore?

The answers to these questions are important in many ways. First of all, the sovereign ceiling rule has significant direct implications for asset markets because of the role that rating agencies play in the pricing of emerging market debt. When S&P relaxed the rule in Argentina, the yield spreads of the affected companies narrowed by 30 to 50 basis points. Furthermore, the notion of "country risk" embodied in the sovereign ceiling rule plays a prominent role in overseas investment of all types. Decisions about bank loans, foreign direct investment, and portfolio investment in developing countries depend crucially on how investors perceive the risks associated with the home country of the borrower or project. Yet in spite of its widely recognized importance, there has been little formal analysis of country risk.

Another argument for studying emerging market bonds is that they have become a much more important source of emerging market financing in recent years. From 1991 to 1996, the dollar amount of long-term bonds issued in emerging markets grew eight-fold, from $12.4 billion to $93.9 billion.[1] By comparison, new equity issues grew from $5.6 to $16.4 billion, and syndicated loan commitments, which were the traditional vehicle of emerging market financing during the 1980's, grew from $50.7 to $79.7 billion. The sheer volume of the debt market argues for the importance of studying the pricing of these securities.

There are at least two ways that a firm's home country can affect the firm's repayment capacity. First, the government has the power to tax firms, impose foreign exchange controls, or seize the firm's assets. If the government's repayment capacity falls, the government is more likely to exercise one or more of these rights, which in turn will lower the firm's repayment capacity. This effect is called "transfer risk," that is, the risk that a sovereign borrower's repayment problems will be transferred to the firm.[2] Transfer risk is behind the informal stories that are often told to justify the sovereign ceiling. Euromoney (1997) cites a senior analyst at Moody's: "From our standpoint, it's inevitable that controls would be imposed on private companies" when a government defaults on its debt.

However, it is not clear that the government will always transfer all its repayment problems to the firm. If the sovereign faces a short-term liquidity crisis, for example, it may not be best to respond with a large tax on firms' foreign exchange earnings. Any action that risks bankrupting the firm may be politically difficult if it leads to unemployment or threatens entrenched interests. In sum, the factors determining the government's decision to default are not well understood. As long as it is not certain

[1] Euromoney Bondware (1997). Bonds considered here, as well as in our sample, are those issued in hard currency.

[2] IMF(1991)

that the government will clamp down on all firms in a crisis, the strict application of the sovereign ceiling may not make sense.

The second reason that a firm's home country is important is that it affects the macroeconomic environment in which the firm operates. An economy-wide downturn may lower the firm's prospects at the same time that it increases the likelihood of a government repayment crisis. Likewise, a currency devaluation will imply difficulties for both the firms and the government in meeting foreign currency obligations. Thus the sovereign ceiling may make sense as a rule of thumb simply because firm and government revenues come from similar sources.

Thinking about the problem in this way makes it clear that different firms might face different amounts of country risk. Some firms may be more closely tied to the government, or easier to tax in bad times. Likewise, some firms are more dependent on the domestic business cycle. Industrial characteristics of firms should affect their sensitivities to country wide shocks: a construction firm's prospects will decline if the domestic economy enters a recession, whereas oil companies may be almost entirely independent of the domestic economy.

One way to measure investors' beliefs about country risk is to examine the secondary market spreads of the debt of emerging market firms. The yield spread of a firm's or country's bond over a comparable US treasury bond reflects investors' beliefs about the probability that the issuer will default. If a firm is subject to country risk, its bond's yield spreads will covary positively with those of its host government.

In this paper we use firm-level data on bond prices to study this relationship between sovereign risk and firm risk. We measure country risk by looking at that part of the firm's yield premium that is explained by the government's yield premium. Our principal question is: How big a role does the default risk of the host government play in determining its companies' debt prices? We test the hypothesis that whenever a government defaults, the firm defaults, or equivalently, that transfer risk is 100%. First, we simply compare the yield spreads of corporate bonds to those of government bonds of similar maturities. In several cases, the corporate spreads are lower, indicating that the market assesses a lower default risk for the company than for its host government. Second, we regress the corporate yield spread on that of the government. We again find evidence that transfer risk is less than 100%.

In recent years, country risk has received considerable attention in the literature. However, we believe that this paper is the first to study specifically the meaning of country risk for *firms* in emerging markets. The existing literature, motivated by the debt crisis of the early 1980's, is mainly concerned with the determinants of sovereign default. This work, beginning with Edwards (1984), examines the relationship between the yield spread on sovereign debt and various macroeconomic variables to determine which best explain government payments crises. More recent work in the area includes Boehmer and Megginson (1990). This literature almost exclusively studies sovereign government's repayment capacity but never extends the inquiry to the firms in emerging markets.

Claessens and Pennacchi (1996) present a model in which they derive repayment capacity from observed Brady Bond prices. They assume that the repayment capacity of the government is captured by a single state variable that follows arithmatic Brownian motion. Cumby and Evans (1998) allow a more general time-series process for the state variable which fits the data better. They however are not able to derive a closed-form solution for the probability of default that comes from this more general time series process. We also use a simple state-variable model to motivate our empirical work, but we focus on the relationship between the government's and the firms' repayment capacities.

A broader study of emerging market debt is found in Eichengreen and Mody (1997). This study uses the launch prices of emerging market debt issues from the last two decades to examine whether the increase in emerging market bond prices during the second half of the 1990's was due to economic fundamentals or a change in "market sentiment." Though they include a dummy variable indicating whether the issuer is a government or private entity, the authors are not expressly interested in comparing the characteristics of private and sovereign debt. In contrast, our paper puts the distinction between private and public bond spreads at center stage, and systematically studies the effect of a sovereign on the cost of capital of its domestic firms.

Our work has implications for a growing literature that looks at investment in emerging markets in the context of a portfolio decision. Claessens, Dasgupta and Glenn (1995), Bekaert and Harvey (1997) and Harvey (1995), for example, test whether emerging market stock returns can be explained through some form of capital asset pricing model and/or other risk factors. Our paper contributes to this literature by helping to clarify the nature of risk in emerging market securities.

The remainder of the paper is organized as follows. Section 1 describes a simple model of the relationship between firm and government bond yield spreads. Section 2 describes our data set, and section 3 presents our estimation results. Section 4 concludes.

1. Model

In this section we develop a simple model intended to illuminate the implications of the sovereign ceiling for yields of corporate and government bonds. If we interpret the sovereign ceiling as meaning "firms are always riskier than governments," then the implication for yields is straightforward: corporate bonds will always have higher yields than government bonds, since investors will require compensation for the greater risk. We will test this by simply comparing default spreads of corporate bonds to those of the associated sovereign bonds. We also wish to test the statement that "firms will always default when the government defaults." This is a stronger statement than the first. Firms may default for reasons that have nothing to do with the government, and it is clearly possible that a firm is riskier than its government for reasons that have nothing to do with "country risk." To explore the implications of the stronger statement for yields, we develop a model in which both the firm's and the government's default probabilities are determined by a common state variable. We interpret this state variable as a summary statistic that captures all macroeconomic factors affecting the repayment capacity of the government or the firm (later we will consider a second factor that captures firm-specific factors that are independent of the government's repayment capacity). The implication of this model will be that if the sovereign ceiling rule holds, then a change in the yield of a sovereign bond will be associated with at least as great a change in the yield of a similar corporate bond in the same country.

