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# THE COST OF CORPORATE BOND FINANCING IN LATIN AMERICA.

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**The Cost of Corporate Bond Financing in Latin America**

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Abstract

Applying an extended version of the structural approach to pricing risky corporate debt, we look into the evolution and determinants of the cost of bond financing for Latin American firms. We use a dataset including 667 quarterly panel observations of Argentinean, Brazilian, Chilean and Mexican firms, with market and balance-sheet information in order to account for the cross-sectional and time series variations in the yield spreads of 72 US dollar-denominated corporate bonds issued by 22 different publicly traded (listed) firms. Resorting to panel econometric techniques, we test the economic and statistical significance of the determinants of corporate bond spreads, namely sovereign default risk, liquidity, leverage, firm-value volatility and risk-free interest rate volatility and the interaction between the latter two and leverage. In addition, when sovereign spreads come out as a statistically and economically significant determinant of corporate spreads, we test whether market participants apply the sovereign ceiling rule to the prices and yield spreads of those firms' bonds, as rating agencies do under a number of circumstances and conditions.

**JEL codes**: F34, G0, G3.
**Keywords**: Emerging Bond Markets, Latin America, Structural models, Corporate bond yields, Corporate bond spreads, Sovereign Ceiling.

## 1. Introduction

Bond finance is becoming a more prominent source of funding for corporations in emerging and developing countries seeking out new investment opportunities, the expansion of their production capacity, and looking to meet the increasing demand for bond securities worldwide; a demand driven by ample liquidity and the search for higher yields as long-term real interest rates in developed economies have flattened (IMF Global Financial Stability Reports [2005 and 2006],).

In this paper we aim to answer the following questions: 1) what are the determinants of Latin American corporate bond spreads[1], namely the part of the firm's cost of debt attributable to default risk?, 2) is sovereign default risk (i.e., sovereign spreads) an economically relevant and statistically significant factor to account for the cross-country and time-series variation in the corporate spreads of the firms we sample?, 3) if yes, do bond market participants apply the sovereign ceiling rule to Latin American firms' bonds? How does it compare to rating agencies' ceiling policy?

There is a wealth of literature on the determinants of corporate bond spreads in mature markets. For a survey of this literature we refer the reader to Elton et al [2001], Cossin and Pirotte [2001] or Grandes and Peter [2005]. However, the question of what determines emerging markets corporate spreads, including the role of sovereign spreads as a major explanatory variable and the test for the sovereign ceiling hypothesis, has only been recently investigated. To the best of our knowledge, Durbin and Ng [1999 and 2001], Grandes and Peter [2005], and Cavallo and Valenzuela [2006] are the only contributions to this literature. A related strand of the literature on emerging market corporate creditworthiness (Ferri et al [2002] or Borensztein et al [2006]) has researched the determinants of corporate ratings instead of looking at market prices and yield spreads.

Durbin and Ng [1999 and 2001] study the relationship between secondary market spreads of foreign currency bonds issued by emerging market firms and by their countries. They span 108 bonds issued by 85 firms in 14 countries, including Latin American, Asian and Eastern Europe over the period of 1995-2000. Durbin and Ng find that market participants do not fully apply the sovereign ceiling, in contrast to the policy followed at the time by the rating agencies, in particular Standard & Poor´s. The limitation of their study is that they can only evaluate the proposition that "firms are always riskier than governments" and not the origin of risk transferred from the government to the firm. Moreover, they do not control for firm-idiosyncratic determinants or global push factors such as risk aversion, liquidity or stock market volatility which could drive both corporate and sovereign spreads if omitted in the relevant econometric model.

Grandes and Peter [2005] study the importance of sovereign risk in explaining corporate spreads using a sample of 9 domestic currency bonds issued by 9 large South African firms in 2000-2003. They control for firm-specific variables derived from the structural approach (see Black and

[1] This paper will use interchangeably the terms "corporate bond spreads", "(corporate) credit risk", "credit yield spreads" and "corporate default risk premium".

Scholes [1973], Merton [1974], Shimko, Tejima, and Van Deventer [1993] or Longstaff and Schwartz [1995] among others), yet they find that sovereign risk is the most significant and economically relevant variable to account for corporate spreads on South African local currency bonds. Furthermore, Grandes and Peter [2005] find that the sovereign ceiling applies to banks and not to firms in other sectors such as oil and gas or mining. Notwithstanding this latter finding, the authors don´t include international foreign currency bonds issued by the same firms wherever possible, and limit their study to a short sample without offering additional evidence on other emerging market corporations having recently issued local currency bonds domestically and globally.[2]

Cavallo and Valenzuela [2006] estimate the determinants of corporate bond spreads for 139 firms in 10 emerging market economies, 6 from Latin America and 4 from East Asia. Using quarterly data of Option-adjusted spreads (OAS) extracted from Bloomberg in the period that runs from June 1999 to June 2006, they find that corporate bond spreads are mainly determined by firm-specific variables (i.e., profitability, equity volatility, etc), bond characteristics (time to maturity), and to a lesser extent by sovereign risk and global factors (e.g, US "junk" bonds yield spreads, Treasury yields). Cavallo and Valenzuela also confirm the sovereign lite theory [Borensztein et al 2006] which argues that there should be an asymmetric impact of sovereign spreads on corporate default risk when spreads go up compared to when they decrease (positive correlation on the upside, but no correlation or negative correlation on the downside). A shortcoming of their contribution is that they fail to control for the term structure of sovereign risk. They use the EMBI+ indicator of sovereign risk across all firms/bonds in a given country at a given time instead of matching corporate bonds with sovereign bonds according to their maturity or duration, or even their coupon structure. Besides this, the authors do not test for the sovereign ceiling hypothesis *a la* Durbin and Ng [1999 and 2001] or Grandes and Peter [2005] and don´t use the structural approach to derive the determinants of corporate default risk.

In related literature, Ferri et al. [2002] evaluate the sensitivity of corporate rating changes to sovereign ones. They find the pass-through to be greater in low-income countries and particularly for downgrades. However, it cannot be ruled out that this high sensitivity observed in emerging markets is because company risk may be more procyclical on account of less-diversified economies, typical in poor countries. Borensztein et al [2006] also examine the link between corporate and sovereign ratings in foreign currency. In addition to emerging market borrowers, they include advanced economies issuers over the past decade and conclude that the sovereign risk effect is pervasive. First, they find that the sovereign ceiling effect is statistically highly significant and robust, as well as financially substantial. Second, this result is robust to controlling for the macroeconomic conditions in the country and indicators of the financial strength of the companies and banks. Third, this relation is non-linear and asymmetric. Fourth and lastly, the impact of sovereign ratings is larger on banks than on corporations.

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[2] In a later unpublished version of their paper, Grandes and Peter [2006] are able to prove the robustness of their findings to the inclusion of global factors, namely the UST 10-year bond yield, the CBOE VIX measure of risk aversion and the volatility of global (MSCI) equity.

Taking Latin American firms as a case study, we intend to make a contribution to the literature on the determinants of corporate bond spreads and the corporate cost of debt in emerging markets. This contribution is manifold: a) to the best of our knowledge we are the firsts to apply the structural approach to Latin American bonds, b) we use a new panel of 22 firms and 72 global dollar-denominated bonds –most of them issued by industrial firms- over 1996-2004, c) we control for firm-diosyncratic risk attributes consistent with the predictions of the structural approach to pricing risky debt securities, d) we estimate an unbalanced panel model to quantify the statistical and economic significance of these attributes and sovereign spreads, e) we display a number of alternative estimators for the sake of robustness, and f) based on a theoretical result obtained by Durbin and Ng [2001], we introduce an adjusted test for the sovereign ceiling hypothesis and compare our results to previous findings in the literature which build on an "unadjusted (unconditional)" version of that test (i.e. Durbin and Ng [2001], Grandes and Peter [2005]).

The remainder of this paper is organized as follows. Section 2 sets out the theoretical framework. Section 3 describes our panel data features and explains how we compute spreads, namely the dependent variable (Latin American corporate bond spreads) and one of its determinants, the sovereign bond spreads. It also operationalizes the other determinants of corporate bond spreads derived from the structural model set forth in Section 2. Section 4 presents the descriptive statistics of our data set, and displays and discusses the results of the panel econometric regressions. Finally, Section 5 concludes.2.Theoretical framework

As the theoretical framework for our investigation, we adopt the simplest version of the structural approach to pricing defaultable fixed income assets (i.e., corporate bonds)[3]. This ***structural approach*** is based on Black and Scholes [1973] and Merton [1974].[4] It relies on the balance sheet of the borrower and the bankruptcy code to endogenously derive the probability of default and the corporate credit spread, based on no-arbitrage arguments and making some additional assumptions on the recovery rate and the process of risk-free interest rates.
The determinants of corporate default risk are derived in four steps. In the first step, we recapitulate briefly the Merton [1974] model of risky debt valuation. In the second step, Merton's assumption of a constant risk-free interest rate is relaxed and stochastic (risk-free) interest rates *à la* Shimko, Tejima, and Van Deventer [1993] are introduced. In the third step, we relax the assumption that government bonds are risk-free, that is, we allow for sovereign (credit) risk; we introduce the sovereign default premium as an additional, emerging-market specific determinant of

[3] Other theoretical frameworks are 1) the classical or actuarial (for a survey of these methods, see for instance Caouette, Altman, and Narayanan [1998]), and 2) reduced-form, statistical or intensity-based approach. Readers interested in *reduced-form* models are referred to the works of Pye [1974], Litterman and Iben [1991], Fons [1994], Das and Tufano [1996], Jarrow and Turnbull [1995], Jarrow, Lando, and Turnbull [1997], Lando [1998], Madan and Unal [1998], Duffie and Singleton [1999], Collin-Dufresne and Solnik [2001] and Duffie and Lando [2001], most of which are surveyed and nicely put into a broader context by Cossin and Pirotte [2001], and Bielecki and Rutkowski [2002]. We choose the structural approach like Grandes and Peter [2005] because the classical approach is both too subjective and too backward looking and the reduced-form approach is atheoretical with respect to the determinants of default risk.
[4] Other important contributions to this approach include Shimko, Tejima, and Van Deventer [1993], Longstaff and Schwartz [1995], Saá-Requejo and Santa Clara [1997], Briys and De Varenne [1997], and Hsu, Saá-Requejo, and Santa Clara [2003].

corporate default risk. In the fourth step, we briefly consider some potential further determinants that result once the frictionless market assumption is relaxed or specific bond indenture provisions are taken into account, in particular liquidity. A final subsection synthesizes and summarizes the determinants identified.

## 2-1 Starting Point: The Merton [1974] Model

Merton [1974] applies the option pricing theory developed by Black and Scholes [1973] to the pricing of corporate debt (the so-called "contingent claims analysis"). Merton's model hinges on a number of critical assumptions. They are: (i) competitive and frictionless markets; (ii) constant risk-free interest rates (i.e., flat term structure of interest rates); (iii) the firm holds a single type of liability: a non-callable zero-coupon bond; (iv) the value of the firm follows a geometric Brownian motion process;[5] (v) firm management acts to maximize shareholder ealth; (vi) there is perfect antidilution[6] and bankruptcy protection;[7] and (vii) the Modigliani-Miller theorem holds (i.e., the firm's value is independent of its capital structure).

In this highly simplified model, the corporate default risk premium of the firm's bond, $corpspread_t$ or $s$, is a function of only three variables: (i) the volatility of the returns on the firm value $\sigma_V$ (or simply firm-value volatility), (ii) the quasi-debt ratio $d$ (a form of leverage ratio),[8] and (iii) the remaining time to maturity of the bond $\tau$ (*M-t*, where M is the bond's redemption date and t the days out to maturity, expressed in terms of years), i.e.,

$$corpspread_t = s_t = f(d, \sigma_V, \tau) \qquad (1)$$

where $s_t \equiv y_t - r$ with $y_t$ being the yield to maturity of the risky zero-coupon bond and $r$ the (constant) risk-free interest rate.

5 $dV_t / V_t = \mu dt + \sigma_V dZ_{1,t}$, where μ is the instantaneous expected rate of return on the firm value, $\sigma_V^2$ is the instantaneous variance of the return on the firm value V per unit of time (henceforth called "asset return volatility" or simply "firm-value volatility") , and $dZ_{1,t} = \varepsilon_1 \sqrt{dt}$ is a standard Gauss-Wiener process.

6 There are neither cash flow payouts, nor issues of any new type of security during the life of the bond, nor bankruptcy costs. This implies that default can only occur at maturity if the firm cannot meet the repayment of the face value of the bond.

7 Firms cannot file for bankruptcy except when they are unable to make the required cash payments. In this case, the absolute priority rule cannot be violated: shareholders obtain a positive payoff only if the debt holders are fully reimbursed.

8 The quasi-debt ratio is the ratio of the present value (discounted at the risk-free rate, hence "quasi") of the bond over the current value of the firm.

Merton [1974] shows that $\partial s/\partial\sigma_V^2 > 0$, $\partial s/\partial d > 0$, and $\partial s/\partial\tau <> 0$, that is, the corporate default spread, is an increasing function of firm-value volatility and leverage, which seems intuitive; however, it can be an increasing or decreasing function of remaining time to maturity, depending on leverage. The Merton model thus produces the classical hump shaped "term structure of credit spreads" – a non-intuitive result but a fact often found in actual data.[9] This term structure of credit risk spreads is downward sloping for high-leveraged firms (i.e., $d > 1$)[10], hump-shaped for medium-leveraged firms, and upward sloping for low-leveraged firms ($d < 1$). In other words, for firms with a leverage ratio $d > 1$, an increase in time to maturity $\tau$ will lead to a declining default premium ($\partial s/\partial\tau < 0$); for intermediate leverage ratios ($d$ between around 0.7 and 1), the credit spread first rises and then falls as maturity increases; for low leverage ratios ($d$ below about 0.7), the default premium increases with longer time to maturity. Before discussing the economic intuitiveness of $\partial s/\partial\sigma_V^2 > 0$ and $\partial s/\partial d > 0$, we extend the Merton model by introducing interest rate risk.

## 2-2 Adding Stochastic Interest Rates: The Shimko et al. [1993] Model

Shimko, Tejima, and Van Deventer [1993] proposed to extend the Merton model by relaxing the assumption of constant risk-free interest rates, letting interest rates be stochastic instead. They achieve this extension by integrating the Vasicek [1977] term-structure-of-interest-rates model into the Merton [1974] framework, thereby integrating interest rate risk into the pricing of credit risk.
The fundamental result of the model by Shimko, Tejima, and Van Deventer [1993] is that once (risk-free) interest rates are allowed to be stochastic, interest rate volatility $\sigma_r$ becomes an additional determinant of the corporate default premium $s$. They also confirm the importance of the three determinants found by Merton [1974], firm leverage $d$, firm-value volatility $\sigma_V$, and remaining time to maturity of the bond $\tau$. Strictly speaking, the corporate yield spread $s$ is also a function of the correlation $\rho$ between the stochastic factor of the firm-value process $V$ and the stochastic factor of the interest rate process $r$, and of $\alpha$, the speed of convergence of the risk-free rate $r$ to its long-run mean $\gamma$.[11] For the present empirical investigation, however, these two parameters are assumed to be constant over the sample period.

9 Merton [1974], p. 456; see also Sarig and Warga [1989b], p. 1356.
10 A firm with d >1 is technically insolvent.
11 Shimko et al. [1993] assume that the short-term risk-free interest rates follows a stationary Ornstein-Uhlenbeck process of the form $dr = \alpha(\gamma - r)dt + \sigma_r dZ_{2,t}$ ,where $\gamma$ is the long-run mean which the short-term interest rate r is reverting to, $\alpha > 0$ is the speed at which this convergence occurs, $\sigma_r$ is the instantaneous variance (volatility) of the

In summary, Shimko, Tejima, and Van Deventer [1993] find that the corporate default premium $corpspread_t$ or $s$ is essentially a function of four determinants: (i) firm leverage (measured by the quasi-debt ratio $d$); (ii) firm-value volatility $\sigma_V$; (iii) remaining time to maturity of the bond $\tau$; and (iv) interest rate volatility $\sigma_r$,

$$corpspread_t = s_t = f(d, \sigma_V, \tau, \sigma_r). \qquad (2)$$

What is the impact on the corporate credit spread $s$ of changes in these four determinants? Apart from identifying an additional determinant ($\sigma_r$), the major difference of the model by Shimko *et al.* compared to that by Merton is that the nonlinear impact of these determinants on the spread are more complex. One can show that the spread $s$ is a positive function of firm leverage $d$ and firm-value volatility $\sigma_V$, but can be either an increasing or decreasing function of interest rate volatility $\sigma_r$ and remaining time to maturity $\tau$, depending on the size of $\alpha$ (the speed of convergence of the risk-free rate $r$ to its long-run mean $\gamma$), $\rho$, (the correlation between shocks to the firm-value returns and risk-free interest rate shocks), $\tau$, $\sigma_r$, $\sigma_V$, and $d$.[12] The economic intuition of these effects is as follows:

- ***Firm leverage:*** The higher a firm's debt in relation to the value of its assets ($d$), other things equal, the lower its net worth and, hence, the closer it is to default (i.e., bankruptcy) at any given moment in time. To be compensated against the higher probability of default (and, hence, expected loss), investors will ask a higher default premium (i.e., spread).

