Why Do Emerging Markets Borrow Short Term?

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Abstract

This paper argues that the investor side of capital markets is important to understand why emerging markets borrow short term. We present a model where the risk premia on short- and long-term debt and the optimal maturity structure are jointly determined. The model shows that high risk premia on long-term bonds can lead countries to rely on short-term debt at the expense of more likely rollover crises. Using a new database on sovereign bonds, we find evidence consistent with the model predictions. Emerging market bonds carry a substantial risk premium over comparable risk-less bonds and this risk premium is higher for long-term bonds. During crises, both risk and term premia increase, and bond issues shift toward shorter maturities.

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1 Introduction

During the last two decades, international capital markets have become much more integrated than at any other time in history.[1] This integration has been characterized by a sharp increase in the size and volatility of capital flows, which were associated with a number of financial crises, especially in emerging markets.[2] Several authors have argued that the volatility of capital flows reflects serious imperfections in financial markets, and that these imperfections play an important role in the severity and contagious nature of crises.[3]

Among the factors that explain the susceptibility of emerging economies to financial crises, a crucial one is the mismatch between the maturity of assets and liabilities. In particular, when countries rely excessively on short-term capital inflows relative to their ability to generate cash on short notice, they become vulnerable to sudden reversals of capital inflows and, consequently, to liquidity crises. For example, large amounts of short-term debt had been accumulated by governments prior to the crises of Mexico 1994, Russia 1998, and Brazil 1998, and by the private sector in Indonesia, South Korea, and Thailand before the East Asian crisis.[4] Based on these experiences, some authors have claimed that the ratio of short-term liabilities over liquid assets (e.g. international reserves) can explain why some countries suffer crises while others do not. They conclude that countries can decrease their vulnerability to capital inflow reversals by lengthening the maturity structure of liabilities.[5]

Why do countries rely so heavily on short-term borrowing despite its associated risks? Traditionally, the literature has addressed this question by focusing on the debtor side. In particular, several authors have argued that short-term debt can alleviate moral hazard problems. The early literature, such as Calvo (1988) and Blanchard and Missale (1994), focused on the government incentives to lower the real value of public debt by creating inflation. These papers showed that

[1] One possible exception is the period of high integration during the late nineteenth and early twentieth century. See Frankel (2000) and Obstfeld and Taylor (2002).

[2] See Calvo and Reinhart (2000), Mishkin (2001), and Mendoza (2002).

[3] See Calvo and Mendoza (2000), Kaminsky and Reinhart (2000), Caballero and Krishnamurthy (2001), and Chang and Velasco (2001).

[4] For example, according to central bank sources, the average maturity of outstanding government bonds in Brazil was 1.7 years in 1998. While in the case of South Korea and Thailand, different reports show that short-term debt (maturing at most in five years) was 97 and 60 percent of total corporate bonds outstanding in 1997.

[5] See Cole and Kehoe (1996), Sachs, Tornell, and Velasco (1996), Furman and Stiglitz (1998), Obstfeld (1998), Radelet and Sachs (1998), Corsetti, Pesenti, and Roubini (1999), Eichengreen and Hausmann (1999), and Feldstein (1999).

this incentive is higher when debt is non-indexed, in domestic currency, and of long-term nature. More recent work by Rodrik and Velasco (1999) and Jeanne (2000) show that opportunistic governments have less incentives to default on their debt and more incentives to carry out revenue-raising reforms when they have to meet early debt repayments. In this context, short-term debt serves as a commitment device for the borrower.

In this paper, we propose an alternative explanation to why countries rely on short-term debt that focuses on the investor side. In particular, we emphasize the role of frictions that arise when bond holders are specialized investors subject to liquidity shocks. In this context, we argue that borrowers pay a risk premium on their debt and, as a result, the cost of borrowing affects their decision of debt maturity structure. To support this, we show that emerging market debt does in fact pay a substantial risk premium over comparable risk-less debt and that this risk premium is much higher for long-term debt than for short-term debt. Consequently, emerging economies face higher borrowing costs on long-term debt than on short-term debt, which gives them incentives to borrow short term.[6]