At time t the state variable is represented by $X_t \in \Re$. We suppose that higher values of the state variable are associated with greater repayment capacity, so that default is likely when the value of X_t is low. Specifically, we assume that there exists a cutoff level for the government, K^G, and for the firm, K^F, such that if the state variable is below K^G when the bond matures, the government will default on its obligations. Likewise if the state variable is below K^F the firm will default.[3] Note that the chance of the firm defaulting encompasses the possibility of "transfer risk," that is, the chance that the firm

[3] In principle, the government may default either because it is unwilling to pay or because it is literally unable to pay. We lump all possible explanations for default into the single "repayment capacity" variable.

will default due to direct action by the government.

We compare two zero-coupon bonds, one issued by the firm and one by the government, and each maturing at time T. The value of each is determined by the probability that the state will fall in the default region at time T. The results that follow will concern the impact of a small change in the value of the state variable on the yields of the two bonds. As in Claessens & Pennachi (1996), we assume that the state variable follows an arithmatic Brownian motion with drift,

$$dX_t = \mu dt + \sigma dZ$$

where $dZ = \varepsilon_t \sqrt{dt}$ with ε_t an independent, standard normal random variable. Under this assumption, we can write the default probability for the government at any time $t < T$, $d^G(X_t)$, as

$$d(X_t, K^G) \equiv \Pr(X_T - K^G \leq 0) = \Phi(\frac{K^G - X_t - \mu T}{\sigma\sqrt{T}}) \tag{1.1}$$

where Φ is the cumulative distribution function of a standard normal distribution (the derivation is in the appendix). The default probability of the firm is determined in the same way, using K^F instead of K^G.

Consider the justification of the sovereign ceiling offered by Moody's, that "if the government defaults, then it will cause the firm to default." If this is true, then the conditions under which the government defaults must be a subset of those under which the firm defaults. That is,

$$K^F \geq K^G. \tag{1.2}$$

We assume for now that total default is the only possible form of non-payment for both firms and the government; if default occurs, creditors receive zero payments. The intuition for the empirical work that follows will be the implication of (1.2) that if a change in the state variable leads the default probability of the government to go up by one percentage point, it will cause the default probability of the firm to increase by at least one percentage point. Assume the current state at time $t = 0$ is X_0 (we will refer to changes in the state variable at time 0, though the time chosen is not important to our results).

Lemma 1.1. *If (1.2) holds and $K^F < X_0 + \mu T$ (so that the ex-ante default probability of the firm is less than 50%), then $d_1(X_0, K^F) > d_1(X_0, K^G)$ (where $d_1()$ refers to the derivative of $d()$ with respect to its first argument).*

The proof is in the appendix.

The intuition for this is given in Figure 1. When the firm is more likely to default than the government, the probability that the firm will default is more sensitive to changes in the state variable. This follows from the fact that the probability distribution function is increasing for low default probabilities. When the default probability is high, the opposite is true. Intuitively, if the firm is almost certain to default, a change in the state variable will not affect the firm's prospects much.

Our data are in terms of bond yields, rather than default probabilities, so we need to consider the link between the two. We will show that the result of Lemma 2.1 also holds for the bond yields. That is, if the spread on a government bond over risk-free bonds goes up by one point, then the spread on a corporate bond in the same country should go up by at least one point.

Assume that agents are risk neutral. The yield of the emerging market bond, y_t, is then defined by

$$(1 + y_t) = (1 + r_t)/(1 - d(X_t, K))$$

where y_t is the yield on the bond, r_t is the risk-free interest rate, and $d(X_t, K)$ is the probability that the bond issuer will be in default in period T. Rearranging, we have $y_t = r_t + d(X_t, K) + d(X_t, K)y_t$. So,

$$s(X_t, K) = d(X_t, K)\frac{1 + r_t}{1 - d(X_t, K)}$$

where $s(X_t, K) = y_t - r_t$ is the spread of the bond over that of the risk-free interest rate at time t.

Proposition 1.2 below proves the main result of this section: that if the firm always defaults when the government does (so that $K^F \geq K^G$), then a given change in the state variable will have a greater impact on the firm spread than on the government spread.

Proposition 1.2. *If $K^F \geq K^G$ and $K^F < X_0 + \mu T$, then*

$$\frac{s_1(X_0, K^F)}{s_1(X_0, K^G)} \geq 1 \tag{1.3}$$

The proof is in the appendix.

The proposition says that if investors believe the firm will default whenever the government defaults, and if the firm's default probability is less than 50%, yields on corporate bonds will be more sensitive to changes in the state variable than will sovereign bonds. Because firms will default whenever the government does, an increase in the probability that the government will default must imply at least as great an increase in the probability that the firm will default.

1.1. Two firm state variables

In this subsection we show that the result of Proposition 1.2 carries through to the case where there is a second, firm-specific state variable capturing factors that affect the default probability of the firm, but not that of the government. This risk is the residual effect on the firm's repayment risk that is orthogonal to the first risk factor.

As before there is a single state variable, $X_{1,t}$, that reflects macroeconomic or countrywide shocks at period t and affects the default probability of both the firm and the government. We introduce a second state variable, $X_{2,t}$, that reflects changes to the firm's repayment capacity and has no relation to the government's default probability. Each state variable evolves as an arithmatic Brownian motion with drift,

$$dX_{1,t} = \mu_1 dt + \sigma_1 dZ_1$$

$$dX_{2,t} = \mu_2 dt + \sigma_2 dZ_2$$

where $dZ_1 = \varepsilon_{1t}\sqrt{t}$, $dZ_2 = \varepsilon_{2t}\sqrt{t}$, and ε_{1t} and ε_{2t} are independent standard normal random variables.

There are now two cutoffs for the firm, K_1^F and K_2^F, such that if $X_{1,T} < K_1^F$ then the firm will default because of countrywide factors, and if $X_{2,T} < K_2^F$ then the firm will default because of firm-specific factors. The firm's default probability at $t = 0$ can then be expressed as the following:

$$\begin{aligned} d^F(X_{1,0}, X_{2,0}, K^F) &\equiv \Pr(X_{1,T} < K_1^F \text{ } or \text{ } X_{2,T} < K_2^F) \\ &= \Pr(X_{1,T} < K_1^F) + \Pr(X_{2,T} < K_2^F) - \Pr(X_{1,T} < K_1^F \text{ \& } X_{2,T} < K_2^F) \end{aligned}$$

while the government's default probability is given as before as

$$d^G(X_{1,0}, K^G) \equiv \Pr(X_{1,T} < K_1^G).$$

Proposition 1.3. *In the model with two state variables, if* $K^F \geq K^G$ *and* $K^F < X_{1,0} + \mu T$*, then*

$$\frac{s_1^F(X_{1,0}, X_{2,0}, K^F)}{s_1^G(X_{1,0}, K^G)} \geq 1 \tag{1.4}$$

The proof is in the appendix.