- ***Firm-value volatility:*** The higher the day-to-day fluctuations in the value of the firm's assets ($\sigma_V$), other things equal, the higher the probability that—purely by chance—the asset value is smaller than the value of the debt on the day the debt is due, that is, that the firm defaults. To be compensated against the resulting higher default probability and expected loss, investors will ask for a higher spread.

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interest rate, and $dZ_{2,t} = \varepsilon_2 \sqrt{dt}$ is a second standard Gauss-Wiener process, whose correlation with the stochastic firm value factor, $dZ_{1,t}$, is equal to $\rho$, i.e., $dZ_{1,t} \cdot dZ_{2,t} = \rho\, dt$.

[12] Shimko, Tejima, and Van Deventer [1993] determine the signs of $\partial s/\partial d$, $\partial s/\partial \sigma_V$, $\partial s/\partial \tau$, and $\partial s/\partial \sigma_r$ through simulations.

- ***Interest rate volatility:*** The corporate spread can be an increasing or decreasing function of interest rate volatility $\sigma_r$, depending on the firm's leverage $d$, its asset volatility $\sigma_V$, the correlation between asset return shocks and interest rate shocks $\rho$, and the term structure of interest rates. However, Shimko, Tejima, and Van Deventer [1993] note that "the credit spread is an increasing function of [interest rate volatility] for reasonable parameter values."[13] Grandes and Peter [2005] first estimate the parameter values of $\alpha$ and $\rho$ implied by their sample. Then, they simulate the impact of changes in $\sigma_r$ on s for various combinations of sample values for d , $\sigma_v$ , and □. The simulations show that for all combinations of sample values for d, $\sigma_v$ and □ , the corporate spread either stays constant (for small d, $\sigma_v$ or □) or increases as interest rate volatility rises (i.e., $\partial s/\sigma_r \geq 0$ ). Moreover, the stronger the impact of $\sigma_r$ on s the higher leverage is. To control for this dependence, we will also include the interaction term $\sigma_r d$ in the (linearized) estimated equation in Section 3.2. We expect its coefficient to be positive.

- ***Time to maturity:*** The corporate default spread can also be an increasing or decreasing function of remaining time to maturity $\tau$, depending on the same parameters as the impact of changes in interest rate volatility. More precisely, the Shimko *et al.* model produces a term structure of credit spreads that is similar to the one obtained in the Merton model, except that now it is not only the result of the dependence on leverage $d$ but also $\sigma_V$: For small values of $d$ or $\sigma_V$, the spread increases when time to maturity $\tau$ lengthens; for intermediate values of $d$ or $\sigma_V$, the spread first increases sharply, then reaches a maximum and finally declines gradually as $\tau$ increases; for high $d$ or $\sigma_V$, the spread declines as maturity increases. The economic intuition behind this theoretical result is as follows: If there is only a short time to go before maturity and leverage or firm-value volatility is high, the risk of default (and, hence, the spread) is high; the more time there is to go before maturity, the more opportunities the firm will have, with the same leverage (or asset return volatility), to increase earnings and reduce leverage and, hence, the lower its default risk and spread will be. Grandes and Peter [2005] prove through simulations that, at the mean sample values of values of $d$, $\sigma_r$, and $\sigma_V$, there is a strong dependence of $\partial s/\partial$□ on leverage d. To control for this dependence in the simplest possible way, we will also include the interaction term $\tau d$ in the linearized estimating equation, along with time to maturity $\tau$. We expect the coefficient of maturity alone to be positive because our average leverage values are relatively low (0,11, see Exhibit 3) and the one of the interaction term to be negative. Hence the net (conditional) impact is expected to be ambiguous.

2-3 Adding Sovereign Risk

[13] Shimko, Tejima, and Van Deventer (1993), p. 59.

The main argument in this paper to add sovereign risk as an explanatory variable is that in an emerging market context, sovereign (default or credit) risk has to be factored into the corporate default premium equation as an additional determinant. All structural models of corporate credit risk pricing implicitly assume that government bonds are risk-free, i.e., that sovereign risk is absent. As these models are implicitly placed in a context of an AAA-rated country (typically the US or the European Union), this assumption seems justified. In analyzing emerging bond markets, however, the "zero-sovereign-risk" assumption has to be relaxed. In the international rating business, the importance of sovereign default risk for the pricing of all corporate obligations has given rise to the concept of the "sovereign ceiling," the rule that the rating of a corporate debt obligation (in foreign- but also domestic-currency terms (see Grandes and Peter [2005]) can usually be at most as high as the rating of government obligations.

What is the economic rationale for sovereign risk to be a determinant of corporate default risk **in foreign-currency terms**? Empirically, there has been a high correlation between sovereign defaults and company defaults. That is, it has been very difficult for companies to avoid default once the sovereign of their jurisdiction has defaulted. This historical regularity has been used by all major rating agencies to justify their country or sovereign ceiling policy, which usually means that the debt of a company in a given country cannot be rated higher than the debt of its government. The economic rationale behind the sovereign rating ceiling for foreign-currency debt obligations is direct sovereign intervention risk, also called transfer risk. The term transfer risk (or direct sovereign intervention risk) is usually only used in a foreign-currency context (recall that this paper studies Latin American dollar-denominated bonds). It refers to the probability that a government with (foreign) debt servicing difficulties will impose foreign exchange payment restrictions (e.g., debt payment moratoria) on otherwise solvent companies and/or individuals in its jurisdiction, forcing them to default on their own foreign-currency obligations.

Until 2001, the "big three" main rating agencies, Moody's Investors Service, Standard & Poor's, and Fitch Ratings –these latter two de facto-, followed their country or sovereign ceiling policy more or less strictly.[14] They amended it, however, under increasing pressure from capital markets after the (ex post) zero-transfer-risk experience in Russia (1998), Pakistan (1998), Ecuador (1999), and Ukraine (2000) (see Moody's Investors Service [2001b], Standard & Poor's [2001], Fitch Ratings [2001] or more recently Moody's [2006]). Moody's—the last among the big three to abandon the strict sovereign ceiling rule—justified the policy shift as follows: "This shift in our analytic approach is a response to recent experience with respect to transfer risk /in Ecuador, Pakistan, Russia, and Ukraine). Over the past few years, the behavior of governments in default suggested that they may now have good reasons to allow foreign currency payments on some favored classes of obligors or obligations, especially if an entity's default would inflict substantial damage on the country's economy."[15]

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14 Standard & Poor´s in 1997 allowed some emerging market firms to pierce the foreign currency long term rating ceiling under very strict conditions. Among these firms, some were from Latin America. See Standard & Poors [1997].

15 See Moody's Investors Service [2001a, p.1].

Under specific and very strict conditions, rating agencies now allow firms to obtain a higher rating than the sovereign of their incorporation (or location). The conditions for "piercing" the sovereign foreign-currency rating are stricter than for the sovereign local-currency rating [Moody's 2006]. Bank ratings are almost never allowed to exceed the sovereign ceiling (in both foreign and domestic currency terms) because their fate tends to be closely tied to that of the government. As a result, the default risk of any firm is likely to be a positive function of sovereign risk. An interesting observation in this context is that Elton *et al.* [2001] find that—even in the U.S.—corporate default premia incorporate a significant risk premium because a large part of the risk in corporate bonds is systematic rather than diversifiable. One could argue, following Grandes and Peter [2005], that in emerging markets a major source of systematic risk is sovereign risk, as measured by the yield spread of government bonds over comparable risk-free rates (i.e., the sovereign default premium).

From our sample of Latin American firms, we observe a significant number of times when corporate issuers pierce the sovereign ceiling (Exhibit 13), i.e., they are rated higher than their sovereign of incorporation. These are: YPF SA (Argentina) in 1997-2004, Braskem (Brazil) from June 2003 until November 2003, Telenorte (Brazil) over the same period, Unibanco (Brazil) over the same period, and surprinsingly as it is a bank, Televisa Group (Mexico) from June 2004 until January 2005, Kimberley Clark (Mexico) from July 1999 until November 2005, America Movil (Mexico) from August 2002 until January 2005, Coca Cola Femsa (Mexico) from October 1996 to date, and CEMEX (Mexico) from November 1997 until January 2005. We would like to test whether these examples are consistent with the market views of the application of the sovereign ceiling in the corporate bond spreads.

To test whether the sovereign ceiling applies in our dollar-denominated corporate spreads data, we resort to a result obtained by Durbin and Ng [2001]. In a simple theoretical model similar to the framework used in this section, Durbin and Ng [2001] show that a 100 percent transfer risk implies that a one-percent increase in the government spread should be associated with an increase in the firm spread of at least one percent. In other words, in a regression of corporate spread changes on corresponding sovereign spread changes, 100 percent transfer risk implies that the beta-coefficient (point estimate associated with sovereign spreads) should be greater than or equal to one. In the logic of their model, the size of this estimated coefficient can be interpreted as the market's appreciation of transfer risk: a coefficient that is larger than one would imply that the market prices in transfer risk of 100 percent (i.e., whenever the government defaults, the prevailing economic conditions force the firms into default as well); a coefficient statistically smaller than one would imply that the market judges transfer risk to be less than 100 percent.

In light of these considerations, we will add the sovereign default premium, or sovereign spread, $sovspread_t$ to our estimating equation. $sovspread_t$ is defined as $s^{sov} = sovspread_t = y_t^{sov} - R_t$, with $y_t^{sov}$ the yield to maturity on the (risky) government discount bond and $R_t$ the yield to maturity on the risk-free discount bond with the same maturity. In Section 4, we will first test whether the sovereign spread can be considered as an additional determinant of corporate credit spreads. We would expect the associated coefficient ($\partial s / \partial s^{sov}$) to be positive, as increasing sovereign risk should be associated with higher corporate risk as well. Then, if the sovereign spread turns out to be a significant explanatory factor for corporate spreads, the size of the coefficient $\partial s / \partial s^{sov}$ will be a test of whether the sovereign ceiling applies or not: If $\partial s / \partial s^{sov} \geq 1$, the sovereign ceiling in spreads applies; $\partial s / \partial s^{sov} < 1$, the sovereign ceiling does not apply. In Section 4.2 we will present two tests of the sovereign ceiling hypothesis, one similar to the one performed by Durbin and Ng [2001] or Grandes and Peter [2005], and the other a conditional test which improves the accuracy of the results and hence avoids potential biases in the conclusions about the transferability of sovereign default risk to corporate default risk, namely transfer risk.

## 2-4 Other Potential Determinants

Once the assumption of frictionless markets is relaxed and/or particular bond indenture provisions are allowed, other determinants of the corporate default premium have to be taken into account. These include differential taxation of corporate and risk-free bonds, differences in liquidity of corporate and risk-free bonds, business cycle (macroeconomic) conditions, temporary demand for, and supply of, bond imbalances, and specific bond indenture provisions, such as when call options are embedded in corporate bonds or there is a presence of a sinking fund provision.[16]

Among all these factors, only potential differences in liquidity are controlled for explicitly in the present study. Liquidity refers to the ease with which a bond (issue) can be sold without a significant price discount. One might expect the risk-free bond issues to be larger and thus more liquid than the corporate issues, such that the liquidity premium on corporate bonds will be larger than the one on comparable risk-free bonds. As a result, we would expect that the higher the liquidity, $l$, of a given corporate bond relative to that of a comparable risk-free bond, the lower the corporate spread would be. Thus, we expect $\partial s / \partial l$ to be negative.

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[16] These factors are dealt with in the literature on corporate default risk in mature markets, in particular the US corporate bond market. See for instance Athanassakos, George and Peter Carayannopoulos [2001].

With the exception of short-run supply and demand imbalance and taxation differences, which have to be omitted for lack of appropriate data, all other factors are implicitly controlled for: macroeconomic conditions will be controlled for insofar as they are reflected in sovereign spreads; embedded call (and other) options are avoided by construction, as well currency or jurisdiction differences because we work with dollar bonds issued globally (e.g. under the New York or London jurisdiction).

## 2-5 Synthesis

According to the theoretical framework laid out in this section, the corporate default premium is a function of (i) sovereign risk, (ii) leverage, (iii) firm-value volatility, (iv) interest rate volatility, (v) remaining time to maturity, and (vi) liquidity, that is,

$$Corpspread_{\mathrm{t}} = s = f(\overset{+}{s_t^{sov}}, \overset{+}{d}, \overset{+}{\sigma_V}, \overset{+/-}{\sigma_r}, \overset{+/-}{\tau}, \overset{-}{l}). \qquad (3)$$

The plus- or minus-signs on top of each of the right-hand-side variables indicates how each of these determinants is expected to influence the corporate default premium (or spread) according to the theory.

In Section 4.2, we estimate a linearized version of Equation (3). As mentioned in Section 2.2, motivated by the results of the Merton and Shimko *et al.* models, we will also consider the interaction between two variables: One between interest rate volatility and leverage ($\sigma_r d$), the other between maturity and leverage ($\tau d$). These will help us to unambiguously determine the expected signs of the coefficients involving $\sigma_r$ and $\tau$: We expect the coefficient of $\sigma_r d$ to be positive, as the impact of interest rate volatility on spreads appears to be increasing with leverage; the coefficient of $\sigma_r$ alone could be positive or insignificant because the spread (and hence the influence of any determinant) vanishes as leverage tends toward zero. The coefficient of $\tau d$, on the other hand, is expected to be negative, along with a positive coefficient for maturity $\tau$ alone because the spread increases with maturity when leverage is small, whereas it declines with maturity when leverage is high[17].

# 3- Data and econometric framework

## 3-1 Data set, variable operationalization and measurement issues

Matching bond market data extracted from Thomson Financial Datastream with balance-sheet data from Economatica we obtain an unbalanced panel of 667 quarterly observations for the period 1996-2004 containing information on corporate spreads, sovereign spreads, liquidity, leverage,

[17] See Section 2.2

time to maturity, firm-value volatility and risk-free interest rate volatility. The actual sample period is constrained by the intersection between the two datasets and other qualitative considerations: only those corporate bonds issued by firms with reliable balance sheet information were kept in the sample. This implies an important restriction on the number of available corporate bonds. The pre-requisite that a firm had to be listed on a stock market and post balance sheet data on a quarterly basis on the one hand, and that for reasons laid out above we chose to work with bonds denominated in US dollars on the other, led us to a database comprising 72 corporate bonds issued by 22 different firms from Argentina, Brazil, Chile and Mexico listed in at least one stock market[18].

Exhibit 2 summarizes our corporate bond database. It reports the number of issuers, splitting them into industrials and financials, and reports the number of corporate bonds for each country. Initially, we looked for corporate bonds from Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela. However, we were forced to drop Colombian, Peruvian and Venezuelian bonds because of inaccurate bond data and/or missing balance sheet information. Note that most issuers and bonds are in Mexico (roughly 50% of the sample), followed, in order, by Brazil, Chile and Argentina.

### 3-1-1 Dependent Variable: How Corporate Default Spreads are Measured

In order to compute corporate bond default premia (or "spreads"), we first need to subtract from each corporate yield to maturity the corresponding yield to maturity from a risk-free bond. We proceed as follows:

We first collect yield to maturity data for Latin American corporate bonds. Although it would be desirable to restrict the sample only to zero-coupon bonds, as our theoretical framework prescribes (see Section 2), we mainly end up collecting yield to maturity observations on coupon-paying corporate bonds.[19] This is because there are a small number of zero-coupon bonds issued by Latin American firms precisely because some of the default risk is translated into a regular coupon payment.

[18] In Thomson Financial Datastream we found 171 firms having issued at least one bond. However, many of these bonds didn´t display yield to maturity and price data over the relevant period.

[19] Elton et al. [2001] argue that one should use spreads calculated as the difference between yield to maturity on a zero coupon corporate bond (called corporate spot rate) and the yield to maturity on a zero-coupon government bond of the same maturity (government spot rate) rather than as the difference between the yield to maturity on a coupon-paying corporate bond and the yield to maturity on a coupon-paying risk-free bonds.