The paper shows the importance of the investor side by presenting a model and empirically testing its implications. The model assumes that a government borrows to finance a long-term "project," by selling short- and long-term bonds to specialized investors. We show that in the presence of investor side frictions, the expected return on long-term bonds is higher than on short-term bonds because investors demand a higher risk premium on long-term bonds to compensate for their associated "price risk." As a result, the government faces a trade-off in the choice of debt maturity. On the one hand, by issuing short-term bonds the government decreases the expected cost of servicing the debt. On the other hand, by issuing short-term bonds the government increases the likelihood and cost of a rollover crisis. The model allows us to analyze the joint behavior of the risk premium on short- and long-term bonds and the optimal debt maturity structure. Interestingly, the predictions of the model depend on whether crises are mostly characterized by a deterioration in the liquidity position of investors or by a deterioration in the fundamentals of the country. In the former case, the risk premium and the term premium (the difference between the risk premium on

[6] By cost of borrowing we refer to the expected net present value of debt repayments for every dollar borrowed as opposed to contractual yields. This distinction is important because emerging markets sometimes default on their debts. Chang and Velasco (2000) also make this distinction in a model where short-term debt is contractually cheaper than long-term debt, although not in a net present value sense.

long-term bonds and that on short-term bonds) increase during crises, while bond issuance shifts to shorter maturities. When crises are due to changes in fundamentals, the risk premium and term premium still increase, but bond issuance shifts to longer maturities.

To test the predictions of the model, we construct a new database on bond prices and bond issuances for a number of emerging markets since the early 1990s, using a variety of sources. We use the price data to estimate time series of sovereign spread curves; this allows us to calculate bond returns at different maturities. We find that risk premia, measured as the excess returns of holding emerging market bonds relative to comparable risk-less German or U.S. bonds, are close to zero in tranquil times. However, both risk premia and term premia increase substantially during periods of financial turbulence. With respect to quantities, we find evidence that countries issue relatively more short-term debt during periods of financial turmoil and wait for tranquil times to issue long-term debt. As a consequence, the average maturity shortens during crises. Overall, the evidence is strongly suggestive of the importance of investor side factors in the determination of borrowing costs at different maturities and the choice of debt maturity structure.

The paper is organized as follows. Section 2 presents a model that highlights the trade-off between issuing cheaper short-term debt and issuing long-term debt. Section 3 describes the data. Section 4 studies the behavior of bond returns at different maturities. Section 5 analyzes the pattern of long- and short-term debt issuance. Section 6 concludes.

2 The Model

In this section, we present a model of the joint determination of the risk premium on short- and long-term bonds and the optimal maturity structure. The model is composed of the government of country A, which is borrowing in international capital markets, and a set of international investors of mass 1.[7] We assume that international investors have limited wealth and face idiosyncratic liquidity shocks. These two assumptions make investors sensitive to the price risk associated with long-term debt and make short-term borrowing cheaper for the government.[8] On the other hand,

[7] In the presentation of the model we refer to bond holders as international investors, but the results apply more generally to any environment where the government cares about borrowing costs. It is simplest to model bond holders as international investors because in that case their utility does not enter the government objective function.

[8] For a discussion on the type of environment where price risk matters, see Holmström and Tirole (2001).

short-term debt exposes the country to costly rollover crises. The optimal maturity structure is determined by the trade-off between the cost of long-term debt and the cost of a rollover crisis. The model shows that a crisis can be triggered both by a deterioration in the country's ability to repay and by a deterioration in the balance sheet of international investors. In both cases risk premia increase, however in the first case the optimal debt structure shifts towards longer maturities while in the second case it shifts towards longer maturities.

Debtor country

There are three periods, dated 0, 1, and 2. In period 0, the government must borrow D_0 in order to finance old debt coming to maturity. The government can sell either short-term (1-period) or long-term (2-period) bonds. In period 1, the government pays the short-term bonds issued in period 0 by issuing new short-term debt and by generating short-term "emergency" revenue. In period 2, the government generates "regular" revenue, pays back maturing long- and short-term bonds, and consumes the residual (i.e. uses it to reduce taxation or for public spending). We abstract from strategic default by assuming that the government repays its debts whenever feasible.[9]

The government's budget constraint in period 0 is

$$D_0 = p_S D_S + p_L D_L$$

where D_S and D_L are the amount of short-term and long-term bonds issued in period 0, and p_S and p_L are their respective prices.