We will test the implications of (1.4) directly in our empirical work. If (1.4) is false, then it must be that the strict sovereign ceiling condition does not hold. Notice that it is quite possible that the default probability of the firm is greater than that of the government, but that (1.4) is false. Firm-specific factors may make the firm riskier than the government, even if the sources of risk are completely different. If firm-specific risk makes firms generally less creditworthy than the government, then the sovereign ceiling may make sense as a rule of thumb. (1.4) gives us a way to test the stricter condition that "whenever the government defaults, it will cause the firms to default."

1.2. Recovery rates

The above results are derived under the assumption that in the case of default, investors recover none of their investment. Reality is of course much more complicated. A more general approach would be to suppose that the fraction of their investment recovered by investors depends on the "severity" of the default, or in terms of our model, how far below the threshold the state variable falls. We do not solve the most general case, but we will consider the implications of a model where investors recover a fixed fraction of their investment in the case of default, and this fraction can be different for corporates and sovereigns. We show that the result above holds under the assumptions that 1) the firm always defaults when the government defaults, and 2) the recovery rate for the government is larger than that of the firm. We believe that the same results would hold in a more general model, under the assumption that "if the government defaults, investors will not recover more from the firms than from the government." This seems like the inference that should follow Moody's rationale for the sovereign ceiling.

Proposition 1.4. *Suppose that in the case of default, investors recover a fraction* λ_G *from the government and* λ_F *from the firm. If* $K^F \geq K^G$, $K^F < X_0 + \mu T$, *and* $\lambda_G \geq \lambda_F$, *then*

$$\frac{s_1(X_0, K^F, \lambda_F)}{s_1(X_0, K^G, \lambda_G)} \geq 1. \tag{1.5}$$

The proof is in the appendix.

2. Data Description and Empirical Approach

This section describes the methodology used to select our sample and presents summary statistics.

In this study we use bond yields to measure the perceived default risk of the issuer. To this end, we do everything we can to isolate the role of default risk in the pricing of the bond. By using only eurobonds issued in hard currency, we avoid bonds that carry currency risk.[4] We restrict our sample to the most standard category of bonds: those that that pay a fixed interest rate, have no collateral or third-party guarantor, and contain no warrants or embedded options. Euromoney magazine identifies 727 corporate bonds launched after 1980 that meet our criteria. We then attempt to match each corporate bond with a sovereign bond in the same country (and meeting the same selection criteria). In the case of South Korea, which did not issue any sovereign debt prior to 1998, we use bonds issued by the Korea Development Bank as a proxy for sovereign debt.[5] Other countries with substantial corporate borrowing but little or no sovereign borrowing include India, Hong Kong, and Singapore. However for these countries we were unable to find an obvious substitute for the sovereign debt.

[4]We consider only bonds issued in US, German, UK, Japanese, and Swiss currencies. Such bonds constitute 95% of the international bond issues listed by Euromoney. To exclude the interest rate risk associated with these currencies we look at spreads above risk-free rates; see below.

[5]Korean Development Bank debt is guaranteed by the Korean government, as outlined in Article 44 of the Korean Development Bank Act.

The process leaves us with 659 corporate bonds. Of these, we were able to obtain time series data from January 1995 to September 1998 for 116 corporate bonds and sovereign counterparts.[6] When there is more than one sovereign bond available, we use the one for which the maturities of the corporate and sovereign bonds are most closely matched.

The home country of each firm refers to the home country of the entity legally obligated to repay the bond issue; cases where the bond's guarantor is different from the issuing firm were eliminated from the sample. In some cases of firms with foreign affiliates, however, legal obligations might not be the only consideration in case of default. For example, Telefonica de Argentina is closely affiliated with Telefonica de Espana, and the Spanish firm holds a substantial minority stake. Legally there would be no obligation on the part of Telefonica de Espana to bail out its Argentine affiliate, but investors might expect such action. We do not have reliable data on foreign affiliations, and we will not make the distinction in this study.

One difficulty in working with these data is the illiquidity of many emerging market bond issues. The prices we use (taken from Datastream) represent the most recent traded price as of the final day of the month (or in some cases an average of bid and ask prices). Since many of the bonds do not trade very often, the price listed on the last day of the month may reflect investor's beliefs as of some previous date. This problem can be characterized as measurement error: at any point in time the observed price will be an imperfect measure of investors' current risk assessment. We discuss the implications of this in more detail when we report the results.

We compute the yield spread for a given bond by taking its yield and subtracting the risk-free interest rate for bonds issued in the same currency. For example, given a

[6] One reason that we found so few series from Datastream is that they do not keep data for expired bonds. About half of these eligible bonds expired before we retrieved the data in fall of 1998.

dollar-denominated Mexican bond maturing in five years, we compute the yield spread by subtracting the yield on a five-year US Treasury bond. We interpret this yield spread as representing exclusively the premium coming from default risk. In fact, it should also include a liquidity premium, given the illiquidity problem mentioned above. We would expect sovereign bonds to be more liquid than their corporate counterparts, so to the extent liquidity is a problem we should expect our data to overstate the default risk of firms by more than it overstates the default risk of governments.

Table I presents summary statistics for these 116 pairs of bonds. As we would expect, firms overall are riskier: corporate spreads are on average about 60% higher than sovereign spreads. The correlation between corporate and sovereign spreads is positive and fairly high, at 0.7. This is not too surprising and confirms the intuition that country risk plays an important role in emerging market corporate bonds. When we look at the bonds by country and industry, we see considerable variation. Comparing Argentina and Mexico, for example, we see that within our sample Mexican corporate debt reflects a much higher risk premium over sovereign debt than does corporate debt in Argentina. Also, the covariance of sovereign and corporate debt is much lower in Mexico than in Argentina. Note that Russia is an outlier in our sample, reflecting the collapse that took place in 1998.

Looking at industry data, we see that oil & gas and telecommunications firms in fact have lower spreads, on average, than their host governments. Comparing spreads before and after the beginning of the Asian crisis in October 1997, we see a considerable jump in the spreads, though the difference between corporate and sovereign spreads has narrowed somewhat, and the covariance between the two remains constant.

Table II presents frequencies, by industry and country, both for bonds in our sample and in the larger Euromoney data set. The industry distribution is fairly reflective of the overall population of bonds: almost half of corporate bonds are issued by banks, indicating that financial institutions play an important role in providing hard-currency funds to the economy. Our sample is dominated by Latin American firms, in large part because Asian governments issue few hard-currency bonds. (Thus there is not a scarcity of East Asian corporate bonds, but of sovereign bonds to match them to). Countries outside of East Asia and Latin America represented in our sample are South Africa, Lebanon, Russia, Czech Republic and Romania. From Table II, we can see that the only issuers of hard currency bonds in these countries are banks.