We attempt to circumvent the inexistence of firm zero-coupon bonds by finding the yield to maturity of the sovereign bond[20] with the same coupon and the same maturity as the corporate borrower. Then, if there is coupon-specific risk in our dependent variable, it will also show up in our independent variable, namely sovereign risk. The problem is that such exactly corresponding sovereign bonds do not exist, except by chance. Therefore, we choose those liquid corporate bonds whose maturity dates and coupons are closest to the maturity dates of the sovereign bonds.

As for the risk-free bond we need in order to compute the corporate yield spread, we use US Treasury bonds in US dollars. The direct implication of this choice is that we opt for restricting the sample to those Latin American corporate and sovereign bonds denominated in US dollars and select as our corresponding risk-free bond yields the US Treasury bond yields with similar maturity. In doing this, we isolate the pure default premium, as there is no currency risk component embedded in either spread. Note also that corporate dollar-denominated bonds are most frequently exchanged in New York and Luxembourg. Should there be a jurisdiction premium, it would be negligible, and in this case we will assume the premium remains constant over our sample period.

Before moving on to compute corporate default premia, we proceed to clear out our database from potential anomalies or data that might bias the results of our econometric estimation. First, we drop out of the sample all public companies (known as "parastatals", e.g., Petrobras, Pemex), because they hold the same riskiness as the sovereign borrower. Second, for some corporations we eliminate outlier data due to inconsistent price quotes or yield to maturity at given points in time. This is particularly the case of Argentinean yield data, due to reported data on the days close to the debt restructuring processes of November 2001, February 2002, and January-February 2005. Third, we exclude bonds with special clauses such as callable options, convertibles, etc. The firm's bonds, their main features, and the corresponding sovereign bonds used to calculate both corporate and sovereign default premia are summarized in Exhibit 13.[21]

Concerning corporate yield to maturity data, as mentioned before, we use daily observations from the period of the 8th of August 1996 to the 31st of December 2004.

As for US Treasury yields, we work with the US Treasury historical matrix of yield curves.[22] This matrix reports, on a given day, yield curve data corresponding to the estimation done by the US Treasury on the basis of outstanding bonds. Since the matrix only exhibits the observations

[20] Recall that the sovereign spread is one of the independent variables in our estimating equation, derived in Section 2.

[21] We make an exception in the case of five Argentinean firms for which we choose sub-sovereign bonds instead of sovereign bonds as the corresponding sovereign instruments. We choose these bonds (issued by the City of Buenos Aires and Mendoza Province, see Exhibit 13) because they exhibited similar credit ratings to the Argentinean sovereign bonds over the period under analysis and because the corresponding maturities of those sub-sovereign bonds provided a much better fit than sovereign bonds than we could have picked otherwise.

[22] Available at http://www.treas.gov/offices/domestic-finance/debt-management/interest-rate/yield.shtml

at 1, 3 and 6 months, and 1, 2, 3, 5, 7, 10, 20, and 30 years maturity, we run a regression on a daily frequency basis in order to get an approximation of the yield curve and extrapolate the exact yield corresponding to the maturity of interest at each day.[23]
The corporate spreads are computed as follows:

$$corpspread_{j,M-t} = corpyield_{j,M-t} - USrate_{j,M-t} \quad (4)$$

where $j$ indicates each bond and $M\text{-}t$ indicates each bond's time to maturity expressed in years or fractions of years. Since we use quarterly data in our econometric exercise, we proceed to compute quarterly averages of these yield spreads.

3-1-2 Explanatory Variables

A. Sovereign Default Premium

For this variable we also collect daily yield to maturity for the period from August 1st, 1996 to December 31st, 2004. We proceed as in the case of corporate default spreads, this is:

$$sovspread_{j,M-t} = sovyield_{j,M-t} - USrate_{j,M-t} \quad (5)$$

Note that the risk-free rate is the same in the calculation of both corporate and sovereign spreads. Again, as we use quarterly data in our econometric exercise, we proceed to compute quarterly averages of these yield spreads.

B -Other Determinants

The empirical counterparts of the five theoretical determinants (and the two interaction terms) derived and discussed in Section 2 are:

(i) Quasi-debt-to-firm-value (or leverage) ratio ($d_t$);

(ii) Volatility of returns on the firm's value ($\sigma_V$), measured as a 2-year rolling volatility of the value of the firm;

[23] The econometric specification we applied is $y_i = \beta_1 + \beta_2 \log(t_i) + \beta_3 t_i^{\,2} + \varepsilon_i$ where y denotes each bond yield and t denotes time to maturity. The specification fitted well the US Treasury estimation.

(iii) Volatility of risk-free interest rate ($\sigma_r$), calculated as a 2-year rolling volatility of the yield of the 3-month US Treasury-bond (USTB yield vol);
(iv) Time to maturity ($\tau$), measured in years;
(v) Liquidity ($l$), proxied by the percentage of days with transactions;
(vi) Interaction between maturity and leverage ($\tau \cdot d_t$); and
(vii) Interaction between interest rate volatility and leverage ($\sigma_r \cdot d_t$);

Exhibit 1 sums up the operationalization, measurement, and subcomponents of these firm- or bond-specific determinants.[24]

3-2 Econometric framework

Using a linearized version of the Merton-Shimko (extended) model introduced in the theoretical framework in Section 2, we will now examine the statistical and economic relevance of the main structural determinants of corporate bond spreads in our sample of Latin American bonds.

Following Grandes and Peter [2005], the estimating equation can be written as:

$$corpspread_{i,M-t} = \alpha_i + \beta_i sovspread_{i,M-t} + \sum_{j=1}^{k} \gamma_j X_{j,it} + \varepsilon_{i,t}; \qquad (6)$$

$$i = 1,\ 2,\ \ldots,\ N;\ j = 1,\ 2,\ \ldots,\ k$$

where $corpspread_{j,M-t}$ is the corporate spread of firm bond $i$ at the end-month $t$; $sovspread_{j,M-t}$ is the sovereign spread which best matches $corpspread_{j,M-t}$ (see 3-1-2); $X_{1,it},\ldots,X_{k,it}$ is the following set of $k$ = 7 firm-specific variables (including their interaction terms) :

(1) Quasi-debt-to-firm-value (or leverage) ratio $d^*_t$
(2) 2-Year rolling firm value volatility $\sigma_V$
(3) 2-Year rolling yield volatility of the 3-month US T-bond (*USTB-yield volatility*) $\sigma_r$
(4) Years to maturity $\tau$
(5) Liquidity (% of day with transactions) $l$
(6) Interaction 1: between years to maturity and *leverage* $\tau d$

[24] A methodological note discussing in detail the operationalization and measurement of these determinants can be obtained from the authors upon request.

(7) Interaction 2: between *USTB-yield volatility* and *leverage*; $\sigma_r d$

$\alpha_i$ denotes the (unobservable) firm-specific effect (not included in OLS pooled regressions); $\beta_i$ (with $\beta_i = \beta$ when specific sovereign spread coefficients are not allowed) and $\gamma_1, \gamma_2, ..., \gamma_7$ are regression coefficients to be estimated; and $\varepsilon_{it}$ are the regression residuals.

Ideally, we would want to estimate the coefficients $\alpha_i$ and $\beta_i$ as well as separate $\gamma_j$-coefficients (i.e., $\gamma_{1,i}, \gamma_{2,i}, ..., \gamma_{7,i}$ for $i$ = 1,..., $N$) in individual time-series regressions for each of the different $N$ = 72 bonds. However, with 36>T>1 observations per bond (9 years times 4 observations per year), it would be difficult to obtain efficient and unbiased estimates. To reduce collinearity problems and increase the degrees of freedom and the efficiency of estimation, we pool the time series of our 72 bonds. However, pooling data amounts to imposing restrictions on the parameters. In a fully pooled model, for instance, we assume that the parameters $\alpha_i$, $\beta_i$, and $\gamma_{1,i}, \gamma_{2,i}, ..., \gamma_{7,i}$ are the same across all bonds, i.e., that $\alpha_i = \alpha$, $\beta_i = \beta$, and $\gamma_{j,i} = \gamma_j$ for all $i = 1,..., N$ bonds and control variable. However, we can also have less restrictive pool-specifications, like the one proposed in Equation (6), where the intercepts $\alpha_i$ and the slope coefficients $\beta_i$ of $sovspread_{j,M-t}$ are allowed to vary across the bonds. Letting $\beta_i$ vary across bonds and firms allows us to give an answer to two of the three main questions we aim to answer in this study, namely:

-Is sovereign default risk (i.e., sovereign spreads) an economically relevant and statistically significant factor to account for the cross-country and time-series variation in the corporate spreads of the firms in our sample?,
-If yes, do bond market participants apply the sovereign ceiling rule to Latin American firms' bonds? How Does it compare to rating agencies' ceiling policy?

Regarding the panel econometric regressions, we should stress that the estimated coefficients strongly rely on the underlying assumptions of different residual and specification tests, which leads to an eclectic stance on the "different perspectives of reality" which lie behind these assumptions.[25] This view is commonly associated with some kind of methodological triangulation or sensitiveness analysis.[26] Based on the

25 For Fielding and Schreier [2001] every method imposes a "perspective" of reality and for that reason they have something different to say on the symbolic reality (interpreted by the researcher).
26 One of the first approximations of this approach in social sciences has been the work of Campbell and Fiske [1959] who proposed the use of matrices (multi-trait multi-method) to verify the validity of the conclusions in their investigation, through the correlation of the results of several tests applied to the same subjects studied.

"triangulation" or sensitiveness approach, we regress Equation (6) resorting to 8 alternative estimators, namely ordinary least squares (OLS), random effects (RE), fixed effects (FE), fixed effects corrected for serial correlation (FE-AR), first difference (FD), random effects corrected for serial correlation (RE-AR) and generalized least squares (GLS-RE and GLS-FE) estimators -which remedy both serial correlation and heteroskedasticity.

The residual and specification tests we perform help pin down the "best" estimator although these tests do not come without shortcomings of diverse nature and extent. [27] Indeed, 1) we conduct the standard Hausman [1978] test to check whether the RE estimator is consistent or not, 2) we test for pooled and panel serial correlation applying the Breusch-Godfrey [1978] and the Wooldridge (2002) statistics, respectively, 3) we perform a modified Wald test for group-wise residual heteroskedasticity (see Green [2003]), 4) we test for both global significance (for all covariates) and potentially significant, unobserved individual heterogeneity (pooled vs. fixed effects), 5) we test for independent specific slopes in sovereign spreads (a Wald-chi2 test after seemingly unrelated regressions (SUR)), and 6) we also test for the hypothesis of the existence of either a global or specific bond sovereign ceiling (using again a Wald-chi2 test with linear restrictions).
In Section 4.1 we show the descriptive statistics of our dependent and independent variables and make a few remarks about the conditional or unconditional relationship between corporate spreads and time to maturity. Next, in Section 4.2 we present and discuss the econometric results, their statistical and economic significance and how these two relate each other.

## 4-Empirical results

### 4-1 Descriptive statistics

Before examining and discussing the panel econometric output, we will provide an overyiew of the panel database we use in order to estimate the determinants of corporate spreads in Argentina, Brazil, Chile, and Mexico. In Exhibit 3 we can see the mean, standard deviation and the median of the corporate bond spread, the corresponding sovereign spread and its structural determinants by country and for the entire sample (pooled data).

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Hammersley and Atkinson [1983] state that "what is involved in methodological triangulation is not the combination of different types of methodologies per se, but to correct the potential weaknesses that may limit the validity of the analysis." For Fielding and Fielding [1986], the conventional idea of triangulation is that if diverse types of data or methods sustain the same conclusion, the trustworthiness of the results is increased.
[27] For further details, see Grandes, Panigo and Pasquini [2007].

Note: the average, median and std dev values of the 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) should be the same across countries but they differ slightly because the panel is unbalanced.

A few comments are in order:

1) Mean corporate bond spreads are slightly higher (and generally more volatile) than their corresponding sovereign spreads with the exception of Chile, where corporate spreads are more than two times higher than sovereign spreads, and Argentina, where corporate spreads are almost 400 basis points lower than sovereign spreads over the relevant period. This can be partly accounted for by the relatively harsher financial distress experienced by Argentinean government bonds around the dates of the default in early 2002 or the 3 phases of sovereign debt restructuring carried out between 2001 and 2005.

2) Mean liquidity records are relatively low when measured as the percentage of days with transactions for sampled bonds, with the sole exception of Chile. This finding is in line with Grandes, Panigo and Pasquini [2006] who study seven Latin American stock markets -including the countries in this paper- and find that equity markets are relatively illiquid and shallow across the border. Corporate bonds are traded between 22% and 53% (Argentina) of the calendar working days and display a large standard deviation. One would have expected to see more liquid corporate bonds in Chile. This seemingly paradox could be explained by the deeper and more developed bond markets in Chile, where institutional investors hold larger shares of bonds. By definition, these investors practice a policy of buy and hold securities..

3) Leverage (Quasi-debt to firm value ratio) mean values are quite low (between 6% and 32% in Brazil). It has been well documented that Latin American firms display low leverage ratios compared to the average firm in mature markets (Elosegui et al [2005]). This may be attributable to the generalized constraints that firms face in emerging and developing financial markets (Elosegui et al [2006]). Still, the leverage ratios in our sample stand lower than those in Elosegui [2005 and 2006] or in Grandes, Panigo and Pasquini [2006] who report leverage figures ranging from 50% to 82% (in the case of Brazilian firms). This discrepancy may be due to the fact that the quasi-debt to firm (leverage) values calculated in our study only take into account 50% of the non-financial debts .

4) Surprisingly, Argentina displays the lowest firm-value volatility and Brazil the highest; this could be due to the presence of financial firms (banks and insurance companies) in Brazil, which by definition hold more volatile assets. Conversely, all Chilean and Mexican firms are industrial corporations and have less firm-value volatility than Brazil, yet they are a little more volatile than their Argentinean peers.

5) The average time to maturity expressed in years is roughly 10. Typically, emerging-market corporations are not able to borrow long-term globally, i.e., at 15, 20 or 30 year's maturity, and are barely able to issue long-term bonds in local currencies at such long maturities. This is a well documented feature of Latin American bond markets overall (see Borensztein et al. [2006] or Min et al. [2003]).

Looking across countries, we observe a clear-cut pattern between mean values of time to maturity and corporate bond spreads. The longer the average time to maturity, the lower mean corporate spreads are. Chile posts the lowest corporate yield spreads and the longest average time to maturity whereas Argentina shows the opposite, i.e., the widest spreads and the shortest average maturity, followed by Brazil and Mexico, in that order. In Exhibit 4, we present further evidence on the term-structure distribution across countries. Here we check the same pattern when we, for instance, look at the median maturity across countries. In all cases, at least 50% of observations lie in the 0-11 years to maturity range (0-3,3 for Argentina; 0-7,6 for Brazil; 0-10,7 for Chile and 0-9,1 for Mexico).

The (unconditional, unadjusted for credit-quality) negative correlation between corporate spreads and time to maturity can be fitted making use of all available observations in our sample. Exhibit 5 depicts the second order polynomial approximation of this relationship. Exhibit 6 displays the fitted curves by country and sub-periods.

From Exhibits 5 and 6, we can draw two preliminary conclusions, namely 1) there is a significantly negative (unconditional) correlation between corporate spreads and time to maturity but, 2) it is highly unstable over time and (Exhibit 6, Panel a), 3) it appears to be mainly driven by cross-country differences (Exhibit 6, panel b), with firms in investment grade countries –Chile and Mexico- issuing long-term, low-risk bonds which require lower required returns and therefore lower corporate spreads, while firms in speculative grade countries –Argentina and Brazil- issue riskier shorter term bonds with higher required returns and subsequently wider corporate spreads. Indeed, the negative relationship we find for the whole sample in Exhibit 5 would only be appropriate for Argentina in the relevant range (with maturities of up to 10 years) as all other countries display the standard hump-shaped slope predicted by Merton [1974] or Shimko et al [1993] and tested by Sarig and Warga [1989b] in the case of risky bonds.

### 4-2 Econometric Results

This section presents and discusses the econometric output of the multivariate analysis of the determinants of Latin American corporate spreads. We estimate Equation (6) over the full sample (667 observations in 1996-2004) using 8 different estimators, and we perform a number of specification and residual tests as said above.

We divide our discussion in two parts. In the first, we focus on the statistical significance of the variables on the right hand side of (6), the relevance of sovereign risk as an explanatory variable of corporate spreads, and on the tests of the sovereign ceiling hypothesis applied to our bond market data. In the second part, we analyze the "economic" significance of the determinants of corporate bond spreads using alternative variance decomposition methodologies, i.e., we aim to find out how much of the explained variability in corporate spreads is attributable to each of its determinants.