In period 1, the government has to roll over an amount D_S of short-term bonds. The government's budget constraint in period 1 is

$$D_S = p_{S,1} D_{S,1} + X$$

where $D_{S,1}$ is short-term debt issued in period 1, $p_{S,1}$ is its price, and X are government revenues in period 1. Short-term debt issued in period 1 is junior to existing long-term debt. In order to

[9] We are implicitly assuming the existence of costs of default. These costs can be reputational, or involve direct interference by creditors on debtors' transactions in international goods and capital markets. (See Bulow and Rogoff 1989 for a discussion of the latter.)

generate an amount $X > 0$ of revenues in period 1, the government has to resort to emergency finance which entails an additional cost $C(X)$. We will assume that the government faces the convex cost of emergency finance

$$X + C(X) = X + \frac{\kappa_g}{2} X^2$$

The cost incorporates the inefficiencies associated with raising resources too soon, and can be thought of as arising from the premature liquidation of long-term projects (for example, through excessive taxation). It is assumed that the cost of emergency finance affects the country's welfare, but does not affect the availability of resources in period 2. We assume that the costs of default are large enough so that the country never defaults in period 1.

In period 2, the government revenue is $\tilde{Y}$, which is a random variable that takes the value Y in the good state and 0 otherwise. The extreme case of zero realization in the bad state simplifies the analysis since in equilibrium there is no partial default. As of period 0, the probability of the good state is π_0. In period 1 a shock is realized that affects the probability of the good state, the updated probability is denoted by π. As of period 0, π is a random variable distributed on $[\underline{\pi}, \overline{\pi}]$ according to the distribution F, which satisfies $\pi_0 = \int \pi \, dF(\pi)$.

The government maximizes the objective function

$$W = E\left[\max\left\{\tilde{Y} - D_L - D_{S,1}, 0\right\} - X - C(X)\right]$$

where the first term accounts for the resources that can be consumed by the country's residents in period 2 (i.e. output minus debt payments) minus the costs incurred in order to raise revenue in period 1.

We make the following assumption regarding initial government liabilities.

Assumption 1. *(Government solvency) The government resources satisfy*

$$\pi_0 Y > D_0.$$

Investors

Investors have initial wealth w_0 and consume only in the final period. In periods 0 and 1, they trade three assets: an international risk-free asset which is offered at exogenous price 1 (e.g. U.S. treasury bills) and short- and long-term bonds issued by country A. Investors preferences are given by

$$E\left[u\left(c_2\right)\right]$$

and the utility function is given by

$$u\left(c_2\right)=c_2-\frac{\kappa}{2}\left(c_2^{-}\right)^2$$

where c_2 is consumption in period 2 and c_2^{-} denotes the negative part of c_2.

These preferences are meant to represent a risk-neutral investor with limited resources that faces a convex cost associated to financial losses, $c_2<0$. This cost may be associated to the issuance of equity or other sources of outside finance or to the liquidation of other projects to finance the losses.

The investor budget constraint is:

$$\begin{aligned}
&b_0+p_S d_S+p_L d_L=w_0\\
&b_1+p_{S,1}d_{S,1}+p_{L,1}d_{L,1}=b_0+d_S+p_{L,1}d_L-a\\
&c_2=\iota_{(\tilde{Y}=Y)}(d_{S,1}+d_{L,1})+b_1
\end{aligned}$$

where the b's denote holdings of the international risk-free bond, the d's denote holdings of the risky bonds issued by country A, the p's denote bond prices, and $\iota_{(\tilde{Y}=Y)}$ is an indicator variable. Short-term debt issued by country A in period 0 is risk-less as the government always generates emergency finance to pay back in period 1. On the other hand, long-term debt issued in period 0 is risky as its price $p_{L,1}$ depends on the realization of π. In the second period investors are hit by an idiosyncratic liquidity shock captured by the variable a. The liquidity shock is a random variable distributed according to the CDF G on $[0,A]$. The shock is purely idiosyncratic so G corresponds to the cross sectional distribution of the shock across investors. The liquidity shock is uninsurable and stands to represent gains and losses made by the individual investor on other investments or the presence of alternative investment opportunities in period 1. Finally, in period 2 investors face default risk associated to the realization of $\tilde{Y}$.

This setup captures the idea of specialized investors with limited wealth, subject to liquidity shocks that induce them to sell long-term bonds before maturity. The higher an investor's initial wealth w_0, the more her behavior resembles that of a risk-neutral investor. In particular, if the value of her portfolio is larger than or equal to a with probability 1, she acts as a risk-neutral agent.