The regressions in the next section will use the basic form

$$\triangle s_{it}^F = \beta_i \triangle s_{it}^G + u_{it} \tag{2.1}$$

where $\triangle s_{it}^F$ is the change in the spread of the firm's bond from period $t-1$ to period t, and $\triangle s_{it}^G$ is the change in the spread of the corresponding sovereign bond. By taking differences of the spreads, we control for any systematic firm-specific component of the firm default probability. Equation (1.4) implies that if the rationale for the sovereign ceiling is strictly believed by investors, then we must have $\beta_i \geq 1$.

Apart from allowing us to study the sovereign ceiling, the term $\beta_i \triangle s_{it}^G$ represents the "country risk component" of changes in the firm's risk premium. Clearly this is not the only way that one could express country risk, but it is convenient and we believe that it is useful. Country risk is a term that is used loosely to refer to the risk faced by a firm as a result of political or economic instability in its home country. Our claim is that the default risk of sovereign bonds is an appropriate summary statistic for these risks. In particular, defining country risk in this way allows us to compare country risk across different firms. We will use the coefficient to look at differences in country risk across industries, regions, and time periods.

3. Results

3.1. Comparing spreads directly

We begin analyzing the relationship between corporate and sovereign default risk by comparing the yield spread of individual corporate bonds to those of their associated sovereign bonds.[7] This exercise provides a direct test of whether investors apply the sovereign ceiling rule: if firms are always riskier than their governments, then there should be no instance in which a given corporate bond has a lower spread than a sovereign bond issued by that firm's home government.

The above statement assumes an ideal pair of bonds that are identical in every way besides the identity of the issuer. Of course in practice we do not have pairs of identical bonds. We try to get as close as possible, by considering only bonds issued in hard currency and by looking and yeild spreads over risk-free rates. To avoid comparing bonds at different points in the yield curve, in this subsection we will consider only pairs of bonds whose maturity dates are closely matched.[8]

As discussed above, liquidity risk is an additional factor determining the price of a bond, so that the bond spreads we use will not reflect pure default risk. We do not have data on liquidity, and so have no way of separating default risk from liquidity risk (later we will use issue size as a crude proxy for liquidity). On average, we expect sovereign

[7] In most cases comparing the spreads is approximately identical to comparing the yields; there will be a difference when the bonds are issued in different currencies.

[8] Specifically, for this sample we consider only pairs of bonds whose maturities differ by less than 10%. That is, if t is the current date and T_i and T_s are the maturity dates of the firm and sovereign respectively, we require $|\frac{T_i - T_s}{Ti - t}| < 0.1$. Unlike the samples used for our regressions, we use the entire time series available for each bond to compute these means. We also looked at the relative durations of the bonds, to consider the impact of coupon structure on the effective maturity of the bond. The duration ratios were not substantially different from the maturity ratios.

issues to be larger and more liquid than corporate issues, so that the liquidity premium for corporate bonds will be greater than that for sovereigns. Thus liquidity risk should act to reinforce the positive difference between corporate spreads and sovereign spreads that is implied by the sovereign ceiling.

If the sovereign ceiling is strictly respected by investors, then they will never be willing to pay more for a corporate bond than for a similar sovereign bond in the same country. As described in the previous section, illiquidity means that our data may not reflect corporate and sovereign default risk at the same moment. For example, suppose investors believe that the default probability of both the sovereign and the corporate has increased during the day, but that no one has traded the corporate bond (while the sovereign bond has been actively traded). At the end of the day, the price of the sovereign bond will have fallen while that of the corporate will be the same as before. The quoted price for the corporate does not reflect current expectations, so it is possible that, even if investors see the corporate as more risky, the observed spread on the sovereign is higher. Thus we do not ask whether there is a single month in which the sovereign spread is higher than the corporate, but rather whether the sovereign spread is higher, on average, over the duration of our sample period. There is no reason to expect either spread to be a *biased* estimate of default probability, so looking at the averages should give us an accurate picture of investors' views.

Table III presents the mean yield spread for the firms in our sample whose maturities are most closely matched to those of the sovereign. We see that in several cases the average yield spread for the firm is lower than that of its host government; for six firms this difference is negative and significant at the 5% level. As a crude indicator of liquidity, we report the size (in dollars) of each issue, to make sure that in these examples we are not comparing a large corporate issue to a small sovereign issue. In all but one case, the sovereign issue is substantially larger than the corporate issue.

It is worth noting that the three Argentinian companies with lower spreads than their governments were all among those upgraded past the sovereign ceiling by Standard & Poor's in 1997. Thus, investors appear to support S&P's decision rather than Moody's policy of describing these corporate issues as no safer than the government's debt.

The existence of firms with lower spreads than their governments implies that investors sometimes consider the corporate bond safer than the sovereign. These examples call into question the validity of the sovereign ceiling; in the next subsection we will use regressions to investigate more generally the role of country risk in corporate bond spreads.

3.2. Estimating country risk

We now turn to a more systematic test of the sovereign ceiling rule using the full set of 116 bonds. We will do so using the basic regression form

$$\Delta s_{it}^F = \beta \Delta s_{it}^G + u_{it} \tag{3.1}$$

where Δs_{it}^F is the change in the risk premium for firm i in period t and Δs_{it}^G is the change in the corresponding sovereign risk premium. β represents the ratio of the firm's and sovereign's sensitivity to economy-wide shocks. We use this regression to test whether, on average for the bonds in our sample, investors believe that "whenever the government defaults, the firm defaults." Proposition 1.3 shows that if investors believe this strong statement of the sovereign ceiling rule then we must have $\beta \geq 1$. That is, if the sovereign spread increases by one percentage point, then the corporate spread must increase by at least one percentage point.

In principle, each firm has a separate β_i: firms clearly will differ in their sensitivity to macroeconomic conditions and in the degree to which they might be taxed by the government in bad times. For our analysis, we will initially constrain all firm β's to be equal within three broad regions (East Asia, Latin America, and Other).

We will then test whether the coefficient is different for firms in different industries. It is easy to imagine reasons that some industries might have higher country risk than others. Firms should have greater country risk if they are closely related to the government, serve the domestic market, or are in procyclical industries. Examples would include utilities (with domestic cash flows and higher likelihood of nationalization) or the construction industry (which is very dependent on the domestic business cycle). Firms whose business is international and whose revenues are in foreign currency, such as oil & gas firms, would be expected to have a lower level of country risk.

We are particularly interested in the banking industry. There are many reasons to believe that country risk is closely related to the banking system, and many analysts feel that the sovereign ceiling is particularly relevant to banks.[9] Banks may face higher transfer risk if the government sees them as the most readily accessible source for foreign exchange. The risk of a banking crisis may also exacerbate country risk, as a financial crisis will make it more difficult for the government and firms to repay debt (cf. Mishkin (1996)). Krugman (1998) suggests that this is the main factor behind the recent Asian crisis. If either of these effects is present, we should expect a stronger relationship between the risk premia of banks and the government than between non-banks and the government.