#### 4-2-1 Statistical significance of firm-idiosyncratic determinants

From Exhibits 7 and 8 (with and without allowing for specific sovereign spread coefficients, respectively) we can see that the relatively "best-performing" estimator is GLS-RE [28] As we are primarily interested in idiosyncratic effect of sovereign spreads on corporate spreads, we limit our results discussion to the regressions with specific sovereign spread coefficients. The main findings are:

1.- ***Liquidity*** is the most statistically significant variable, with a negative impact on corporate spreads which significant at 5%. A 10 percentage point increase in the number of days with transactions reduces corporate bond spreads by 0.08 basis points, which is not a strong effect. This result contrasts with Grandes and Peter [2005] who found that liquidity is not significantly correlated to South African corporate spreads in local currency. However, our result is in line with Longstaff, Mithal and Neis [2005] who find *"... a significant non-default component in corporate spreads…[which] is strongly related to measures of bond-specific illiquidity*".
2.- The ***quasi-debt to firm-value (leverage) ratio*** is also very significantly statistically correlated to corporate spreads Its ultimate impact on corporate spreads depends on the interaction with the ***risk-free interest rate volatility*** and, mainly, with the remaining ***time to maturity***. The stand alone effect is positive: ten percentage point increase in our leverage ratio (d rises by 0,1) increases the dependent variable by **1.7 basis points**. The ***interaction effect with the risk-free interest rate volatility*** is positive but statistically insignificant while the ***interaction with time to maturity*** is negative and statistically significant at the 1% level.
3.- ***Time to maturity alone*** has a positive and very statistically significant effect on corporate spreads meaning that a 1-year increase in maturity would raise the average firm credit spreads by 6,5 basis points. However this finding is not robust because the other estimators shown in Exhibit 8 display a negative coefficient on time to maturity and are significant in two cases.
3.- The other structural determinants (risk-free interest rate volatility and firm-value volatility) are not statistically significant to account for the panel variability in corporate bond spreads for our sample of Latin American bonds.

4-2-2 Statistical significance of sovereign spreads and the sovereign ceiling test

The coefficient associated with the **sovereign spread** is not significant in Exhibit 7, but it becomes extremely statistically significant when bond-idiosyncratic slopes are allowed, as Exhibit 8 shows (with each specific coefficient displayed in Exhibit 14). The use of different slopes for sovereign spreads is supported by the result of the joint-Wald test for different slopes across bonds. We strongly reject the null hypothesis of non-significant differences across slopes, i.e., we conclude the point estimates associated with sovereign spreads are significantly

[28] We make this choice despite rejecting the null of the Hausman test, which favours the FE estimator to RE as the latter is inconsistent though efficient under the alternative hypothesis, The Hausman's test may not be reliable under certain conditions**.** Given that RE-GLS remains efficient and unbiased and corrects for both serial correlation and heteroskedasticity we prefer to retain this estimator.

statistically different. In addition, we can see from Exhibits 7 and 8 that allowing for different slopes in sovereign spreads sizably increases the $R^2$.

Notwithstanding the statistically significant positive impact of sovereign risk on corporate bond spreads, Exhibit 10, Exhibit 11 and Exhibit 13 show that market participants seem not to be applying the sovereign ceiling rule for most Latin American bonds/firms included in our sample. The test is performed over the GLS-RE estimator. Note that the rejection rates of the null hypothesis that markets apply the sovereign ceiling rule to our corporate bonds are very sensitive to the underlying constraints. Exhibit 11 presents two alternative methodologies to test for the sovereign ceiling hypothesis. First, we use the approach followed by Grandes and Peter [2005]: the null hypothesis of sovereign ceiling cannot be rejected when the sovereign spread coefficient ($\beta_1$) is positive and Prob. ($\beta_1$=1) >0.05 or Prob. ($\beta_1$=1)<0.05 and $\beta_1$>1. These results are presented in Column (b) of Exhibit 11. In Column (a) we introduce the additional (but reasonable) constraint that Prob. ($\beta_1$=0) must be lower than 0.05 to avoid sovereign ceiling rejection when we shouldn't reject it (otherwise, we would not only be able to reject that $\beta_1 \geq 1$, but it would also be impossible to reject that $\beta_1$=0). When we follow the methodology adopted by Grandes and Peter [2005], rejection rates range from 0.38 in Chile to 0.8 in Argentina. However, when we introduce the "new" conditional approach, almost no bond is viewed as being bound by the sovereign ceiling (rejection rates fluctuate between 0.77 and 0.9, i.e., market participants don't assess transfer risk as binding in 77% to 90% of the bonds). Overall, our results are in line with Durbin and Ng [2001], who also use US dollar-denominated bonds issued in jurisdictions like New York or London.

Based on the results obtained through the "new" conditional test, a few comments are in order:
a) it is not surprising that the sovereign ceiling hypothesis is rejected most of the time because nearly all firms (21) in our sample are industrial corporations. This is a necessary, but not sufficient condition for firms to pierce the sovereign ceiling, as explained in Durbin and Ng [2001], Grandes and Peter [2005] or Moody's [2006]. Moreover, for seven of these firms (33 bonds) the market views appear consistent with the recent succesive relaxations of the rating ceiling policy for some sub-periods or over the full sample, namely YPF SA (Argentina) in 1997-2004, Telenorte (Brazil) from June 2003 until November 2003, Televisa Group (Mexico) from June 2004 until January 2005, Kimberley Clark (Mexico) from July 1999 until November 2005, America Movil (Mexico) from August 2002 until January 2005, Coca Cola Femsa (Mexico) from October 1996 to date, and CEMEX (Mexico) from November 1997 until January 2005. [29]

b) Unibanco, a Brazilian financial corporate, has bonds for which the sovereign ceiling hypothesis holds (2) and some (7) for which it doesn't. We would have expected the sovereign ceiling to be applied across all bonds issued by Unibanco, as banks and financial companies are typically more exposed to government risk, and generally to systemic risk. To our surprise, we realize that Unibanco pierced the rating ceiling for a short

[29] Note that within industrials firms, Braskem (Brazil) appears as the only inconsistent case. Although its credit rating pierced the sovereign ceiling from June 2003 until November 2003, market views seem to reflect the opposite, as we accept the null hypothesis that market participants apply the sovereign ceiling rule to Braskem´s bond.

period of time, i.e., June 2003-November 2003. The bond market participants may regard Unibanco as unconstrained overall by the ceiling, despite viewing that the rule is applicable to two bonds around the period 2002-2004 which post the highest relative liquidity records (26% and 23.5% of days with transactions). This result may have to do with the shortness of the sample.

3) Besides Unibanco, there are other firms for which there is mixed evidence regarding the rejection of the sovereign ceiling hypothesis: Comercial del Plata (an Argentinean industrial holding, the ceiling binds in one out of three bonds), Enersis (a private Chilean utility, the ceiling binds in one out of six bonds), Andina (a Chilean food and beverage producer, the ceiling binds in two out of three bonds) and Hylsamex (a Mexican steel and metal manufacturer, the ceiling binds in two out of three bonds). There are no episodes of actual piercing of the ceiling for any of these firms. Regarding Andina and Hylsamex, we think that these seemingly counterintuitive results may be explained by the different number of observations available for each bond, and sometimes by the corresponding sovereign bond with which the matching could be sub-optimal (different coupon size, diverging maturities, etc). Still, if we picked their most liquid bonds, the conclusion would be to accept the null of the applicability of the sovereign ceiling. The case of Enersis is less problematic because the ceiling binds in one out of six bonds and because we reject the null of sovereign ceiling when we keep its most liquid bond (44% of days with transactions). Finally, we would –similarly to Andina and Hylsamex- conclude, should we choose the bond associated with the longest span (1996q3-2001q1) and the highest liquidity (20.55% of days with transactions), that the markets do apply the ceiling rule to Comercial del Plata

Summing up, sovereign risk is a very statistically significant factor to explain corporate bond spreads (we will see later that indeed it is the single most important explanatory variable), but the sovereign ceiling hypothesis does not generally hold.

#### 4-2-3 Economic significance

As for the economic significance, the idea is to compute the part of the explained variance of corporate bond spreads that is accounted for by each determinant. We perform three alternative variance decomposition calculations, which we discuss in detail in Appendix (A) (based on OLS and GLS-RE estimators, and the R-squared coefficient).

1.- In spite of some differences across variance decomposition methods and/or econometric estimators, we observe in Exhibit 12 that the **sovereign spread is the major determinant** of corporate bond spreads in our sample. This result is similar to that obtained by Grandes and Peter [2005] and (to some extent) Collin-Dufresne, Goldstein, and Martin [2001]. However, it disagrees with Cavallo and Valenzuela [2006] where firm-specific factors account for the largest share of corporate default risk, followed by industry and country fixed effects.

2.- We figure out some stricking results when it comes to liquidity. Contrary to what we find in our econometric panel estimations –Exhibits 7 and 8- concerning the statistical significance of liquidity, Exhibit 12 suggests that the percentage of days with transactions has no major explanatory power on the dependent variable as it accounts for less than 2% of the total corporate spread variation. Is there something wrong here? Not at all. The coefficient associated with liquidity is highly statistically significant but it is relatively small and its covariance/variance ratio is not high enough (see Appendix (A)). There is no contradiction between statistical significance and the extent of economic "irrelevance".

3.- We find that the **quasi-debt to firm-value (leverage) ratio is the most economically significant** structural determinant of corporate bond spreads. It accounts for 7 to 22% (adding up direct and interaction effects) of the corporate bond spread total variance, depending on the variance decomposition method and the econometric estimator.

4.- Among the other covariates, only **time to maturity** appears to have a significant (albeit indirectly through the interaction with the quasi-debt to firm-value ratio) economic impact on corporate bond spreads. Notwithstanding, this variable is unable to explain more than 5 to 11% of the total variance in corporate spreads, even after assigning to it all interaction effects.

5.- Summing up, **sovereign spreads –in our case a proxy for systematic risk factors- overperform idiosyncratic firm attributes in explaining the variation of Latin American corporate spreads**, yet firm specific variables such as leverage and time to maturity carry some important economic explanatory power.

## 5- Conclusions

Exploiting a sample of 72 US dollar-denominated corporate bonds issued by 22 Latin American firms –predominantly industrial- from Argentina, Brazil, Chile, and Mexico over the period 1996-2004, this paper aimed to answer three questions: 1) what are the determinants of Latin American corporate bond spreads? 2) is sovereign default risk (i.e., sovereign spreads) an economically relevant and statistically significant factor among these determinants in order to account for the cross-country and time-series variation in the corporate spreads of the firms we sample?, 3) if yes, do bond market participants apply the sovereign ceiling rule to these firms' bonds? How does it compare to rating agencies' ceiling policy?

To answer these questions, we used an extended version of the structural approach to pricing risky debt securities (or contingent claim analysis). From the structural approach we derived an empirically tractable reduced form equation of the determinants of corporate bond spreads, namely leverage, time to maturity, firm-value volatility and risk-free interest rate volatility. To these variables we added sovereign spreads, as we deal with firms domiciled in emerging countries where sovereign default risk is positive, and we also controlled for liquidity and other bond characteristics.

Our major findings can be summarized as follows:

1.-***Sovereign spreads*** -a proxy for systematic risk in our debt pricing context- are economically far more relevant than firm-specific or firm/bond idiosyncratic factors to explain the variation in corporate spreads (40% on average). Moreover, we find a very statistically significant impact of sovereign risk on corporate spreads when we allow for different impacts of the former on the latter across firms and bonds. This finding is in line with Grandes, Panigo and Pasquini [2007] who on account of the variation in the cost of equity across 924 Latin American firms (including the 22 in this exercise) find that systematic risk is the most relevant explanatory variable. By contrast, our results go counter to Cavallo and Valenzuela [2006], who, for a different sample of emerging-market corporations (including Latin America) and time span, find that firm and bond-specific variables explain the largest part of the corporate spreads variability.

2.- Notwithstanding the economic and statistical relevance of sovereign spreads to corporate default risk, we found strong evidence against the application of the ***"sovereign ceiling rule"*** by market participants. In principle, this should not come as a surprise because 21 of 22 firms are industrial. When we introduced a conditional test, the percentage of rejection of the sovereign ceiling rule ranged from 77% (Chile) to 90% (Argentina) over the 72 bonds issued by the 22 firms we studied. Moreover, for seven out of twenty two firms (representing 33 bonds) we checked that market views were consistent with the rating agencies' policy of allowing these corporations to pierce the sovereign ceiling for at least a sub-period within our sample.[30] As for the other firms, the only puzzling result is Unibanco. Rating agencies allowed this Brazilian bank to pierce the ceiling from June 2003 and until November 2003. Normally, banks are rated at or below the sovereign rating, yet we found mixed evidence from the market views pointing to the acceptance of the sovereign ceiling hypothesis in the case of the most liquid bonds (2 of 9) issued by Unibanco.

We must stress that we rejected the sovereign ceiling hypothesis even for most Chilean bonds/firms (Exhibit 14) where we observed the largest positive differential between corporate and sovereign bond spreads (Exhibit 3). This result is useful to recall that corporate bond spreads higher than sovereign spreads do not necessarily imply that bond market participants apply the sovereign ceiling rule. A firm may bear a relatively high stand-alone risk, which may be reflected in wider spreads and hence higher expected or unexpected losses in case of default. These relatively higher corporate spreads might be the consequence of poor management and weak firm performance, rather than the result of a 100% sovereign transfer risk (1% increase in sovereign increase corporate spreads by the same amount).

3.- Regarding the firm-specific variables, ***liquidity*** is the most statistically significant, and enters the econometric estimations with the expected negative coefficient, i.e., more liquid corporate bonds command lower spreads, hence lower corporate cost of debt, all else equal. Nevertheless, its economic significance is less, as it accounts for about 2% of the total variation in corporate bond spreads. On the other hand, the financial ***leverage*** (quasi-debt to firm-value) ratio is slightly less statistically significant than liquidity, but it is quite relevant from an economic point of view, displaying a strong positive impact on corporate spreads, namely that increasingly leveraged firms will raise more expensive debt capital

[30] These firms are: YPF SA (Argentina) from 1997 to 2004, Telenorte (Brazil) from June 2003 until November 2003, Televisa Group (Mexico) from June 2004 until January 2005, Kimberley Clark (Mexico) from July 1999 until November 2005, America Movil (Mexico) from August 2002 until January 2005, Coca Cola Femsa (Mexico) from October 1996 to date, and CEMEX (Mexico) from November 1997 until January 2005.

all else equal. Furthermore, when we took into account the interaction effects of leverage with the risk-free interest rate volatility and, mainly, with time to maturity, we found that leverage accounts for up to 22% of total variation in corporate bond spreads. Finally, ***time to maturity*** is also economically relevant-but only indirectly-through the above mentioned interaction effect with leverage, explaining between 5 to 11% of the corporate spreads' total variation. When significant, its impact on corporate spreads is mostly negative, which validates our preliminary (unconditional) findings regarding a negatively sloped corporate spread to maturity curve. In other words, highly leveraged firms can also decrease their spreads and ultimately their cost of bond finance by lengthening the maturity of their bond liabilities.

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## Appendix

### A. Different approaches to variance decomposition / variation partitioning

In a number of recent and related documents (e.g., Grandes and Peter [2005] or Cavallo and Valenzuela [2006]), the variance decomposition of corporate spreads has been addressed exclusively by means of variation partitioning.

In those papers, the variance decomposition of corporate spreads (when the unobserved individual heterogeneity has been removed) is given by:

$$1 = \frac{Cov(CS, SY)}{Var(CS)} + \frac{Cov(CS, FS)}{Var(CS)} + \frac{Cov(CS, RE)}{Var(CS)} \qquad (13)$$

where

$CS = SCOR_{it}$ is the vector of corporate default premia

$SY = \beta_i SSOV_{it}$ is the vector of systematic sovereign risk premia

$FS = \sum_{j=1}^{k} \gamma_{j,it} X_{j,it}$ is the vector of firm-specific factors ($X_j$) derived from the contingent claims approach (including interaction effects),

$RE = \varepsilon_{it}$ is the vector of regression residuals, while

*Var(.)* and *Cov(.)* are the variance and covariance operators, respectively.

Unfortunately, this approach is no longer valid in the presence of collinearity among regressors (the standard result). In such a case, three complementary variance decomposition methods become available:

1. The "contribution" of each covariate to the explanation of the corporate spread variance;
2. the corrected "variation share"; and
3. the "partial $R^2$" (partial determination coefficient) between each covariate and the dependent variable.