The presence of liquidity risk makes price risk costly for investors in period 1. If there is a representative investor then the volatility of $p_{L,1}$ in the intermediate period is irrelevant, because each investor has a zero net trade of long-term bonds. In presence of liquidity risk, instead, the volatility of $p_{L,1}$ is costly for investors as it determines at what price they are able to sell their stock of long-term bonds in the event of a high liquidity shock. A crucial ingredient on the investor side is that the volatility of the price of long- term bonds in period 1 has relevant wealth effects. A growing literature has stressed the role of wealth effects of this type in understanding amplification and liquidity effects during crises.[10] These wealth effects can be modeled by introducing other forms of heterogeneity in the model. For example, one can introduce a negatively sloped demand from "long-term" investors, who buy the risky asset from distressed intermediaries. The introduction of a non-insurable liquidity shock is a simple way of adding heterogeneity.

Finally, we assume that

Assumption 2. *(Risk-neutral aggregate investor in period 1) Investors resources satisfy*

$$w_0 \geq D_0 + E\left[a\right].$$

This assumption guarantees that in equilibrium investors with a small liquidity shock always have $c_2 > 0$, so that the price of the risky bonds in period 1 is determined at the margin by these investors. In short, this assumption implies that the aggregate investor is risk neutral in period 1. This is a simplifying assumption that makes risk premia equal to zero in period 1 and allows us to focus on prices and risk premia in period 0.

[10] See for example Grossman and Zhou (1996) and Kyle and Xiong (2001).

2.1 Equilibrium

We solve the model in two steps. First, we take the maturity structure as given (namely we fix D_L) and find equilibrium bond prices. Then, we characterize the maturity structure that maximizes the government objective function.

Under assumption 2, the price of long- and short-term bonds in period 1 is determined at the margin by unconstrained investors, therefore risky bonds trade at their risk-neutral price in period 1. This is established in Lemma 1 in the Appendix. Given that long-term debt is senior, the maximum amount the government can raise in period 1 is equal to $\pi(Y - D_L)$. As a consequence, if $D_{S,1} > Y - D_L$ the price $p_{S,1}$ will adjust so that $p_{S,1}D_{S,1} = \pi(Y - D_L)$. Therefore, we can safely make the normalization

$$D_{S,1} \leq Y - D_L$$

which implies that long- and short-term debt in period 1 always trade at the same price

$$p_{L,1} = p_{S,1} = \pi.$$

Given these prices an investor with a high liquidity shock $a > b_0 + d_S + \pi d_L$ finds it optimal to liquidate all her holdings of emerging market bonds and to set

$$c_2 = b_0 + d_S + \pi d_L - a.$$

This follows from the fact that these investors face payoffs in the risk averse region of their utility function and risky emerging market bonds are traded at the risk-neutral price π.

As of period 0 all investors are identical, therefore in equilibrium we have

$$\begin{aligned} d_S &= D_S \\ d_L &= D_L \\ b_0 &= B_0 \equiv w_0 - p_S D_S - p_L D_L. \end{aligned}$$

The first order conditions for the investors' portfolio problem in period 0 are

$$\begin{aligned}
\lambda &= E\left[\left(1+\kappa\left(a-w_0+\left(p_L-\pi\right)D_L\right)^{+}\right)\right] \\
\lambda p_S &= E\left[\left(1+\kappa\left(a-w_0+\left(p_L-\pi\right)D_L\right)^{+}\right)\right] \\
\lambda p_L &= E\left[\left(1+\kappa\left(a-w_0+\left(p_L-\pi\right)D_L\right)^{+}\right)\pi\right]
\end{aligned}$$

where λ is a Lagrange multiplier. From these conditions we obtain $p_S = 1$ and

$$p_L = \frac{E\left[\left(1+\kappa\left(a-w_0+\left(p_L-\pi\right)D_L\right)^{+}\right)\pi\right]}{E\left[1+\kappa\left(a-w_0+\left(p_L-\pi\right)D_L\right)^{+}\right]} \tag{1}$$

which gives the price of the long-term bonds p_L for a given level of D_L. We can also rewrite (1) in terms of the risk premium $\pi_0 - p_L$

$$\pi_0 - p_L = -\kappa E\left[\left(\pi-p_L\right)\left(a-w_0-\left(\pi-p_L\right)D_L\right)^{+}\right]. \tag{2}$$

The following proposition shows that the risk premium is positive and increasing in the stock of long-term debt D_L.