To examine whether different industries have different country risk coefficients, we

[9] Euromoney (1997) cites an official with IBCA: "If there was a major recession, who would be hit? The banks would have big bad loans. They're in no position to be in a better credit rating than the sovereign."

run the regression

$$\Delta s_{it}^{F} = \beta_0 \Delta s_{it}^{G} + \gamma' D_i \Delta s_{it}^{G} + u_{it} \tag{3.2}$$

where D_i is a vector of dummy variables describing industry groups and $\gamma' = \{\gamma_1, ...\gamma_j, ...\gamma_J\}$ is the vector of industry coefficients.

Ideally, we would want to compare corporate and sovereign bonds that have identical maturities. In the previous subsection we limited ourselves to those corporate bonds in our sample with a maturity very close to that of the corresponding sovereign bond. In this subsection we use the entire panel of 116 bonds, and therefore we will attempt to control for maturity differences.

If the yield curve is fixed over time, the maturity difference will represent a fixed effect that will disappear when we take first differences. However, a fixed yield curve would be a very strong assumption. As a partial correction, we allow a linear, time-varying yield curve. We do this by including a term which is a month dummy variable interacted with the maturity difference of the two bonds. Consider a pair of firm and government bonds with yield spread $s_{it}^{F,m}$ and $s_{it}^{G,n}$ where the firm yield spread has m years to maturity and the government yield spread has n years to maturity. We assume that the yield curve for all securities in period t is represented by:[10]

$$s_{it}^{G,m} - s_{it}^{G,n} = \omega_t (m - n) \tag{3.3}$$

Then we run the following regression:

$$\Delta s_{it}^{F,n} = \beta \Delta s_{it}^{G,m} + \varphi \Delta Z(t) + \varepsilon_{it} \tag{3.4}$$

[10] This assumption, while restrictive, is more general than existing literature. For example, Eichengreen and Mody (1998) assume a linear yield curve that is constant over time. For our data, an F-test statistic rejects the hypothesis that the yield curve is not time varying at 1% level.

where $\Delta Z(t) = Z(t) - Z(t-1)$ and $Z(t) = D(t) * (m-n)$ where $D(t)$ is a month dummy.

Column (a) of Table IV presents results for the basic regression 3.1. We see that the overall country risk coefficient, β, is significantly greater than zero for all three regions. This implies that country risk exists. More important for our analysis, however, is that for East Asia and Latin America the coefficient is significantly less than one. A 100-basis-point increase in the spread of the sovereign bond is associated with a 35 or 45-basis-point increase in the spread of the corporate bond. In the context of our model, this indicates that investors do not believe in the logic of the sovereign ceiling. Latin American and East Asian firms do not have significantly different coefficients, though the coefficient for the rest of the world is much higher (no doubt reflecting the inclusion of Russia).

As discussed in the previous section, these data include measurement error, since end-of-month prices may not perfectly reflect investors' expectations about default on that date. Since it is the corporate bonds that are particularly illiquid, the most serious measurement error is in the dependent variable. To the extent that sovereign bonds are illiquid, however, the measurement error in this variable will bias our coefficient estimate. As a crude check of this, we repeat the regression for a subsample including only those issues larger than US$100 million (about 75% of the sample). Column (b) reports the results of this regression. The coefficient is not substantially different, though the higher R^2 suggests that measurement error is less severe. Considering different bond-size cutoffs yields similar results; the coefficient remains significantly lower than one.

Column (c) presents results from the regression with industry effects. Though the standard errors are large, we get some idea of how country risk differs across industries. The industries with the highest country risk include energy production (utilities) and construction, firms with primarily domestic business. Oil and gas companies, which sell on global markets and earn revenues in hard currency, tend to have lower country risk. Telecommunication companies seem to have very low country risk, perhaps reflecting the remarkable growth that many of these firms are experiencing. An F-test examining whether country risks are the same for all six industries strongly rejects this hypothesis.

Column (d) of Table IV presents the results for the regression including only the industry effect for banks or financial institutions. Surprisingly, the bank interaction coefficient is not significantly different from zero; we find that banks do not have significantly higher country risk than non-bank firms. This runs counter to our intuition and to conventional wisdom, and we believe it merits further study.

3.3. Did country risk increase during the Asian crisis?

One motive for studying country risk is to better understand how the market reacted to the "Asian crisis" that began in late 1997. Spreads for emerging market bonds rose dramatically with the onset of the crisis (as illustrated in Table I). Conventional wisdom is that these increased yields were accompanied by a tendency on the part of creditors to lump all emerging-market securities into the same category. This would imply that country risk has gone up in the wake of the crisis, as investors pay less attention to individual borrower characteristics and more attention to the country in which borrowers are located.

We test this by comparing the country risk coefficient before and after the onset of the crisis. If country risk has increased, the coefficient should be larger for the period that began in October 1997. We also test whether the crisis affected the country risk of banks differently from that of non-bank firms. If banks are more sensitive to the impact of a macroeconomic downturn, then the crisis may have affected them more than other firms in the economy.

Table V presents the results of regressing firm spreads on government spreads and a term interacting the government yield with a post-October 1997 dummy. Column (a) shows that the "crisis" coefficient is in fact negative, and not significantly different from zero. In other words, changes in corporate spreads have not become more closely related to changes in government spreads since the onset of the crisis. This is a surprising result, and suggests that investors have become no less discriminating following the beginning of the crisis. One reason for caution in interpreting this result, however, is the potential for measurement error introduced by illiquid bonds, as discussed in the previous subsection. Anecdotal evidence suggests that markets for emerging-market securities became less liquid during the crisis, which would exacerbate problems of measurement error. However, restricting ourselves to large issues again supports the conclusion that country risk did not increase on average during the crisis.

To see whether the crisis has had a greater impact on the country risk of the banking sector, we interact a crisis dummy with a bank dummy and the government spread. Column (b) reports these results. We see that, when controlling for the overall effect of the crisis and of the banking industry, the crisis increased the country risk coefficient of banks by more than it increased the country risk of other firms, though the difference is not significant at the 5% level. The result suggests that while banks' country risk is not significantly different from others overall, it has been more sensitive to the onset of the crisis.

4. Conclusion

"Country risk" is a concept that is widely used but poorly understood. There is a lack of consensus among credit rating agencies about how the creditworthiness of firms depends on their host governments. Though many analysts believe that the sovereign ceiling should apply, we find evidence of several corporate bonds with lower yields than those of their sovereigns. Both facts demonstrate how much confusion exists about country risk and what it means for emerging market firms. A better understanding of country risk is an important step toward a better understanding of investment in developing countries.