The contribution of an independent variable to the explanation of the corporate spread variance is simply $a_{Z_K} r_{CS,Z_K}$, where $Z_k \in Z = \lfloor SSOV, X_1, X_2, ..., X_j \rfloor$, $a_{Z_K}$ is the standardized (multivariate) regression coefficient of variable $Z_k$ and $r_{CS,Z_K}$ is the (Pearson) simple correlation coefficient between *CS* and $Z_k$. By adding up all contributions we obtain the coefficient of multiple determination (total $R^2$).[31]

In the presence of collinearity, the second approach (the corrected variation share) is similar to that of equation (13), including some additional improvements. Unlike Grandes and Peter [2005] or Cavallo and Valenzuela [2006], we do not use the standard covariance operator, but a multivariate covariance operator, which allows us to control for multicollinearity among regressors. More precisely, instead of using the $Cov(CS, \beta_K Z_K)$ operator, we use the conditional covariance $Cov(CS, \beta_K Z_K | \overline{Z})$, where $\overline{Z} = Z \setminus Z_K$ and $\beta_K$ is the multivariate regression coefficient related to $Z_k$. To obtain such a covariance, let us recall that:

[31] Note that some of these contributions can be either positive or negative depending on the correlation structure.

a) $Cov(Y, \alpha X) = \alpha Cov(Y, X)$, where α is a scalar; and that

b) $Cov(Y, X|W)$ in a multivariate environment is just $\beta_X Var(X)$, where $\beta_X$ is the multivariate regression coefficient related to X.

Because of a) and b), the "variation share" of CS explained by each $Z_k$ is simply:

$$\frac{Cov(CS, \beta_K Z_K | \overline{Z})}{Var(CS)} = \beta_K{}^2 \frac{Var(Z_K)}{Var(CS)} \quad (14)$$

This ratio measures the proportion of the variance of CS explained by the explanatory variable $Z_k$ when all other explanatory variables are held constant with respect to $Z_k$.

Finally, the partial $R^2$ (coefficient of partial determination) is the square of the partial correlation coefficient:

$$\text{Partial } R^2 = \left(r_{CS,Z_K|\overline{Z}}\right)^2 = \left[\frac{r_{CS,Z_K} - r_{CS,\overline{Z}} r_{Z_K,\overline{Z}}}{\sqrt{\left(1 - r^2_{CS,\overline{Z}}\right)\left(1 - r^2_{Z_K,\overline{Z}}\right)}}\right]^2 \quad (15)$$

which measures the square of the mutual relationship between CS and $Z_k$ when all other covariates are held constant with respect to the two variables involved. It allows to directly estimate the proportion of unexplained variation of CS that is then explained with the addition of variable $Z_k$ to the model.

It is worth noting that, unlike the "contribution" coefficient, the sum of all partial $R^2$ (or all variations shares) is not necessarily equal to the coefficient of multiple determination.

**Exhibit 1:** Data Sources and Measurement of Variables

| **Determinant** | | **Sub-components** | | **Source** |
|---|---|---|---|---|
| Variable | Measurement | Symbol | Explanation | |
| Corporate credit spread ($corpspread$) (Dependent | $corpspread_{j,M-t} = corpyield_{j,M-t} - USrate_{j,M-t}$ | $corpyield$ | Yield to maturity of corporate bond. Sample is restricted to US dollars denominated bonds. | Thomson Financial Datastream |

| | | | | |
|---|---|---|---|---|
| | | $USrate$ | Risk free interest rate proxied by the yield to maturity of a US Treasury bond. (Using the US Treasury yield curve data) | US Treasury |
| Sovereign credit spread ($sovspread$) | $sovspread_{j,M-t} = sovyield_{j,M-t} - USrate_{j,M-t}$ | $sovyield$ | Yield to maturity of a government bond. For each corporate bond in the sample a government bond is selected according to to its maturity and cupon characteristics in order to match as close as possible corporate bond characteristics. See Exhibit 13. | Thompson Financial Datastream |
| Leverage (quasi-debt-to-firm-value ratio) ( $d_t$ ) | (1) | *B1, B2* | Face value of total firm debt (B2 includes customer deposits for the financial institutions) | Economatic a |
| | $D1 = B1 \cdot PRF/V1$ , where | *PRF* | Price of risk-free bond that pays one dollar at maturity.(assuming a coupon equal to the one of the corporate bond) | Calculation |
| | | *E* | Market value of firm equity. We use total market capitalization. | Economatic a. |
| | $V1 = E + PT \cdot B1$ | *PT* | Market price of traded debt | Economatic a |

| | | | | |
|---|---|---|---|---|
| | | *V1, V2* | Value of the firm | Calculated |
| Firm-value volatility ( $\sigma_V$ ) | (1) $\sigma_V = Stdev(log(\frac{V_t}{V_{t-1}}))$ over 8 quarters rolling window, . | | Standard deviation of the log return of the firm value, calculated over 2-years rolling windows. V1 or V2 values of the firm are used respectively for each firm as explained above, | Own calculation |
| Interest rate volatility ( $\sigma_r$ ) | $\sigma_r = \sqrt{Var(\Delta r)} * 2$ over 8-quarter rolling window | *r* | Instantaneous standard deviation of the risk-free rate. Calculation follows Shimko et al [1993], Where $\Delta r$ stands for the (absolute) quarterly change. We use the US yield curve with fixed maturity of 3 months. | US Treasury |
| Time to maturity ( $\tau$ ) | *M* | | Number of days from settlement date until maturity date (expressed in years) | Thompson Financial Datastream |
| Liquidity ( $l$ ) | | | We use as proxy the percentage of trading days with transactions (with reported price and volume) | Economatic a |

**Exhibit 2: Sample Issuers and Issues by Country**

| Country | Number of Firms | Industrials or Utilities | Financials | Total number of Corp. Bonds |
|---|---|---|---|---|
| Argentina | 3 | 3 | 0 | 10 |
| Brazil | 5 | 4 | 1 | 14 |
| Chile | 5 | 5 | 0 | 14 |
| Mexico | 9 | 9 | 0 | 34 |
| Full sample | 22 | 21 | 1 | 72 |

**Exhibit 3: Descriptive statistics by country 1996-2004. Simple averages.**

| Variable | Country | Mean | Std. Dev. | Median |
|---|---|---|---|---|
| Corporate spread (basis points) | Argentina (1996q3-2004q3) | 736.07 | 1762.48 | 352.15 |
| Sovereign spread (basis points) | | 1143.25 | 1413.11 | 624.61 |
| Liquidity (% of day with transactions 1=100%) | | 0.53 | 0.45 | 0.68 |
| Quasi-debt to firm value ratio | | 0.07 | 0.07 | 0.04 |
| Years to maturity | | 3.96 | 2.98 | 3.47 |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) | | 0.62 | 0.40 | 0.50 |
| 2-Year rolling firm value volatility | | 0.14 | 0.06 | 0.12 |
| Corporate spread (basis points) | Brazil (1996q4-2004q3) | 481.06 | 441.12 | 447.41 |
| Sovereign spread (basis points) | | 461.79 | 297.10 | 397.22 |
| Liquidity (% of day with transactions 1=100%) | | 0.26 | 0.41 | 0.00 |
| Quasi-debt to firm value ratio | | 0.32 | 0.09 | 0.34 |
| Years to maturity | | 7.86 | 5.53 | 7.46 |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) | | 0.64 | 0.41 | 0.50 |
| 2-Year rolling firm value volatility | | 0.29 | 0.08 | 0.29 |
| Corporate spread (basis points) | Chile (2002q3-2004q3) | 295.89 | 225.93 | 310.14 |
| Sovereign spread (basis points) | | 124.84 | 89.55 | 126.16 |
| Liquidity (% of day with transactions 1=100%) | | 0.34 | 0.44 | 0.00 |
| Quasi-debt to firm value ratio | | 0.10 | 0.10 | 0.07 |

| | | | | |
|---|---|---|---|---|
| Years to maturity | | 14.50 | 16.36 | 10.97 |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) | | 0.67 | 0.42 | 0.51 |
| 2-Year rolling firm value volatility | | 0.15 | 0.10 | 0.13 |
| Corporate spread (basis points) | Mexico (1996q3-2004q3) | 355.53 | 601.04 | 266.16 |
| Sovereign spread (basis points) | | 340.12 | 499.72 | 260.01 |
| Liquidity (% of day with transactions 1=100%) | | 0.22 | 0.40 | 0.00 |
| Quasi-debt to firm value ratio | | 0.06 | 0.05 | 0.05 |
| Years to maturity | | 10.03 | 6.11 | 9.69 |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) | | 0.66 | 0.42 | 0.51 |
| 2-Year rolling firm value volatility | | 0.20 | 0.08 | 0.18 |
| Corporate spread (basis points) | Full sample (1996q3-2004q3) | 417.57 | 832.55 | 300.75 |
| Sovereign spread (basis points) | | 424.41 | 656.33 | 283.78 |
| Liquidity (% of day with transactions 1=100%) | | 0.27 | 0.41 | 0.00 |
| Quasi-debt to firm value ratio | | 0.11 | 0.11 | 0.06 |
| Years to maturity | | 9.96 | 8.76 | 9.17 |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield vol) | | 0.66 | 0.42 | 0.51 |
| 2-Year rolling firm value volatility | | 0.19 | 0.09 | 0.17 |

**Exhibit 4: Years to maturity distribution across countries**

| Percentil | Argentina | Brazil | Chile | Mexico | Full sample |
|---|---|---|---|---|---|
| 1% | 0.04 | 0.06 | 0.33 | 0.16 | 0.10 |
| 5% | 0.23 | 0.39 | 1.83 | 1.17 | 0.83 |
| 10% | 0.58 | 0.89 | 3.42 | 2.48 | 1.83 |
| 25% | 1.55 | 2.90 | 6.75 | 5.27 | 4.59 |
| 50% | 3.33 | 7.59 | 10.72 | 9.17 | 8.79 |
| 75% | 5.52 | 12.35 | 16.43 | 12.72 | 12.84 |
| 90% | 8.29 | 15.45 | 27.64 | 16.71 | 16.97 |
| 95% | 10.04 | 16.60 | 92.94 | 18.76 | 22.14 |
| 99% | 12.04 | 18.30 | 99.69 | 32.31 | 91.27 |

**Exhibit 5: Unconditional spread to maturity curves for the full sample. A second order polynomial approximation.**

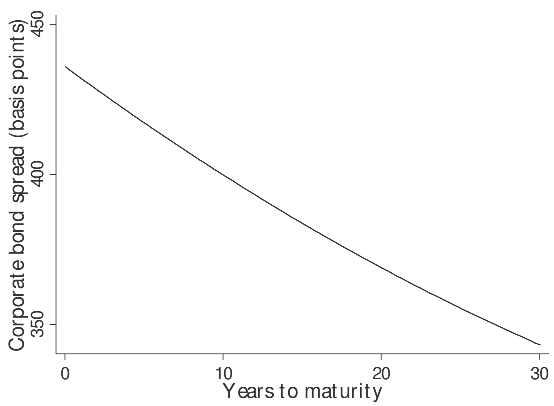
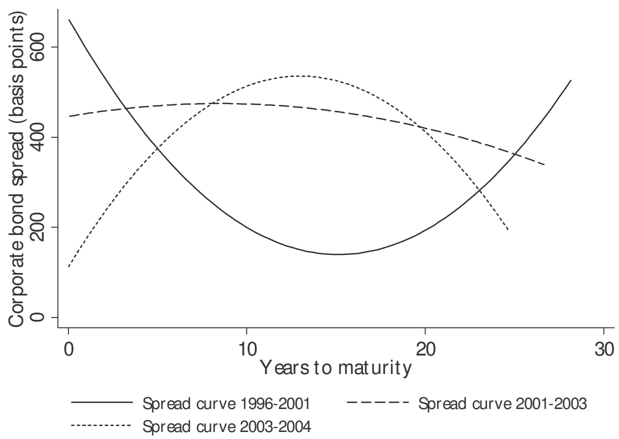
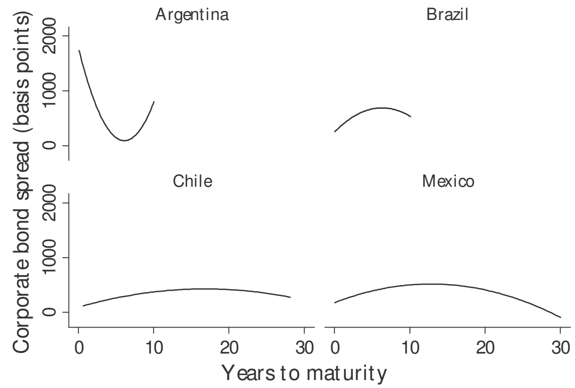


**Exhibit 6: Unconditional spread to maturity curves by period and country. A second order polynomial approximation.**




(a)




( b)

**Exhibit 7: The Determinants of Corporate Bond Spreads in Latin America. Econometric Results-Full Sample**

| Covariate | [1]OLS | [2]FE | [3]RE | [4]FD | [5]FE-AR | [6]RE-AR | [7]GLS-RE | [8]GLS-FE |
|---|---|---|---|---|---|---|---|---|
| Sovereign spread (in basis points) | 0.079*** | -0.043 | 0.059 | 0.06 | 0.069 | 0.055 | 0.122*** | 0.082*** |
| | [0.022] | [0.070] | [0.065] | [0.062] | [0.063] | [0.063] | [0.020] | [0.026] |
| Liquidity: % of day with transactions | -2.436 | -7.876*** | -5.060*** | -2.624*** | -1.940** | -3.067*** | -0.630*** | -1.137*** |
| | [4.504] | [1.806] | [1.822] | [0.878] | [0.944] | [0.959] | [0.220] | [0.372] |
| Quasi-debt to firm value ratio (as % of firm value) | 48.068** | 119.579*** | 49.488*** | -12.425 | -3.632 | 6.105 | 6.029* | 9.920* |
| | [21.354] | [14.617] | [9.957] | [9.373] | [9.772] | [8.328] | [3.128] | [5.564] |
| Years to maturity | -27.853*** | -91.894*** | -21.749*** | 4,832.983*** | -301.808*** | -32.983*** | 2.155 | -12.601 |
| | [5.001] | [29.048] | [8.008] | [1,834.180] | [113.559] | [10.442] | [6.736] | [10.717] |
| 2-Year rolling yield volatility of the 3-month US T-bond | 280.146*** | 199.171* | 220.497* | 49.297 | 39.405 | 32.541 | 28.872 | 46.539 |
| (USTB-yield volatility) | [78.227] | [112.533] | [113.657] | [93.574] | [98.042] | [99.150] | [20.879] | [28.531] |
| 2-Year firm value volatility | 42.673 | -6.611 | -160.124 | 436.624 | 281.142 | 283.617 | 205.738*** | 173.671* |
| | [464.939] | [532.481] | [474.326] | [335.441] | [362.819] | [341.096] | [75.628] | [96.916] |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Interaction 1: Quasi-debt to firm value - Years to maturity | -0.943 | -8.116*** | -2.934*** | 0.069 | -1.173 | -0.869 | -0.253 | -1.218*** |
| | [1.189] | [1.096] | [0.809] | [0.790] | [1.039] | [0.694] | [0.229] | [0.438] |
| Interaction 2: Quasi-debt to firm value - USTB-yield volatility | -24.444** | 0.21 | -9.669 | 7.689 | 14.389** | 6.507 | 1.087 | 7.074** |
| | [11.126] | [8.397] | [7.939] | [6.154] | [6.779] | [6.313] | [2.187] | [3.067] |
| Constant | 318.328 | 604.406** | 419.727* | 1,248.939*** | 1,962.393*** | 709.469*** | 226.829*** | 3,109.61 |
| | [313.339] | [277.997] | [214.823] | [456.328] | [51.964] | [184.299] | [57.455] | [1,983.237] |
| Observations | 667 | 667 | 667 | 574 | 591 | 667 | 662 | 662 |
| Number of bonds | 76 | 76 | 76 | 71 | 71 | 76 | 71 | 71 |
| R-squared | 0.17 | 0.203 | 0.16 | 0.09 | 0.05 | 0.14 | | |
| Log likelihood | | | | | | | -3993.95 | -4206.66 |
| Prob > F [GLOBAL SIGNIFICANCE] | 0.00 | | | | | | | |
| Prob > chi2 - [SOV-CEILING] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Prob > F [POOLED SERIAL CORRELATION] | 0.00 | | | | | | | |
| Prob > F - [POOLED OLS VS. FIXED EFFECTS] | | 0.00 | | | | | | |
| Prob > chi2 - [HETEROSKEDASTICITY] | | | | | | | 0.00 | |
| Prob > F - [SERIAL CORRELATION] | | | | | 0.00 | | | |
| Prob > chi2 - [FIXED VS RANDOM EFFECTS] | | | 0.00 | | | | | |

Note: The dependent variable is the corporate bond spread. Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. OLS, RE, FE, FD, FE-AR, RE-AR, GLS-RE and GLS-FE stand for ordinary least squares, random effects, fixed effects, first differences, fixed effects with serial correlation corrections, random effects with serial correlation corrections, generalized least squares with random effects, and generalized least squares with fixed effects estimators, respectively.