Proposition 1. *The equilibrium price of long-term bonds p_L is given by the function $p\left(D_L\right)$ defined implicitly by (1). The function p is non-increasing and it satisfies $p\left(D_L\right) \leq \pi_0$; the latter holds as an equality iff $\Pr\left[a+\left(p_L-\pi\right)D_L > w_0\right] = 0$.*

An essential feature of the model is that the period-1 price of long-term debt $p_{L,1} = \pi$ is volatile due to shocks to expected revenues. Since investors are hit by liquidity shocks, they may need to liquidate their holdings of long-term bonds at the price π. As a result, holding long-term bonds between periods 0 and 1 is riskier than holding short-term debt for investors. A larger level of D_L increases the exposure of investors to price risk and reduces the price at which they are willing to purchase long-term debt in period 0.

We turn now to the choice of D_L by the government and consider four cases. Depending on the parameters of the model we can have or not a positive risk premium and a positive probability of a liquidity crisis. We distinguish four cases depending on the model parameters. In particular, we consider investors wealth, w_0, and the government revenue in the good state, Y. When w_0 is above a given threshold there is no risk premium in period 0, while when Y is above a given threshold there are no costly rollovers. In each case, we derive the relation between the risk premium and the stock of long-term debt and we derive the optimal debt maturity structure.

Case I: No price risk, no liquidity crises

Suppose that the following two conditions hold

$$w_0 \geq A + \frac{\pi_0 - \underline{\pi}}{\pi_0} D_0 \quad \text{(I.a)}$$

$$Y \geq D_0 / \underline{\pi}. \quad \text{(I.b)}$$

Then, the equilibrium price of long-term debt in period 0 is

$$p_L = \pi_0 \quad (3)$$

independently of the maturity structure. The first condition ensures that investors' wealth is high enough that they can withstand any liquidity shock for any realization of π and for any level of long-term debt. Since the value of investors' portfolio satisfies

$$w_0 + (\pi_0 - \pi) D_L - a > 0$$

for any $D_L \in [0, D_0/\pi_0]$, the pricing equation (3) follows directly from proposition 1.

The second condition ensures that the government is able to roll over short-term debt at no cost. The government can issue any combination of short and long-term bonds such that $\pi_0 D_L + D_S = D_0$ and all short-term bonds are rolled over in period 1 by issuing an amount $D_{S,1} = \frac{1}{\pi} D_S$ of new short-term bonds. The second inequality guarantees that the equilibrium entails $X = 0$ in all states, irrespective of the maturity structure. To see this notice that the second inequality, together with the no-arbitrage condition $p_L \geq \underline{\pi}$, implies

$$\underline{\pi} (Y - D_L) \geq D_0 - p_L D_L = D_S$$

for all D_L. Therefore, in period 1 the government is always able to roll over short-term bonds at no cost.

Since the term premium is zero and the probability of a rollover crisis is zero it is immediate to prove the following.

Proposition 2. *If conditions I.a and I.b are satisfied, then the term premium is zero and the government is indifferent among all maturity structures that satisfy* $\pi_0 D_L + D_S = D_0$. *For all maturity structures the government payoff is equal to* $W_1 = \pi_0 Y - D_0$.

Case II: Price risk

Consider now the case in which

$$w_0 < A + \frac{\pi_0 - \underline{\pi}}{\pi_0} D_0 \tag{II.a}$$

$$Y \geq D_0/\underline{\pi}. \tag{II.b}$$

The second inequality still guarantees that the government is able to roll over any amount of short-term bonds at no cost. On the other hand, according to condition II.a, investors' wealth is now not large enough to avoid financial losses for investors in period 1. Therefore investors need to be compensated *ex ante* for the price risk associated with holding long-term bonds. Now we can distinguish two sub-cases. If $w_0 < A$ then the risk premium is positive for any level of D_L, that is $p_L < \pi_0$ for any D_L. If $w_0 \geq A$ then the risk premium is zero if the stock of long-term debt is small enough, namely if $D_L \leq \frac{w_0 - A}{\pi_0 - \underline{\pi}}$. However if $D_L > \frac{w_0 - A}{\pi_0 - \underline{\pi}}$ then we still have a positive risk premium in equilibrium.

The government's payoff in equilibrium is equal to

$$W = \pi_0 Y - D_0 - (\pi_0 - p_L) D_L \tag{4}$$

and the following proposition follows immediately.