We study country risk by comparing the spreads on bonds issued by corporations in emerging markets to those of their governments over the past 3 1/2 years. By looking at a panel of bonds traded on secondary markets, we are able to analyze the relationship between a change in a corporate bond's spread and a change in the spread of a bond issued by the corporation's home government. We find that country risk is significant. For Latin America and Asia, an increase in the government spread of 100 basis points is on average associated with about a 40-basis-point increase in the spread of corporate bonds in the same country. This is less than the one-for-one response that we would expect if the sovereign ceiling were strictly appropriate. So while our results indicate that market participants do believe that country risk is important, they do not believe the statement that firms will always default when the government defaults.

The central message of this study is quite simple: even in emerging markets, the price of corporate debt depends on more than the home country, and in particular, a well-run company may have higher creditworthiness than a poorly managed government. Firms in some industries are considered to be more tied to the risks of their countries than those in other industries. These results paint a picture of a more sophisticated financial market than that implied by the policy of Moody's, which condemns all emerging market corporate bonds to a lower creditworthiness than their governments.

5. Appendix

Derivation of equation 1.1 Suppose the state variable follows a Brownian motion with drift.

$$dX_t = \mu dt + \sigma dZ_t$$

Hence,

$$\int_0^T dX_t = \int_0^T \mu dt + \int_0^T \sigma dZ_t$$

$$X_T - X_0 = \mu T + \sigma \int_0^T dZ_t$$

$X_T - X_0$ thus follows a normal distribution with mean μT and variance $\sigma^2 T$, so we have

$$\Pr(X_T \leq K) = \Phi(\frac{K - X_0 - \mu T}{\sigma\sqrt{T}}).$$

Proof of Lemma 1.1

$$d_1(X_0, K^F) < d_1(X_0, K^G) \Leftrightarrow$$

$$\frac{-1}{\sigma\sqrt{T}}\phi(\frac{K^F - X_0 - \mu T}{\sigma\sqrt{T}}) < \frac{-1}{\sigma\sqrt{T}}\phi(\frac{K^G - X_0 - \mu T}{\sigma\sqrt{T}}) \Leftrightarrow$$

$$\frac{1}{\sqrt{2\pi}}e^{\frac{-1}{2}(\frac{K^F - X_0 - \mu T}{\sigma\sqrt{T}})^2} > \frac{1}{\sqrt{2\pi}}e^{\frac{-1}{2}(\frac{K^G - X_0 - \mu T}{\sigma\sqrt{T}})^2} \Leftrightarrow$$

$$(K^F - X_0 - \mu T)^2 < (K^G - X_0 - \mu T)^2$$

If $K^F > K^G$, then this will be true if $K^F < X_0 + \mu T$.

Proof of Proposition 1.2 The change in the spread given a change in the initial state variable X_0 is given by:

$$s_1(X_0, K) = \frac{d_1(X_0, K)(1 + r)}{[1 - d(X_0, K)]^2}$$

The ratio of the change for the firm versus that of the government is given by

$$\frac{s_1(X_0, K^F)}{s_1(X_0, K^G)} = (\frac{[1 - d(X_0, K^G)]^2}{[1 - d(X_0, K^F)]^2})(\frac{d_1(X_0, K^F)}{d_1(X_0, K^G)})$$

The first part of this expression is greater than one since d is increasing in K and $K^F > K^G$. The second part will be greater than one per Lemma 2.1.

Proof of Proposition 1.3 The probabilities of the government and firm default can be expressed as:

$$d^G(X_{1,0}, K^G) = \Phi(\frac{K^G - X_{1,0} - \mu T}{\sigma\sqrt{T}})$$

$$d^F(X_{1,0}, X_{2,0}, K) = \Phi(\frac{K_1^F - X_{1,0} - \mu T}{\sigma\sqrt{T}}) + \Phi(\frac{K_2^F - X_{2,0} - \mu T}{\sigma\sqrt{T}}) - \Phi(\frac{K_1^F - X_{1,0} - \mu T}{\sigma\sqrt{T}})\Phi(\frac{K_2^F - X_{2,0} -}{\sigma\sqrt{T}}$$

As before, the ratio of the change for the firm versus that of the government is given by:

$$\frac{s_1^F(X_{1,0}, X_{2,0}, K^F)}{s_1^G(X_{1,0}, K^G)} = (\frac{[1 - d^G(X_{1,0}, K^G)]^2}{[1 - d^F(X_{1,0}, X_{2,0}, K^F)]^2})(\frac{d_1^F(X_{1,0}, X_{2,0}, K^F)}{d_1^G(X_{1,0}, K^G)})$$
$$= \frac{[1-a]^2}{[1-b]^2[1-c]}(\frac{\phi(\frac{K_1^F - X_{1,0} - \mu T}{\sigma\sqrt{T}})}{\phi(\frac{K^G - X_{1,0} - \mu T}{\sigma\sqrt{T}})})$$

where $a = \Phi(\frac{K^G - X_{1,0} - \mu T}{\sigma\sqrt{T}})$, $b = \Phi(\frac{K_1^F - X_{1,0} - \mu T}{\sigma\sqrt{T}})$, and $c = \Phi(\frac{K_2^F - X_{2,0} - \mu T}{\sigma\sqrt{T}})$.

We have $[1-b] < [1-a]$ since $K^F > K^G$. Since $c < 1$, the first term $\frac{[1-a]^2}{[1-b]^2[1-c]} > 1$. The second term is bigger than one as per Lemma 2.1. Hence, in the presence of an additional factor, the firm spread will still move by more than the government spread given a change to the state variable X_1.

Proof of Proposition 1.4 The value of a one-period bond with principal repayment P, recovery rate λ, and current state X_t is

$$\frac{\lambda P + (1-\lambda)(1 - d(X_t, K))P}{1 + r_t}$$

In terms of the yield, the value of the bond is

$$\frac{P}{1+y_t}.$$

Thus we have

$$1+y_t = \frac{1+r_t}{\lambda+(1-\lambda)(1-d(X_t,K))}$$

Rearranging, we get

$$s_t = y_t - r_t = (1+r_t)\frac{(1-\lambda)d(X_t,K)}{\lambda+(1-\lambda)(1-d(X_t,K))}$$

So the change in the spread as a function of a change in any initial state X_0 is given by

$$s_1(X_0,K,\lambda) = \frac{(1+r)(1-\lambda)d_1(X_0,K)}{\lambda+(1-\lambda)(1-d(X_0,K))} + \frac{(1+r)(1-\lambda)^2 d_1(X_0,K)d(X_0,K)}{[\lambda+(1-\lambda)(1-d(X_0,K))]^2}$$

or

$$\frac{ds}{dX_0} = \frac{(1+r)(1-\lambda)d_1(X_0,K)}{[\lambda+(1-\lambda)(1-d(X_0,K))]^2}$$

The ratio of the change in the firm spread to the change in the sovereign spread will be given by

$$\frac{s_1(X_0,K^F,\lambda^F)}{s_1(X_0,K^G,\lambda^G)} = [\frac{(1-\lambda^F)}{(1-\lambda^G)}][\frac{d_1(X_0,K^F)}{d_1(X_0,K^G)}][\frac{[\lambda^G+(1-\lambda^G)(1-d(X_0,K^G))]^2}{[\lambda^F+(1-\lambda^F)(1-d(X_0,K^F))]^2}]$$

Under the assumption that $K^G \leq K^F$, we have $d(X_0,K^G) \leq d(X_0,K^F)$. Under the assumption that $\lambda^G \geq \lambda^F$, then we know that the first and second parts will both be greater than one under the same assumptions as in Proposition 1.2. As for the third part, it is a weighted average of one and $1-d$; for G, both the weight on one and the $1-d$ are larger, so it must be larger.