**Exhibit 8: The Determinants of Corporate Bond Spreads in Latin America. Econometric Results-Full Sample- allowing for different slopes in sovereign spreads**

| Covariate | [1]OLS | [2]FE | [3]RE | [4]FD | [5]FE-AR | [6]RE-AR | [7]GLS-RE | [8]GLS-FE |
|---|---|---|---|---|---|---|---|---|
| Liquidity: % of day with transactions | -5.889*** | -9.220*** | -5.889*** | -2.565*** | -2.114** | -3.683*** | -0.764** | -149.21*** |
| | [1.920] | [1.892] | [1.920] | [0.947] | [1.061] | [1.038] | [0.353] | [0.000] |
| Quasi-debt to firm value ratio (as % of firm value) | 29.489*** | 108.782*** | 29.489*** | -15.299 | -15.049 | 9.306 | 17.645*** | |
| | [11.029] | [16.332] | [11.029] | [10.499] | [11.646] | [9.906] | [3.660] | |
| Years to maturity | -7.124 | -64.725* | -7.124 | -1,155.58 | -441.749*** | -10.715 | 6.499** | |
| | [13.699] | [35.991] | [13.699] | [2,038.226] | [144.804] | [14.199] | [3.121] | |
| 2-Year rolling yield volatility of the 3-month US T-bond (USTB-yield volatility) | 73.758 | 70.167 | 73.758 | 7.92 | 3.513 | -16.248 | 25.841 | |
| | [127.677] | [131.924] | [127.677] | [95.273] | [101.510] | [107.560] | [27.627] | |
| 2-Year rolling firm value volatility | -252.972 | -79.699 | -252.972 | 341.223 | 161.506 | 115.549 | 85.928 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | [534.130] | [571.684] | [534.130] | [368.741] | [410.613] | [379.962] | [94.792] | |
| Interaction 1: Quasi-debt to firm value – Year s to maturity | -3.967*** | -8.340*** | -3.967*** | -0.133 | -0.92 | -1.658** | -1.501*** | |
| | [0.929] | [1.231] | [0.929] | [0.867] | [1.138] | [0.797] | [0.378] | |
| Interaction 2: Quasi-debt to firm value - USTB-yield volatility | 19.046* | 16.418* | 19.046* | 10.966* | 15.055** | 10.479 | 2.545 | |
| | [9.976] | [9.958] | [9.976] | [6.372] | [7.095] | [7.119] | [2.865] | |
| Constant | 682.568*** | 836.002** | 682.568*** | -234.011 | 2,507.221*** | 723.585*** | 145.309*** | |
| | [224.571] | [354.898] | [224.571] | [507.506] | [50.226] | [206.911] | [46.552] | |
| Observations | 667 | 667 | 667 | 574 | 591 | 667 | 662 | 662 |
| Number of bonds | 76 | 76 | 76 | 71 | 71 | 76 | 71 | 71 |
| R-squared | 0.525 | 0.383 | 0.53 | 0.08 | 0.11 | 0.3 | | |
| Log likelihood | | | | | | | -4175.76 | -80382.1 |
| Prob > F [GLOBAL SIGNIFICANCE] | 0.00 | | | | | | | |
| Prob > chi2 - [EQUAL SLOPES FOR SOV. SPREAD] | 0.00 | | | | | | | |
| Prob > F [POOLED SERIAL CORRELATION] | 0.00 | | | | | | | |
| Prob > F - [POOLED OLS VS. FIXED EFFECTS] | | 0.00 | | | | | | |
| Prob > chi2 - [HETEROSKEDASTICITY] | | | | | | | 0.00 | |
| Prob > F - [PANEL SERIAL CORRELATION] | | | | | 0.00 | | | |
| Prob > chi2 - [FIXED VS. RANDOM EFFECTS] | | | 0.00 | | | | | |

Note: The dependent variable is the corporate bond spread. Standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. OLS, RE, FE, FD, FE-AR, RE-AR, GLS-RE and GLS-FE stand for ordinary least squares, random effects, fixed effects, first differences, fixed effects with serial correlation corrections, random effects with serial correlation corrections, generalized least squares with random effects, and generalized least squares with fixed effects estimators, respectively.

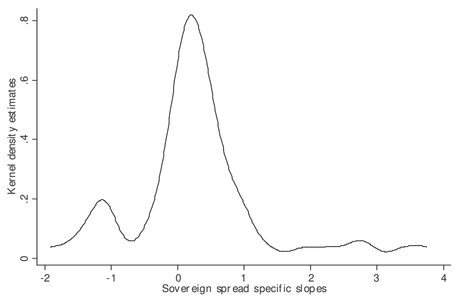



**Exhibit 9: Sovereign spread specific slopes distribution. Kernel density estimates for the whole sample**

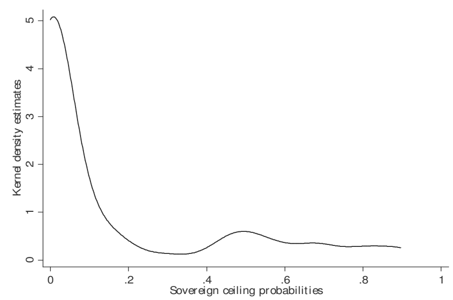



**Exhibit 10: Sovereign ceiling probability distribution. Whole sample kernel density estimates for the probability of specific sovereign pread coefficients being equal to 1**

**Exhibit 11: Rejection rates of the sovereign ceiling hypothesis**

| | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|
| Whole sample | **0.83** | 0.62 |
| Argentina | **0.90** | 0.80 |
| Brazil | **0.79** | 0.64 |
| Chile | **0.77** | 0.38 |
| Mexico | **0.85** | 0.65 |

Note: Rejection rates in Column "Sov. Ceiling (a)" have been calculated assuming that the sovereign ceiling hypothesis cannot be rejected when the corporate spread coefficient ($\beta_1$) is positive and Prob. ($\beta_1$=0)<0.05 and Prob. ($\beta_1$=1) >0.05 or Prob. ($\beta_1$=1)<0.05 & $\beta 1$>1. Rejection rates in column "Sov. Ceiling (b)" are calculated as in "Sov. Ceiling (a)" but without introducing the Prob. ($\beta_1$=0)<0.05 constraint.

**Exhibit 12: Economic significance of corporate spread structural determinants. Different approaches to variance decomposition**

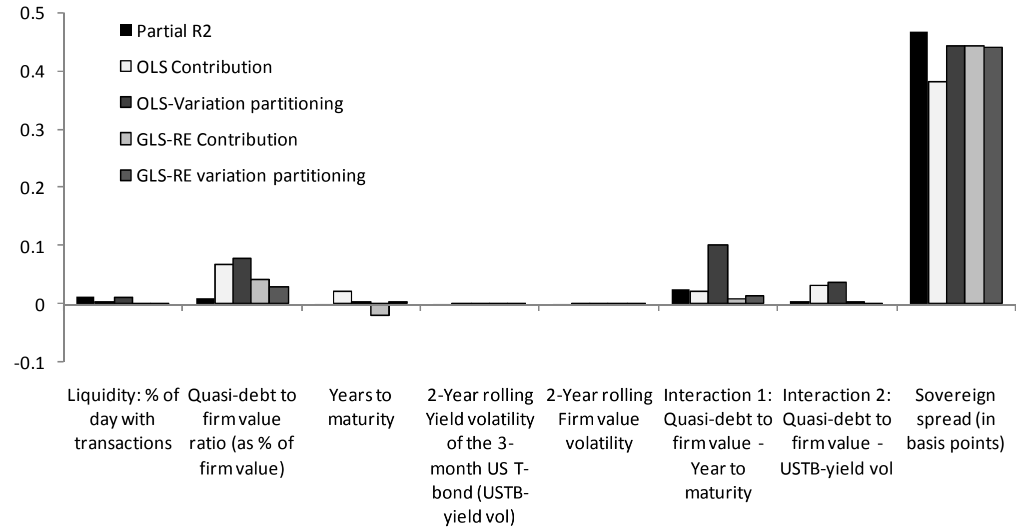



**Exhibit 13: Main characteristics of corporate and related sovereign bonds**

| Corporate Bond Features | | | | | | | | Related Sovereign Bond Characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bond Id | Country | Firm | Sector | Coupon | Issue Date | Redemp. date | Issuer Rating History | Name | Coupon | Issue Date | Redemp. date | Issuer Rating History |
| 101 | Argentina | Alpargatas | Textile | 9 | 02/11/1993 | 26/11/1996 | N/A | Argentina (2) 1993 8 1/4% 02/08/00 S | 8.25 | 07/07/1993 | 02/08/2000 | 21/03/2003 CCC+ ; 03/12/2001* DDD; 06/11/2001* C; 02/11/2001* CC; 30/10/2001 CC; 09/10/2001 CCC+ ; 12/07/2001* B-; 12/07/2001 B-; 11/07/2001* B-; 08/05/2001 B; 28/03/2001* B+ ; 26/03/2001 B+ ; 20/03/2001* BB-; 14/11/2000 BB-; 21/09/2000* BB; 03/12/1997* BB; 28/05/1997* BB; 02/04/1997 BB; |
| 105 | | Comercial del Plata | Other sectors | 8.75 | 01/12/1993 | 14/12/1998 | N/A | Argentina (2) 1993 8 1/4% 02/08/00 S | 8.25 | 07/07/1993 | 02/08/2000 | |
| 106 | | | Other sectors | 10.75 | 29/02/1996 | 06/03/1998 | | Argentina (2) 1993 8 1/4% 02/08/00 S | 8.25 | 07/07/1993 | 02/08/2000 | |
| 107 | | | Other sectors | 11.5 | 01/05/1996 | 09/05/2000 | | Argentina (2) 1993 8 1/4% 02/08/00 S | 8.25 | 07/07/1993 | 02/08/2000 | |
| 108 | | YPF | Oil and Gas | 7 | 26/03/1997 | 26/10/2002 | 03/06/2003 BB; 23/01/2002 B+ ; 13/07/2001 BB-; 08/05/2001 BB; 26/03/2001 BB+ ; 22/04/1997 BBB- | Mendoza Province 1996 10% 25/07/02 Q | 10 | 08/08/1996 | 25/07/2002 | 02/10/2006 B+ ; 24/03/2006 B; 01/06/2005 B-; 29/10/2004 CCC+ ; 20/09/2004* NR; 10/04/2002* C; 02/11/2001* CC; 01/11/2001 CC; 10/10/2001 CCC+ ; 13/07/2001 B- ; 12/07/2001* B- ; 08/05/2001 B ; 28/03/2001* B+ ; 08/08/1997 BB- |
| 109 | | | Oil and Gas | 7.5 | 06/10/1995 | 26/10/2002 | | Mendoza Province 1996 10% 25/07/02 Q | 10 | 08/08/1996 | 25/07/2002 | |
| 110 | | | Oil and Gas | 7.75 | 25/08/1997 | 27/08/2007 | | Mendoza Province 1997 10% 04/09/07 | 10 | 02/09/1997 | 04/09/2007 | |
| 111 | | | Oil and Gas | 9.125 | 20/02/1999 | 24/02/2009 | | Buenos Aires 2000 13 1/4% 29/03/10 Registered | 13.25 | 16/03/2000 | 29/03/2010 | 24/03/2006 B; 01/06/2005 B-; 21/03/2003 CCC+ ; 13/07/2001 B-; 08/05/2001 B; 26/03/2001 B+ ; 14/11/2000 BB-; 14/03/2000 BB; 17/03/1997 BB- |
| 112 | | | Oil and Gas | 8 | 02/02/1994 | 15/02/2004 | | Argentina 1999 F/R 04/04 144a Q | 8.25 | 15/03/1999 | 06/04/2004 | See Above |
| 113 | | | Oil and Gas | 7.25 | 04/03/1998 | 15/03/2003 | | Mendoza Province 1996 10% 25/07/02 Q | 10 | 08/08/1996 | 25/07/2002 | See Above |

**Exhibit 13: Main characteristics of corporate and related sovereign bonds (cont.)**

| Corporate Bond Features | | | | | | | | Related Sovereign Bond Characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bond Id | Country | Firm | Sector | Coupon | Issue Date | Redemp. date | Issuer Rating History | Name | Coupon | Issue Date | Redemp. date | Issuer Rating History |
| 202 | Brazil | Braskem | Chemical products | 11.75 | 22/01/2004 | 22/01/2014 | 03/11/2005 BB; 19/09/2004 BB-; 19/06/2003 B+ | Brazil-CBond (SR-L) Front Loaded Interest RD 8% 15/04/14 | 8 | 15/04/1994 | 15/04/2014 | 05/02/2007* BB ; 28/06/2006* BB ; 28/02/2006 BB ; 14/12/2005* BB- ; 11/10/2005* BB- ; 11/07/2005* BB- ; 28/09/2004* BB- ; 17/09/2004 BB- ; 06/11/2003* B+ ; 03/06/2003* B ; 02/07/2002 B+ ; 03/01/2001 BB- ; 14/01/1999 B+ ; 02/04/1997 BB- ; 18/07/1995 B+ ; 30/11/1994 B |
| 205 | | Gerdau Metalurgica | Steel and Metals | 10.25 | 02/11/1993 | 23/11/2001 | 03/11/2005 BB+ ; 01/09/2005 BB- | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 206 | | | | 11.125 | 20/05/1996 | 24/05/2004 | | Brazil 1999 11 5/8% 15/04/04 S | 11.625 | 23/04/1999 | 15/04/2004 | |
| 207 | | Tele Norte | Telecommunications | 8 | 10/12/2003 | 18/12/2013 | 03/11/2005 BB; 19/09/2004 BB-; 03/07/2002 B+ | Brazil (Exit) 1988 6% 15/09/13 | 6 | 15/09/1988 | 15/09/2013 | |
| 212 | | Unibanco | Finance and Insurance | 7.75 | 12/08/1997 | 14/08/2000 | 28/02/2006 BB; 19/09/2004 BB-; 03/07/2002 B+ ; 04/01/2001 BB-; 14/01/1999 B+ ; 21/05/1997 BB- | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 213 | | | | 8.75 | 30/08/2000 | 30/08/2002 | | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 214 | | | | 8.875 | 12/04/2000 | 26/04/2002 | | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 215 | | | | 9 | 29/06/2000 | 31/12/2001 | | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 216 | | | | 7 | 18/04/2001 | 18/10/2002 | | Brazil 1996 8 7/8% 05/11/01 S | 8.875 | 31/10/1996 | 05/11/2001 | |
| 217 | | | | 9.375 | 22/04/2002 | 30/04/2012 | | Brazil-Dcb.(Series-L) 94 F/R15/04/04-12 S | 6.125 | 15/04/1994 | 15/04/2012 | |
| 219 | | | | 9.375 | 22/04/2002 | 30/04/2012 | | Brazil-Dcb.(Series-L) 94 F/R15/04/04-12 S | 6.125 | 15/04/1994 | 15/04/2012 | |
| 220 | | | | 7.375 | 05/12/2003 | 15/12/2013 | | Brazil (Exit) 1988 6% 15/09/13 | 6 | 15/09/1988 | 15/09/2013 | |
| 221 | | | | 3 | 28/01/2004 | 10/08/2005 | | Brazil Realty 1997 10.05% 22/07/05 P07/02 | 10.05 | 15/07/1997 | 22/07/2005 | |
| 222 | | Usiminas | Steel and Metals | 6.375 | 29/09/2003 | 07/04/2005 | 18/05/2006 BB+ ; 03/11/2005 BB; 19/09/2004 BB-; 14/01/2004 B+ | Brazil 2001 9 5/8% 15/07/05 S | 9.625 | 12/05/2001 | 15/07/2005 | |