Proposition 3. *If conditions II.a and II.b are satisfied, the government's optimal payoff is equal to* $W_1 = \pi_0 Y - D_0$. *If* $w_0 < A$ *then the optimal level of long-term debt is* $D_L = 0$ *and at the optimal debt structure the "shadow" risk premium is positive. If* $w_0 > A$ *then any* $D_L \in \left[0, \frac{w_0 - A}{\pi_0 - \underline{\pi}}\right]$ *is optimal and at the optimal debt structure the risk premium is zero.*

This case illustrates that in this environment the price risk associated with holding long-term bonds makes long-term borrowing expensive for the government. If the government relies too heavily on long-term debt, long-term debt will sell at a positive risk premium. This implies that the government will face an expected cost of $\pi_0/p_L > 1$ for every dollar of long-term finance raised. On the other hand, by rolling over short-term debt the government faces an expected cost of 1 for every dollar of short-term finance raised. Since expected revenue Y is large enough, the government can use all short-term finance with no risk of a rollover crises.

Case III: Liquidity crises

Next, we consider the case in which price risk does not affect the investors' valuation of long-term debt but rollover crises can arise.

$$w_0 \geq A + \frac{\pi_0 - \underline{\pi}}{\pi_0} D_0 \quad \text{(III.a)}$$

$$Y < D_0/\underline{\pi}. \quad \text{(III.b)}$$

In this case, as in case I, long-term bonds always trade at the risk-neutral price $p_L = \pi_0$.

However, if the government issues too much short-term debt it faces a liquidity crisis with positive probability, and $X > 0$. Since the maximum amount of funds the government can raise in period 1 is $\pi(Y - D_L)$, the government is forced to set $X > 0$ whenever $D_S > \pi(Y - D_L)$. Then, the government incurs the welfare cost $C(X)$, where X is given by:

$$\begin{aligned} X &= D_S - \pi (Y - D_L) = \\ &= D_0 - p_L D_L - \pi (Y - D_L) = \\ &= D_0 - \pi Y + (\pi - p_L) D_L \end{aligned} \quad (5)$$

The government's objective function now includes a term for the costly rollover and takes the form

$$W = \pi_0 Y - D_0 - (\pi_0 - p_L) D_L - E[C(X)] \quad (6)$$

The term $(\pi_0 - p_L) D_L$ is equal to zero thanks to condition III.a. Therefore, the government can set D_S small enough so that the last term is also equal to zero. The next proposition follows immediately.

Proposition 4. *If conditions III.a and III.b are satisfied, the risk premium is zero and the government is indifferent among all maturity structures with* $0 \leq D_S \leq \underline{\pi}\frac{\pi_0 Y - D_0}{\pi_0 - \underline{\pi}}$. *The government's optimal payoff is equal to* $W_1 = \pi_0 Y - D_0$.

Case IV: Price risk and liquidity crises

Finally, we consider the case in which both the risk premium is positive and liquidity crises can arise:

$$w_0 < A + \frac{\pi_0 - \underline{\pi}}{\pi_0} D_0 \tag{IV.a}$$

$$Y < D_0/\underline{\pi}. \tag{IV.b}$$

Now the government's objective function takes the form (6) but in this case the government cannot set the last two terms equal to zero.

In this case, the optimal maturity structure may involve the use of both short- and long-term debt. The first order condition for the government optimal maturity problem is

$$\frac{\partial W}{\partial D_L} = \left(p(D_L) - \pi_0 + p'(D_L)D_L\right) + \kappa_g E\left[-X\frac{dX}{dD_L}\right] = 0.$$

The first term is negative and reflects the presence of a positive risk premium due to condition IV.a. The second term is typically negative and reflects the presence of a positive probability of a costly rollover.[11]

The government faces a trade-off between liquidity crises and costly long-term debt and we can have an interior solution for the maturity structure. If the government chooses to set $D_L = 0$, it will use only short-term finance that carries a zero risk premium but will face a high probability

[11] The explicit expression for the derivative $\frac{dX}{dD_L}$ is

$$\frac{dX}{dD_L} = \pi - p(D_L) - p'(D_L)D_L$$

The second term may be negative for some values of D_L if the elasticity of $p(.)$ is very large. In that case we can have a corner solution at $D_L = 0$.

of a liquidity crisis in period 1, when a large stock of short-term debt is to be rolled over. On the other hand, if the government chooses to set $D_S = 0$ it will be able to roll over short-term debt in the intermediate period but will sell long-term debt at a large discount. The optimal maturity structure balances the costs of a liquidity crisis with the costs of issuing long-term debt.