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Table I

Summary statistics

All statistics are based on monthly yield spreads of hard-currency denominated bonds over risk-free bonds of the same currency and same maturity. CORSPREAD refers to the corporate spread and GOVSPREAD refers to the government spread. Each corporate bond is matched to a single government bond in the same country. The sample is an unbalanced panel of 116 bonds from 95:1 to 98:9, representing 88 different firms.

	Number of bonds	CORSPREAD Mean	CORSPREAD SD	GOVSPREAD Mean	GOVSPREAD SD	Cor(C, S)
Total	116	4.272	6.561	2.689	1.492	0.716
By country						
South Africa	2	1.449	0.230	2.063	0.498	0.240
Argentina	30	3.995	3.997	3.431	2.228	0.571
Brazil	24	4.058	3.588	3.615	3.174	0.658
Mexico	25	4.274	5.135	2.694	1.442	0.366
Venezuela	2	2.274	4.466	3.372	3.993	0.342
Lebanon	1	1.958	0.858	1.937	0.460	0.388
Indonesia	6	5.545	5.210	4.127	3.156	0.587
Korea	7	2.899	2.688	2.852	2.495	0.753
Malaysia	2	2.680	3.020	1.846	1.851	0.743
Philippines	9	3.313	2.264	2.930	1.519	0.816
Thailand	1	6.301	2.112	4.174	1.806	0.909
Russia	5	18.725	29.811	11.917	15.690	0.808
Czech Rep.	1	0.783	0.241	0.968	0.412	0.368
Romania	1	4.384	2.761	3.921	4.171	0.777
By industry						
Banking & Fin.	54	4.708	9.012	3.742	4.961	0.749
Construction	8	3.931	3.176	2.700	1.405	0.458
Energy/Utility	5	4.114	3.741	3.098	2.229	0.705
Manufacturing	18	4.931	5.870	3.351	2.531	0.602
Oil & Gas	8	3.147	2.218	3.235	2.112	0.594
Telecom	10	3.307	2.138	3.437	2.234	0.837
Other	13	3.939	2.915	2.758	1.534	0.497
By time						
95:01 to 97:09	107	3.233	2.341	2.524	1.551	0.692
97:10 to 98:09	116	5.380	8.985	4.308	4.787	0.710

Table II

Distribution of bonds by region and industry

	East Asia		Latin America		Other		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Our sample								
Banking & Fin.	7	13	37	69	10	18	54	100
Manufacturing	8	44	10	56	0	0	18	100
Energy/ Utility	2	40	3	60	0	0	5	100
Oil & Gas	1	13	7	87	0	0	8	100
Telecoms	5	50	5	50	0	0	10	100
Construction	0	0	8	100	0	0	8	100
Other	2	15	11	85	0	0	13	100
Total	25	22	81	70	10	9	116	100.00
Euromoney data								
Sovereign	84	13	245	40	294	47	623	100
Public	86	56	15	10	53	34	154	100
Banking&Fin.	744	45	643	40	251	15	1638	100
Manufacturing	141	42	162	49	31	9	334	100
Energy/Utility	59	36	52	33	49	31	160	100
Oil & Gas	39	21	125	68	20	11	184	100
Telecoms	23	32	45	64	3	4	71	100
Construction	25	37	42	63	0	0	67	100
Other	116	49	110	47	9	4	235	100
Total	1317	38	1439	42	710	20	3466	100.00

Table III

Average Spreads of bond pairs with similar maturities

This table reports yield spreads of hard-currency denominated bonds over risk-free bonds of the same currency and same maturity. CORSP refers to the corporate spread and GOVSP refers to the government spread. Each corporate bond is matched to a single government bond in the same country. The 28 bonds here comprise all those in our sample for which the times to maturity of the corporate and sovereign bonds differ by less than 10%. The industries are: OG (Oil and Gas), BF (Banking and Finance), TC (Telecommunication), MN (Manufacturing), CN (Construction) & OT (Other). Diff refers to the difference in spreads (Corporate spread – sovereign Spread). * means that the two spreads are different at a 5% significance level.

		Country	Industry	Mean Corsp	Mean Govsp	Mean Diff	SE Diff	Maturity date_c	Maturity Date_s	Issue Amt Corp($m)	Issue Amt Govt($m)	Months of Observations
1	Astra – Compania Argentina de	Argentina	OG	2.65	2.76	-0.12	0.26	199912	199912	100	152	(9601-9809)
2	Banco Bansud SA	Argentina	BF	3.66	2.56	1.11	0.31	199911	199912	100	152	(9612-9809)
3	Banco Rio de la Plata SA	Argentina	BF	4.57	4.61	-0.04	0.14	200312	200312	250	1000	(9501-9809)
4	Bridas Corp	Argentina	OG	3.32	2.68	0.63	0.24	199911	199912	150	152	(9604-9809)
5	Compania Naviera Perez Companc	Argentina	OG	3.20	2.76	0.44	0.20	199909	199912	75	152	(9510-9707)
6	Invergas SA	Argentina	OG	3.88	3.22	0.65	0.38	199911	199912	100	152	(9502-9804)
7	Multicanal SA	Argentina	TC	4.52	3.95	0.57	0.28	200701	200609	125	1000	(9702-9809)
8	Perez Companc SA	Argentina	OG	2.84	3.19	-0.36*	0.20	200401	200312	300	1000	(9701-9809)
9	Perez Companc SA	Argentina	OG	3.14	4.31	-1.17*	0.18	200707	200609	400	1000	(9707-9809)
10	Sociedad Comercial del Plata	Argentina	MN	3.70	2.31	1.39	0.14	200005	200008	125	100	(9606-9712)
11	Telecom Argentina STET-France	Argentina	TC	3.32	3.62	-0.29*	0.10	200010	200008	500	100	(9501-9808)
12	Telefonica de Argentina SA	Argentina	TC	5.83	7.22	-1.38*	0.28	200411	200312	300	1000	(9501-9601)
13	Telefonica de Argentina SA	Argentina	TC	3.55	3.75	-0.20	0.14	200010	200008	300	100	(9501-9809)
14	Banco Real SA	Brazil	BF	3.81	2.71	1.10	0.44	200107	200110	75	750	(9707-9805)
15	Daewoo Corp	Korea	MN	1.06	0.51	0.55	0.07	199909	199907	132	300	(9701-9709)
16	Korea Telecom	Korea	TC	0.59	1.43	-0.84*	0.48	199912	200001	100	500	(9604-9804)
17	Pohang Iron & Steel Co Ltd	Korea	MN	2.97	2.77	0.19	0.17	200307	200311	200	500	(9611-9809)
18	Pohang Iron & Steel Co Ltd	Korea	MN	3.02	3.11	-0.09	0.21	200610	200605	300	750	(9703-9809)
19	Pohang Iron & Steel Co Ltd	Korea	MN	2.84	2.40	0.43	0.48	200505	200512	250	200	(9706-9807)
20	Samsung Electronics Co Ltd	Korea	MN	3.38	3.47	-0.09	0.28	200111	200202	200	500	(9703-9809)
21	Yukong Ltd	Korea	OG	4.28	4.05	0.23	0.84	200011	200012	100	300	(9710-9809)
22	Cemex SA de CV	Mexico	CN	4.31	3.14	1.17	0.49	200607	200701	300	1000	(9707-9809)
23	Empresas ICA Sociedad Controla	Mexico	CN	3.38	2.25	1.14	0.13	200105	200102	150	1000	(9606-9806)
24	Gruma SA de CV	Mexico	OT	2.49	4.27	-1.78*	0.63	200709	200803	250	1000	(9803-9809)
25	Grupo Elektra SA de CV	Mexico	OT	4.32	2.52	1.80	0.20	200105	200102	100	1000	(9605-9808)
26	Grupo Tribasa SA de CV	Mexico	CN	9.74	2.77	6.97	0.48	200012	200102	100	1000	(9602-9809)
27	Transportacion Maritima Mexica	Mexico	OT	3.28	2.71	0.57	0.08	200010	200102	150	1000	(9602-9708)
28	Transportacion Maritima Mexica	Mexico	OT	4.73	3.14	1.59	0.49	200611	200701	200	1000	(9707-9809)