## Exhibit 13: Main characteristics of corporate and related sovereign bonds (cont.)

| Corporate Bond Features | | | | | | | | Related Sovereign Bond Characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bond Id | Country | Firm | Sector | Coupon | Issue Date | Redemp. date | Issuer Rating History | Name | Coupon | Issue Date | Redemp. date | Issuer Rating History |
| 301 | Chile | Enersis | Electricity | 6.9 | 26/11/1996 | 01/12/2006 | 21/02/2003 BBB-; 11/12/2002 BBB; 31/05/2002 BBB+ ; 11/07/1995 A-; 09/11/1994 BBB+ | Chile 2002 5 5/8% 23/07/07 S | 5.625 | 18/04/2002 | 23/07/2007 | 09/03/2006* A; 14/12/2005* A; 28/03/2005* A; 02/02/2004* A- ; 14/01/2004 A; 24/02/2003* A- ; 20/12/2001* A- ; 11/07/1995 A- ; 20/12/1993 BBB+ ; 17/08/1992 BBB |
| 302 | | | | 7.4 | 26/11/1996 | 01/12/2016 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 303 | | | | 6.6 | 26/11/1996 | 01/12/2026 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 304 | | | | 7.375 | 19/11/2003 | 15/01/2014 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 305 | | | | 7.375 | 19/11/2003 | 15/01/2014 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 306 | | | | 7.375 | 24/11/2003 | 15/01/2014 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 307 | | Embonor | Food and Beverages | 9.875 | 15/09/1999 | 15/03/2006 | 09/06/2005 NR; 25/02/2004 BB+ ; 04/06/2003 BBB-; 11/03/1999 BBB | Chile 2002 5 5/8% 23/07/07 S | 5.625 | 18/04/2002 | 23/07/2007 | |
| 308 | | Andina | Food and Beverages | 7 | 01/10/1997 | 03/10/2007 | 28/04/2006* A-; 24/04/2006* A-; 11/05/2005* A-; 21/04/2004* A-; 12/05/2003* A-; 29/10/2002* A-; 24/07/1995 BBB+ | Chile 2002 5 5/8% 23/07/07 S | 5.625 | 18/04/2002 | 23/07/2007 | |
| 309 | | | | 7.625 | 03/10/1997 | 01/10/2027 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 310 | | | | 7.875 | 03/10/1997 | 01/10/2097 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 311 | | Endesa | Electricity | 8.625 | 23/07/2003 | 01/08/2015 | 09/02/2005* BBB-; 01/07/2004* BBB-; 14/05/2003* BBB-; 21/02/2003 BBB- | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 312 | | | | 8.35 | 23/07/2003 | 01/08/2013 | | Chile 2003 5 1/2% 15/01/13 S | 5.5 | 09/01/2003 | 15/01/2013 | |
| 314 | | CTC | Telecommunications | 7.625 | 15/07/1996 | 15/07/2006 | 01/09/2004 BBB+ ; 06/05/2004 BBB+ ; 10/03/2004 BBB+ ; 09/09/2003 BBB+ ; 27/11/2002 BBB+ | Chile 2002 5 5/8% 23/07/07 S | 5.625 | 18/04/2002 | 23/07/2007 | |
| 315 | | | | 8.375 | 09/01/1999 | 01/01/2006 | | Chile 2002 5 5/8% 23/07/07 S | 5.625 | 18/04/2002 | 23/07/2007 | |

**Exhibit 13: Main characteristics of corporate and related sovereign bonds (cont.)**

| Corporate Bond Features | | | | | | | | Related Sovereign Bond Characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bond Id | Country | Firm | Sector | Coupon | Issue Date | Redemp. date | Issuer Rating History | Name | Coupon | Issue Date | Redemp. date | Issuer Rating History |
| 501 | Mexico (1) | Comercial Mexicana | Wholesale and retail trade | 8.75 | 01/04/1993 | 21/04/1998 | 27/01/2005* BBB-; 15/04/2003* BBB-; 07/02/2002 BBB-; 13/03/2000 BB+ ; 31/03/1998 BB | Mexico 1993 7 1/4% 16/03/98 | 7.25 | 24/02/1993 | 16/03/1998 | 14/12/2005* BBB; 07/12/2005* BBB; 31/01/2005 BBB ; 22/11/2004* BBB- ; 24/09/2003* BBB- ; 07/02/2002 BBB- ; 15/01/2002* BBB- ; 03/05/2000* BB+ ; 10/03/2000 BB+ ; 30/08/1995* BB ; 10/02/1995 BB ; 29/07/1992 BB+ |
| 502 | | | | 9.375 | 13/04/1998 | 14/04/2005 | | United Mexico States 1999 9 3/4% 06/04/05 S | 9.75 | 26/03/1999 | 06/04/2005 | |
| 508 | | Posadas Grupo | Other sectors | 10.375 | 06/02/1997 | 13/02/2002 | 15/07/2004 BB- | Mexico 1992 8 1/2% 15/09/02 S | 8.5 | 15/09/1992 | 15/09/2002 | |
| 511 | | Televisa Gpo | Other sectors | 10 | 26/10/1992 | 09/11/1997 | 17/06/2004* BBB ; 30/03/2004* BBB- ; 18/09/2003* BBB- ; 18/02/2003* BBB- ; 15/02/2002 BBB-; 06/04/2000 BB+ ; 26/04/1996 BB | United Mexico States 1972 8 1/8% 01/12/76-97 S | 8.125 | 01/12/1972 | 01/12/1997 | |
| 512 | | | | 8.625 | 02/08/2000 | 08/08/2005 | | United Mexico States 1999 9 3/4% 06/04/05 S | 9.75 | 26/03/1999 | 06/04/2005 | |
| 513 | | | | 8.625 | 02/08/2000 | 08/08/2005 | | United Mexico States 1999 9 3/4% 06/04/05 S | 9.75 | 26/03/1999 | 06/04/2005 | |
| 514 | | | | 8 | 07/09/2001 | 13/09/2011 | | United Mexico States 2002 7 1/2% 14/01/12 S | 7.5 | 08/01/2002 | 14/01/2012 | |
| 515 | | | | 8 | 13/09/2001 | 13/09/2011 | | United Mexico States 2002 7 1/2% 14/01/12 S | 7.5 | 08/01/2002 | 14/01/2012 | |
| 518 | | Hylsamex | Steel and Metals | 11 | 28/01/1993 | 23/02/1998 | 17/11/2004 BB-; 09/06/2004 B; 02/01/2003 CCC+ | Mexico 1993 7 1/4% 16/03/98 | 7.25 | 24/02/1993 | 16/03/1998 | |
| 519 | | | | 10.5 | 23/04/2002 | 15/12/2010 | | United Mexico States 2001 8 3/8% 14/01/11 S | 8.375 | 10/01/2001 | 14/01/2011 | |
| 520 | | | | 9.25 | 24/09/1997 | 15/09/2007 | | United Mexico States 1998 8 5/8% 12/03/08 | 8.625 | 06/03/1998 | 12/03/2008 | |
| 522 | | Kimberly Clark | Paper and pap. related products | 8.875 | 28/07/1999 | 01/08/2009 | 03/11/2005 A-; 07/02/2002 BBB+ ; 14/03/2000 BBB; 20/07/1999 BBB- | Mexico WW 10 3/8% 17/02/09 Early | 10.375 | 10/02/1999 | 17/02/2009 | |
| 523 | | | | 8.875 | 03/08/1999 | 01/08/2009 | | Mexico WW 10 3/8% 17/02/09 Early | 10.375 | 10/02/1999 | 17/02/2009 | |
| 526 | | Vitro | Non-metallic minerals | 10.75 | 16/07/2004 | 23/07/2011 | ; 23/03/2006 B-; 08/03/2005 B; 26/09/2003 B+ ; 19/05/2003 BB-; 22/04/1997 BB | United Mexico States 2002 7 1/2% 14/01/12 S | 7.5 | 08/01/2002 | 14/01/2012 | |
| 527 | | | | 11.75 | 22/10/2003 | 01/11/2013 | | United Mexico States 2003 5 7/8% 15/01/14 S | 5.875 | 08/10/2003 | 15/01/2014 | |

**Exhibit 13: Main characteristics of corporate and related sovereign bonds**

| Corporate Bond Features | | | | | | | | Related Sovereign Bond Characteristics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bond Id | Country | Firm | Sector | Coupon | Issue Date | Redemp. date | Issuer Rating History | Name | Coupon | Issue Date | Redemp. date | Issuer Rating History |
| 532 | Mexico (2) | America Movil | Telecommunications | 4.125 | 02/03/2004 | 01/03/2009 | 03/11/2005 BBB+ ; 30/09/2005* BBB ; 22/02/2005* BBB ; 31/01/2005 BBB ; 28/10/2004* BBB ; 11/06/2004* BBB ; 21/10/2003* BBB ; 29/08/2002* BBB | Mexico WW 10 3/8% 17/02/09 Early | 10.375 | 10/02/1999 | 17/02/2009 | 14/12/2005* BBB 07/12/2005* BBB 31/01/2005 BBB 22/11/2004* BBB- 24/09/2003* BBB- 07/02/2002 BBB- 15/01/2002* BBB- 03/05/2000* BB+ 10/03/2000 BB+ 30/08/1995* BB 10/02/1995 BB 29/07/1992 BB+ |
| 533 | | | | 5.5 | 02/03/2004 | 01/03/2014 | | United Mexico States 2003 5 7/8% 15/01/14 S | 5.875 | 08/10/2003 | 15/01/2014 | |
| 539 | | | | 5.7735 | 20/04/2004 | 27/04/2007 | | Mexico 1997 9 7/8% 15/01/07 Early | 9.875 | 14/01/1997 | 15/01/2007 | |
| 542 | | Coca Cola Femsa | Food and Beverages | 8.95 | 01/11/1996 | 01/11/2006 | 14/12/2004* BBB+ ; 07/02/2002 BBB; 13/03/2000 BBB-; 18/10/1996 BB+ | Mexico 1997 9 7/8% 15/01/07 Early | 9.875 | 14/01/1997 | 15/01/2007 | |
| 543 | | | | 9.5 | 01/07/1992 | 22/07/1997 | | United Mexico States 1972 8 1/8% 01/12/76-97 S | 8.125 | 01/12/1972 | 01/12/1997 | |
| 544 | | Cemex SA | Non-metallic minerals | 10 | 21/10/1992 | 05/11/1999 | 22/02/2005* BBB; 27/09/2004* BBB; 29/01/2004* BBB; 12/08/2002* BBB; 26/05/2000 BBB-; 25/11/1997 BB+ ; 02/02/1995 BB; 22/10/1992 BB+ | Mexico 1993 6.97% 12/08/00 S | 6.97 | 02/04/1993 | 12/08/2000 | |
| 545 | | | | 8.5 | 16/08/1993 | 31/08/2000 | | Mexico 1993 6.97% 12/08/00 S | 6.97 | 02/04/1993 | 12/08/2000 | |
| 546 | | | | 8.875 | 27/05/1993 | 10/06/1998 | | Mexico 1993 7 1/4% 16/03/98 | 7.25 | 24/02/1993 | 16/03/1998 | |
| 547 | | | | 9.5 | 07/09/1994 | 20/09/2001 | | Mexico 1996 9 3/4% 06/02/01 Registered S | 9.75 | 06/02/1996 | 06/02/2001 | |
| 548 | | | | 10.75 | 17/07/1996 | 15/07/2000 | | Mexico 1993 6.97% 12/08/00 S | 6.97 | 02/04/1993 | 12/08/2000 | |
| 549 | | | | 12.75 | 16/07/1996 | 15/07/2006 | | United Mexico States 2000 8 1/2% 01/02/06 S | 8.5 | 25/07/2000 | 01/02/2006 | |
| 550 | | | | 12.75 | 17/07/1996 | 15/07/2006 | | United Mexico States 2000 8 1/2% 01/02/06 S | 8.5 | 25/07/2000 | 01/02/2006 | |
| 551 | | | | 9.25 | 10/06/1999 | 17/06/2002 | | Mexico 1992 8 1/2% 15/09/02 S | 8.5 | 15/09/1992 | 15/09/2002 | |
| 552 | | | | 9.625 | 01/10/1999 | 01/10/2009 | | United Mexico States 2000 9 7/8% 01/02/10 Tranche 4 | 9.875 | 24/01/2000 | 01/02/2010 | |
| 553 | | | | 9.625 | 24/09/1999 | 01/10/2009 | | United Mexico States 2000 9 7/8% 01/02/10 Tranche 4 | 9.875 | 24/01/2000 | 01/02/2010 | |
| 554 | | | | 9.625 | 25/09/1999 | 01/10/2009 | | United Mexico States 2000 9 7/8% 01/02/10 Tranche 4 | 9.875 | 24/01/2000 | 01/02/2010 | |
| 555 | | | | 8.625 | 13/07/2000 | 18/07/2003 | | Mexico 1992 8 1/2% 15/09/02 S | 8.5 | 15/09/1992 | 15/09/2002 | |
| 556 | | | | 8.625 | 18/07/2000 | 18/07/2003 | | Mexico 1992 8 1/2% 15/09/02 S | 8.5 | 15/09/1992 | 15/09/2002 | |
| 557 | | | | 4.25 | 05/10/1994 | 01/11/1997 | | United Mexico States 1972 8 1/8% 01/12/76-97 S | 8.125 | 01/12/1972 | 01/12/1997 | |

**(cont.)**

**Exhibit 14: Sovereign spread specific slopes and sovereign ceiling test results for the GLS-RE estimator**

| Bond Id | Firm | Sector | Available obs. | % of Days with Transactions | Mean Corp. Spread | Mean Corresponding Sorp. Spread | Sov. Spread coeff. ($\beta_1$) | Prob. $\beta_1 = 0$ | Prob. $\beta_1 = 1$ | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ARGENTINA | | | | | | |
| 101 | Alpargatas | Textile | 1996q3-1996q4 | 2.20 | 3423.50 | 446.51 | 6.03 | 0.211 | 0.297 | 0 | 1 |
| 105 | Comercial del Plata | Others | 1996q3-1998q3 | 14.03 | 349.28 | 284.04 | 0.09 | 0.803 | 0.01 | 0 | 0 |
| 106 | | | 1996q3-1998q1 | 9.47 | 274.75 | 313.21 | -0.28 | 0.293 | 0 | 0 | 0 |
| 107 | | | 1996q3-2000q1 | 20.55 | 922.00 | 289.60 | 10.37 | 0.024 | 0.041 | 1 | 1 |
| 108 | YPF | Oil & Gas | 2001q2-2002q1 | 8.69 | 438.70 | 511.20 | 0.18 | 0.114 | 0 | 0 | 0 |
| 109 | | | 2001q4-2002q1 | 5.77 | 147.69 | 511.20 | 0.13 | 0.653 | 0.002 | 0 | 0 |
| 110 | | | 1997q4-2004q3 | 52.18 | 256.73 | 1800.52 | 0.09 | 0 | 0 | 0 | 0 |
| 111 | | | 2000q2-2004q3 | 44.10 | 394.66 | 4107.73 | 0.09 | 0 | 0 | 0 | 0 |
| 112 | | | 1999q1-2003q3 | 43.87 | 304.29 | 697.01 | 0.06 | 0.333 | 0 | 0 | 0 |
| 113 | | | 1998q2-2002q1 | 28.65 | 330.64 | 512.40 | 0.46 | 0.044 | 0.02 | 0 | 0 |
| | | | | | BRAZIL | | | | | | |
| 202 | Braskem | Chemical products | 2004q1-2004q3 | 15.76 | 654.01 | 627.91 | 0.97 | 0 | 0.896 | 1 | 1 |
| 205 | Gerdau Met | Steel & Metals | 1996q4-2001q2 | 30.52 | 951.37 | 287.81 | 0.72 | 0.283 | 0.671 | 0 | 1 |
| 206 | | | 2001q2-2003q4 | 45.46 | 691.77 | 621.45 | 0.07 | 0.641 | 0 | 0 | 0 |
| 207 | Tele Norte Celular | Telecommunication | 2003q4-2004q3 | 16.26 | 449.77 | 483.61 | 0.45 | 0.139 | 0.067 | 0 | 1 |

| Bond Id | Firm | Sector | Available obs. | % of Days with Transactions | Mean Corp. Spread | Mean Corresponding Sorp. Spread | Sov. Spread coeff. ($\beta_1$) | Prob. $\beta_1 = 0$ | Prob. $\beta_1 = 1$ | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ARGENTINA | | | | | | |
| 101 | Alpargatas | Textile | 1996q3-1996q4 | 2.20 | 3423.50 | 446.51 | 6.03 | 0.211 | 0.297 | 0 | 1 |
| 105 | Comercial del Plata | Others | 1996q3-1998q3 | 14.03 | 349.28 | 284.04 | 0.09 | 0.803 | 0.01 | 0 | 0 |
| 106 | | | 1996q3-1998q1 | 9.47 | 274.75 | 313.21 | -0.28 | 0.293 | 0 | 0 | 0 |
| 107 | | | 1996q3-2000q1 | 20.55 | 922.00 | 289.60 | 10.37 | 0.024 | 0.041 | 1 | 1 |
| 108 | YPF | Oil & Gas | 2001q2-2002q1 | 8.69 | 438.70 | 511.20 | 0.18 | 0.114 | 0 | 0 | 0 |
| 109 | | | 2001q4-2002q1 | 5.77 | 147.69 | 511.20 | 0.13 | 0.653 | 0.002 | 0 | 0 |
| 110 | | | 1997q4-2004q3 | 52.18 | 256.73 | 1800.52 | 0.09 | 0 | 0 | 0 | 0 |
| 111 | | | 2000q2-2004q3 | 44.10 | 394.66 | 4107.73 | 0.09 | 0 | 0 | 0 | 0 |
| 112 | | | 1999q1-2003q3 | 43.87 | 304.29 | 697.01 | 0.06 | 0.333 | 0 | 0 | 0 |
| 113 | | | 1998q2-2002q1 | 28.65 | 330.64 | 512.40 | 0.46 | 0.044 | 0.02 | 0 | 0 |
| | | | | | BRAZIL | | | | | | |
| 202 | Braskem | Chemical products | 2004q1-2004q3 | 15.76 | 654.01 | 627.91 | 0.97 | 0 | 0.896 | 1 | 1 |
| 205 | Gerdau Met | Steel & Metals | 1996q4-2001q2 | 30.52 | 951.37 | 287.81 | 0.72 | 0.283 | 0.671 | 0 | 1 |
| 206 | | | 2001q2-2003q4 | 45.46 | 691.77 | 621.45 | 0.07 | 0.641 | 0 | 0 | 0 |
| 207 | Tele Norte Celular | Telecommunication | 2003q4-2004q3 | 16.26 | 449.77 | 483.61 | 0.45 | 0.139 | 0.067 | 0 | 1 |

Note. In Column "Sov. Ceiling (a)", the sovereign ceiling hypothesis cannot be rejected (1; while 0 stands for rejection) when $\beta1>0$ & Prob. ($\beta1=0$)<0.05 & (Prob. ($\beta1=1$) >0.05 or (Prob. ($\beta1=1$)<0.05 but $\beta1>1$)). In Column "Sov. Ceiling (b)", the Prob. $\beta1=0<0.05$ constraint is no longer introduced. Detailed characteristics for each bond can be obtained from Exhibit 13.