The problem can be interpreted in terms of risk sharing among investors and risk sharing between the government and investors. Investors hit by the liquidity shock can partially cover their losses by unloading their portfolio of country A debt. If country A debt is mostly long-term, this strategy is risky because the value of their portfolio will be very volatile, while if country A debt is mostly short-term it provides better liquidity to investors. Therefore a high stock of short-term debt provides better risk sharing among investors.

Country A wants to cater to the liquidity needs of international investors. However, by offering them a very liquid short-term asset the country exposes itself to the risk of a liquidity crisis. Since the government faces convex costs of emergency finance the optimal maturity structure allocates the costs among the two parties. Comparing expressions (2) and (5) we see that the amount of long-term debt D_L determines the allocation of the portfolio loss $(\pi - p_L) D_L$ between the government and the liquidity-constrained investors.

A simple example to analyze arises when a and π are binary random variables. Let a take the values $\{0, A\}$ with probabilities $\{1-\alpha, \alpha\}$ and π take the values $\{\underline{\pi}, \overline{\pi}\}$ with probabilities $\{1-\beta, \beta\}$. Suppose that the optimal maturity structure implies that liquidity crises happen with positive probability. In this case we can write the objective function of the government as

$$\pi_0 Y - D_0 - (1-\beta)\,\alpha\kappa L\,(A - w_0 + L) - (1-\beta)\,\frac{1}{2}\kappa_g\,(D_0 - \underline{\pi}Y - L)^2$$

where

$$L \equiv (p_L - \underline{\pi}) D_L$$

is the financial loss on long-term debt in the bad state. This simple case makes it clear that the optimal maturity structure is chosen to optimally allocate the cost of the financial loss L between country A and outside investors.

The optimum can then be characterized in terms of L,[12]

$$L^* = \frac{1}{\kappa_g + 2\alpha\kappa} \left(\alpha\kappa \left(w_0 - A \right) + \kappa_g \left(D_0 - \underline{\pi} Y \right) \right).$$

The optimal allocation of the financial loss among the investors and the government depends on the relative wealth of the government and of the international investors. When investors' wealth is higher the optimal L is larger, as investors are willing to bear a larger financial risk. When the country's wealth Y is larger the optimal L is smaller, as the costs of a rollover crisis are smaller and the country is willing to bear more of the financial risk.

2.2 Demand and supply side crises

The four cases discussed above are summarized in Figure 1, where they are represented in the (w_0, Y) space.[13] This figure is useful to discuss two type of crises that can arise in our model and generate an increase in term premia: a supply side crisis, driven by a deterioration in the investors' balance sheet (i.e. a reduction in w_0), and a demand side crisis driven by a deterioration in the revenue prospects for country A (i.e. a reduction in Y).[14]

We can think of a supply side crisis as moving the economy from region III to region IV in the parameter space. In region III, the term premium is zero and 100 percent long-term financing is optimal since international investors are willing to bear the price risk associated to the shocks to π. However, when the economy moves to region IV the government faces a positive term premium and shifts to shorter maturities. This increases the risk of a rollover crisis, but the costs of the rollover crisis are balanced by the savings in terms of cheaper short-term financing.

On the other hand, we can think of a demand side crisis as moving the economy from region II to region IV. In region II, the term premium is zero but it is optimal for the government to issue

[12] We have an interior solution provided that the parameters satisfy:

$$0 < L^* < \left(p \left(D_0/\pi_0 \right) - \pi \right) D_0/\pi_0.$$

.

[13] In Figure 1 and in the discussion below, we assume for simplicity that $w_0 > A$. If investors wealth w_0 falls more than that, the term premia would be positive even in region II. However, the government would not issue any long-term debt in that case. Furthermore, the discussion below would not be affected by considering this case.

[14] By supply and demand, we mean the supply and demand of funds in the international capital markets: international investors are on the supply side and country A is on the demand side.

mostly short-term debt in order not to expose investors to price risk. Since the revenue prospects are high this entails no risk of a rollover crisis. A deterioration of the country fundamentals moves the economy to region IV. Now the government faces the risk of a rollover crisis and prefers to issue more long-term debt to reduce this risk. This comes at a cost because an increase in the supply of long-term debt makes the term premium positive.

The two types of crises have the same prediction with respect to term premia, but opposite predictions with respect to debt maturity. In a supply side crisis the term premia increases while the average debt maturity shortens. In a demand side crisis the term premia also increases but the average maturity of debt lengthens.