Table IV

Basic country risk specification, and for different industries

Estimates are based on monthly yield spreads of hard-currency-denominated bonds over risk-free bonds of the same currency and same maturity. The data set is an unbalanced panel of 116 bonds issued by 88 firms, from 1995:1 to 1998:9.

The regression form used is

$$\Delta \mathbf{COR_{it}} = \beta_0 \Delta \mathbf{GOV_{it}} + \gamma' \mathbf{D_i} \Delta \mathbf{GOV_{it}} + \varphi \Delta \mathbf{Z_t} + \mathbf{e_{it}}$$

where ΔCOR_{it} refers to the change in the spread of firm i's bond in period t and ΔGOV_{it} refers to change in government spread for firm i's home country. D_i is a vector of dummy variables representing industry or regional characteristics. ΔZ_t is a term that allows for a time-varying yield curve as described in the text. For all regressions D_i includes two regional dummies representing East Asia and the "rest of the world" (Latin America is excluded); the coefficients for these terms are γ(EA) and γ(ROW), respectively. Column (a) presents the basic regression results. Column (b) reports the same regression for a sub-sample of the data including only corporate bonds with an issue size greater than 100 million U.S. dollars. For the regression in column (c), D_i includes the regional effects and industry effects for six industry groups (firms in industries classified "other" are omitted). Column (d) reports the results including only the bank interaction term, as well as the regional dummies. Observations are weighted so that each firm receives a weight of 1 in each period; if a firm has n bonds, the weight for each bond is 1/n. Robust standard errors reported.

	(a)	(b)	(c)	(d)
β_0	0.455	0.536	0.064	0.446
SE	(0.074)	(0.084)	(0.197)	(0.086)
γ(Bank)			0.395	0.015
SE			(0.219)	(0.127)
γ(Telecom)			0.354	
SE			(0.216)	
γ(Construction)			0.474	
SE			(0.252)	
γ(Energy)			0.972	
SE			(0.399)	
γ(Manufacturing)			0.474	
SE			(0.274)	
γ(Oil & Gas)			0.278	
SE			(0.225)	
γ(EA)	-0.099	-0.174	-0.136	-0.094
SE	(0.136)	(0.149)	(0.137)	(0.132)
γ(ROW)	0.801	0.966	0.797	0.796
SE	(0.270)	(0.313)	(0.280)	(0.280)
Rsq.	0.352	0.456	0.358	0.352
DF	2566	1936	2560	2565

Table V

Post Asian Crisis dummies & Bank-Crisis interaction

Estimates are based on monthly yield spreads of hard-currency denominated bonds over risk-free bonds of the same currency and same maturity. The data set is an unbalanced panel of 116 bonds issued by 88 firms, from 1995:1 to 1998:9. The regression form used is

$$\Delta COR_{it}=\beta_0\Delta GOV_{it}+\gamma' D_{it}\Delta GOV_{it}+\varphi\Delta Z_t+e_{it}$$

where ΔCOR_{it} refers to the change in spread of the corporate bond and ΔGOV_{it} refers to change in government spread for the corporation's home country. D_{it} is a vector of dummy variables associated with the firm's geographic region, the time period (before or after the Asian crisis), or the industry (bank or non-bank). ΔZ_t is a term that allows for a time-varying yield curve as described in the text. For all regressions D_{it} includes two regional dummies representing East Asia and the "rest of the world" (Latin America is excluded); the coefficients for these terms are γ(EA) and γ(ROW), respectively. Column (a) reports the results of the regression where D_{it} includes a dummy equal to one for observations in or after October 1997. Column (b) reports the results of the regression where D_{it} includes the crisis dummy, a bank dummy, and an interaction between the bank and crisis dummies. Column (c) reports results of the regression where D_{it} includes the crisis dummy and the crisis dummy interacted with the regional dummies. Observations are weighted so that each firm receives a weight of 1 in each period; if a firm has n bonds, the weight for each bond is 1/n. Robust standard errors reported.

	(a)	(b)	(c)
β_o	0.550	0.620	0.455
SE	(0.067)	(0.090)	(0.074)
γ(Crisis)	-0.097	-0.183	
SE	(0.098)	(0.126)	
γ(Bank)		-0.277	
SE		(0.152)	
γ(Bank*Crisis)		0.303	
SE		(0.199)	
γ(EA*Crisis)			0.060
SE			(0.179)
γ(ROW*Crisis)			0.731
SE			(0.298)
γ(EA)	-0.098	-0.088	-0.158
SE	(0.137)	(0.133)	(0.154)
γ(ROW)	0.804	0.794	0.071
SE	(0.270)	(0.280)	(0.161)
Rsq.	0.352	0.353	0.352
DF	2565	2563	2564

Figure 1: Effect of a change in the state variable from X to X’

Before:	After	Hence,
Prob(Govt Default) =B	Prob(Govt Default)=A+B	Increase in Prob(Firm Default) = A+D
Prob(Firm Default) = B+E	Prob(Firm Default)=A+B+E+D	Increase in Prob(Govt Default) = A