**Exhibit 14: Sovereign spread specific slopes and sovereign ceiling test results for the GLS-RE estimator (cont.)**

| Bond Id | Firm | Sector | Available obs. | % of Days with Transactions | Mean Corp. Spread | Mean Corresponding Sorp. Spread | Sov. Spread coeff. ($\beta_1$) | Prob. $\beta_1$= 0 | Prob. $\beta_1$= 1 | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | BRAZIL (cont.) | | | | | | |
| 212 | Unibanco | Finance & Insurance | 1999q3-2000q3 | 16.73 | 430.26 | 304.37 | -1.1 | 0.187 | 0.011 | 0 | 0 |
| 213 | | | 2000q3-2001q4 | 11.52 | 228.68 | 284.97 | -1.08 | 0.162 | 0.007 | 0 | 0 |
| 214 | | | 2000q2-2001q4 | 11.78 | 222.69 | 286.29 | -1.4 | 0.041 | 0 | 0 | 0 |
| 215 | | | 2000q3-2001q4 | 8.57 | 164.42 | 287.48 | -1.09 | 0.116 | 0.003 | 0 | 0 |
| 216 | | | 2001q2-2001q4 | 8.47 | 234.14 | 284.54 | -1.22 | 0.249 | 0.036 | 0 | 0 |
| 217 | | | 2002q2-2004q3 | 25.77 | 647.09 | 363.03 | 0.91 | 0 | 0.67 | 1 | 1 |
| 219 | | | 2003q1-2004q3 | 23.57 | 618.04 | 363.03 | 0.95 | 0 | 0.8 | 1 | 1 |
| 220 | | | 2004q1-2004q3 | 15.54 | 457.84 | 483.60 | 0.3 | 0.299 | 0.013 | 0 | 0 |
| 221 | | | 2004q1-2004q3 | 8.66 | 50.52 | 725.43 | -1.02 | 0.002 | 0 | 0 | 0 |
| 222 | Usiminas | Steel & Metals | 2003q4-2004q3 | 8.51 | 39.56 | 427.76 | -1.16 | 0.332 | 0.071 | 0 | 0 |
| | | | | | CHILE | | | | | | |
| 301 | Enersis | Electricity | 2002q3-2002q4 | 44.44 | 327.84 | 203.37 | -1.92 | 0.052 | 0.003 | 0 | 0 |
| 302 | | | 2003q1-2004q3 | 32.01 | 639.78 | 97.93 | 3.41 | 0 | 0.003 | 1 | 1 |
| 303 | | | 2003q1-2004q3 | 24.86 | 132.72 | -40.79 | -1.55 | 0.732 | 0.573 | 0 | 0 |
| 304 | | | 2003q4-2004q3 | 16.67 | 304.43 | 136.78 | 0.32 | 0.793 | 0.579 | 0 | 1 |
| 305 | | | 2003q4-2004q3 | 16.81 | 323.19 | 136.78 | 0.42 | 0.634 | 0.515 | 0 | 1 |
| 307 | Embonor | Food & Beverages | 2002q3-2004q3 | 29.82 | 379.15 | 127.85 | 0.17 | 0.733 | 0.089 | 0 | 1 |

Note. In Column "Sov. Ceiling (a)", the sovereign ceiling hypothesis cannot be rejected (1; while 0 stands for rejection) when β1>0 & Prob. β1=0<0.05 & (Prob. β1=1 >0.05 or (Prob. β1=1<0.05 but β1>1)). In Column "Sov. Ceiling (b)", the Prob. β1=0<0.05 constraint is no longer introduced. Detailed characteristics for each bond can be obtained from Exhibit 13.

**Exhibit 14. Sovereign spread specific slopes and sovereign ceiling test results for the GLS-RE estimator (cont.)**

| Bond Id | Firm | Sector | Available obs. | % of Days with Transactions | Mean Corp. Spread | Mean Corresponding Sorp. Spread | Sov. Spread coeff. ($\beta_1$) | Prob. $\beta_1 = 0$ | Prob. $\beta_1 = 1$ | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | CHILE (cont.) | | | | | | |
| 308 | Andina | Food & Beverages | 2002q3-2004q3 | 44.12 | 474.95 | 87.91 | 1.88 | 0 | 0.008 | 1 | 1 |
| 309 | | | 2003q1-2004q3 | 41.23 | 434.21 | -56.29 | -2.32 | 0.04 | 0.003 | 0 | 0 |
| 310 | | | 2003q1-2004q3 | 34.91 | -381.20 | -2828.01 | 1.02 | 0 | 0.801 | 1 | 1 |
| 311 | Endesa | Electricity | 2003q4-2004q3 | 17.44 | 275.86 | 116.03 | 0.83 | 0.502 | 0.891 | 0 | 1 |
| 312 | | | 2003q4-2004q3 | 17.57 | 264.16 | 142.89 | 0.65 | 0.491 | 0.707 | 0 | 1 |
| 314 | CTC | Telecommunication | 2002q3-2004q3 | 38.29 | 279.31 | 116.76 | 0.36 | 0.265 | 0.046 | 0 | 0 |
| 315 | | | 2002q3-2004q3 | 39.85 | 181.75 | 135.40 | -0.37 | 0.66 | 0.104 | 0 | 0 |
| | | | | | MEXICO | | | | | | |
| 501 | Comercial Mexicana | Whosale & retail trade | 1996q3-1997q2 | 10.29 | 271.25 | 152.43 | 0.59 | 0.314 | 0.486 | 0 | 1 |
| 502 | | | 1999q3-2004q3 | 36.38 | 1352.52 | 197.75 | 2.28 | 0.181 | 0.452 | 0 | 1 |
| 508 | Posadas Gpo | Others | 1997q1-2001q3 | 28.71 | 556.88 | 216.45 | 1.33 | 0.005 | 0.477 | 1 | 1 |
| 511 | Televisa Gpo | Others | 1996q3-1997q3 | 7.73 | 126.99 | 517.11 | -0.22 | 0.045 | 0 | 0 | 0 |
| 512 | | | 2001q3-2004q3 | 25.53 | 84.86 | 190.72 | 0.67 | 0.192 | 0.511 | 0 | 1 |
| 513 | | | 2000q3-2004q2 | 28.68 | 256.84 | 190.72 | 0.59 | 0.244 | 0.425 | 0 | 1 |
| 514 | | | 2002q1-2004q3 | 28.11 | 321.16 | 243.25 | 0.46 | 0.006 | 0.001 | 0 | 0 |
| 515 | | | 2002q2-2004q3 | 25.93 | 297.69 | 243.25 | 0.49 | 0.009 | 0.007 | 0 | 0 |
| 518 | Hylsamex | Steel & Metals | 1997q1-1998q1 | 9.02 | 167.22 | 178.89 | -2.43 | 0.001 | 0 | 0 | 0 |
| 519 | | | 2003q2-2004q3 | 19.62 | 900.32 | 270.99 | 4.52 | 0 | 0 | 1 | 1 |
| 520 | | | 1999q1-2004q3 | 43.18 | 1933.98 | 312.19 | 3.75 | 0 | 0.001 | 1 | 1 |
| 522 | Kimberly Clark Mex | Paper & pap. related prod. | 2001q1-2004q3 | 33.35 | 283.60 | 595.53 | 0.1 | 0.268 | 0 | 0 | 0 |
| 523 | | | 1999q3-2004q3 | 41.39 | 422.58 | 595.53 | 0.28 | 0.014 | 0 | 0 | 0 |

Note. In Column "Sov. Ceiling (a)", the sovereign ceiling hypothesis cannot be rejected (1; while 0 stands for rejection) when $\beta1>0$ & Prob. $\beta1=0<0.05$ & (Prob. $\beta1=1 >0.05$ or (Prob. $\beta1=1<0.05$ but $\beta1>1$)). In Column "Sov. Ceiling (b)", the Prob. $\beta1=0<0.05$ constraint is no longer introduced. Detailed characteristics of each bond can be obtained from Exhibit 13.

**Exhibit 14. Sovereign spread specific slopes and sovereign ceiling test results for the GLS-RE estimator (cont.)**

| Bond Id | Firm | Sector | Available obs. | % of Days with Transactions | Mean Corp. Spread | Mean Corresponding Sorp. Spread | Sov. Spread coeff. ($\beta_1$) | Prob. $\beta_1$= 0 | Prob. $\beta_1$= 1 | Sov. Ceiling (a) | Sov. Ceiling (b) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | MEXICO (cont.) | | | | | | |
| 526 | Vitro | Non-metallic minerals | 2003q4-2004q3 | 17.25 | 893.63 | 180.69 | 2.67 | 0 | 0.001 | 1 | 1 |
| 527 | | | 2003q4-2004q3 | 16.90 | 928.06 | 180.69 | 2.84 | 0 | 0 | 1 | 1 |
| 532 | America Movil | Telecommunications | 2004q1-2004q3 | 14.55 | 184.88 | 177.66 | 0.01 | 0.994 | 0.126 | 0 | 1 |
| 533 | | | 2004q2-2004q3 | 15.13 | 202.19 | 177.66 | 0.07 | 0.923 | 0.181 | 0 | 1 |
| 539 | | | 2004q2-2004q3 | 13.00 | -16.92 | 385.33 | -0.56 | 0.184 | 0 | 0 | 0 |
| 542 | Coca Cola Femsa | Food & Beverages | 1997q3-2004q3 | 54.46 | 263.88 | 390.19 | 0.05 | 0.705 | 0 | 0 | 0 |
| 543 | | | 1996q3-1997q2 | 5.88 | 144.51 | 551.36 | -0.09 | 0.457 | 0 | 0 | 0 |
| 544 | Cemex SA | Non-metallic minerals | 1996q3-1999q4 | 18.78 | 258.82 | 282.70 | 0.17 | 0.393 | 0 | 0 | 0 |
| 545 | | | 1996q3-2000q3 | 23.41 | 259.41 | 236.48 | 0.27 | 0.282 | 0.003 | 0 | 0 |
| 546 | | | 1996q3-1998q1 | 10.81 | 196.18 | 170.73 | -0.06 | 0.834 | 0 | 0 | 0 |
| 547 | | | 1996q3-2001q1 | 29.64 | 253.27 | 215.29 | 0.19 | 0.388 | 0 | 0 | 0 |
| 548 | | | 1996q3-2000q2 | 22.95 | 257.99 | 244.72 | 0.28 | 0.236 | 0.002 | 0 | 0 |
| 549 | | | 2001q2-2004q3 | 31.70 | 216.35 | 84.31 | 0.21 | 0.567 | 0.035 | 0 | 0 |
| 550 | | | 2001q1-2004q3 | 57.14 | 344.34 | 84.31 | 0.41 | 0.273 | 0.11 | 0 | 1 |
| 551 | | | 1999q3-2002q2 | 17.42 | 185.70 | 210.79 | -0.06 | 0.899 | 0.022 | 0 | 0 |
| 552 | | | 2000q3-2004q3 | 35.53 | 306.44 | 295.38 | 0.35 | 0.117 | 0.003 | 0 | 0 |
| 553 | | | 2001q1-2004q3 | 32.14 | 347.09 | 295.38 | 0.4 | 0.021 | 0.001 | 0 | 0 |
| 554 | | | 2000q1-2004q3 | 39.38 | 320.52 | 295.38 | 0.43 | 0.001 | 0 | 0 | 0 |
| 555 | | | 2001q1-2002q3 | 14.62 | 181.69 | 187.38 | -0.21 | 0.81 | 0.157 | 0 | 0 |
| 556 | | | 2000q3-2002q3 | 17.30 | 192.74 | 187.38 | -0.05 | 0.95 | 0.184 | 0 | 0 |
| 557 | | | 1996q3-1997q3 | 7.69 | 265.86 | 519.95 | 0.17 | 0.414 | 0 | 0 | 0 |

Note. In Column "Sov. Ceiling (a)", the sovereign ceiling hypothesis cannot be rejected (1; while 0 stands for rejection) when β1>0 & Prob. β1=0<0.05 & (Prob. β1=1 >0.05 or (Prob. β1=1<0.05 but β1>1)). In Column "Sov. Ceiling (b)", the Prob. β1=0<0.05 constraint is no longer introduced. Detailed characteristics of each bond can be obtained from Exhibit 13.

**Exhibit 15: Bivariate (credit-quality corrected) years to maturity coefficient distribution. Whole sample kernel density estimates**

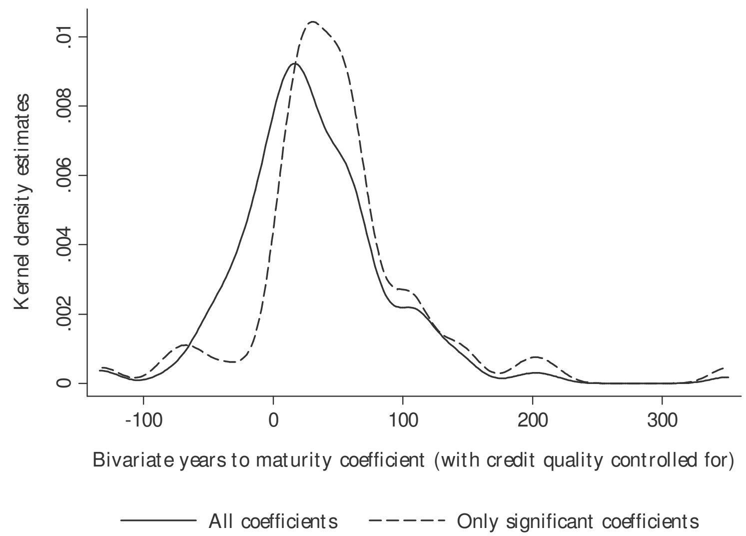



**Exhibit 16: Descriptive statistics for Bivariate years to maturity coefficients when credit quality has been completely controlled for**

| Significance level | Average coefficient | Average number of obs. by equation | Total number of observations |
|---|---|---|---|
| Non-significant coefficients | 28.02 | 4.06 | 94 |
| Significant coefficients at 10% | 37.30 | 4.46 | 24 |
| Significant coefficients at 5% | 122.06 | 4.71 | 24 |
| Significant coefficients at 1% | 106.17 | 6.20 | 25 |
| All coefficients | 83.91 | 4.53 | 167 |