In a richer dynamic model, international investors would be holding an existing stock of debt of various maturities at all points in time. Therefore, shocks to expected government revenue would also affect the wealth of investors on the supply side of the model. In that case, crisis would be characterized by simultaneous changes on the demand and on the supply of funds in international capital markets. The effect on the term premia would always be positive. However, the effect on the maturity structure would depend on which of the two sides dominates. As we will see in the empirical section, crises are typically associated with larger risk premia and a shift towards shorter maturities. This type of comovement supports the idea that a negative shock to investors' balance sheets plays an important role in emerging market crises.

3 Data

To perform the empirical analysis, we collect data on sovereign bonds from the early 1990s up to 2003 for a group of emerging markets, Germany, and the U.S. Bonds issued by Germany and the U.S. are assumed to be default risk-free. We only use sovereign bonds because they constitute the most liquid debt instrument in most countries, with private debtors in emerging markets issuing too few bonds to study spreads at different maturities.

The emerging markets in the sample are Argentina, Brazil, Colombia, Mexico, Russia, Turkey, Uruguay, and Venezuela. The number of emerging markets is constrained by data limitations. To estimate spread curves, we need enough bonds of different maturities at each point in time. As a consequence, we use only emerging markets that borrowed significantly from capital markets during the last decade and, therefore, generated a rich pool of bonds.

We collect different types of bond data to study both bond prices and bond issuance. We gather weekly time series of (end-of-week) bond prices, using as many bonds as possible for each country during the sample period under study. To select these data, we eliminate the observations where bond prices do not change over time, as this typically reflects no trading. We also collect other information on these bonds, including currency denomination, coupon structure, and maturity. In addition, we compile time series of bond issuance in foreign currency. For each bond, we collect the amount issued, the currency denomination, and the maturity date. With this information, we construct weekly time series of amount issued valued in U.S. dollars. We exclude from the sample the bonds with collateral and special guarantees, such as collateralized Brady bonds and those issued by Argentina during the large pre-default swap. We also exclude bonds issued during forced restructurings, like those issued by Russia and Argentina post default.[15] We collect data from three different sources: Bloomberg, Datastream, and J.P. Morgan.

We restrict the sample to bonds denominated in foreign currency, since it is not possible to construct spread curves mixing domestic and foreign currency bonds due to different default properties. Moreover, we want to abstract from the effects of inflation and exchange rate dynamics on bond prices. This reduces the sample significantly, given that most countries (especially Asian and Eastern European ones) mainly issue domestic currency bonds. We just use bonds denominated in Deutsche marks, U.S. dollars, and euros for our estimations of bond prices; but this is not very restrictive as most foreign currency bonds are issued in these currencies. As benchmarks for spreads, we use bonds issued by Germany for Deutsche mark and euro bonds, and bonds issued by the U.S. for dollar bonds. We use bonds in all foreign currencies for our estimations of bond issuance.

Table 1 lists the countries in the sample, along with the time periods used to estimate spread curves and the time periods used to estimate bond issuance activity. The bond data used to estimate prices start in April 1993, with varying starting dates, but all ending in May 2003. The quantity data cover a longer time span, starting in January 1990 and ending in December 2002. Table 1 also displays the number of bonds available to calculate bond prices and the number of bonds issued during the sample period. For the data on prices, the table shows the average minimum maturity, maximum maturity, and 75th percentile. Though most bonds have a maturity of less than 15 years,

[15] See Duffie, Pedersen, and Singleton (2003) for more details on the Russian default.

the countries in the sample have been able to issue long-term bonds with maturity of 20 and 30 years. The bottom panel of Table 1 displays the average amount issued by maturity, showing that issuance is distributed across maturities.[16] Appendix Table 1 lists all the bonds used in the paper, specifying for each bond its characteristics and whether it is used for the price and/or quantity part. The total number of emerging market bonds used in the paper is 466, while the total number of bonds is 746.

4 Analysis of bond returns

In this section, we analyze the behavior of bond prices. Our interest lies in understanding the behavior of the risk premia at different maturities. As mentioned above, we measure the risk premia using excess returns, defined as the returns of emerging market bonds relative to risk-free bonds of similar characteristics. To study how the risk premia vary by maturity, we use the excess term premia, defined as the returns of holding long-term bonds over short-term bonds in excess to the returns of holding long-term risk-free bonds over short-term risk-free bonds. In other words, the excess term premium is the difference between long-term and short-term excess returns.

The aim of this section is to analyze whether average excess returns and excess term premia are positive and whether they vary during crises and, more generally, in periods of high spreads. This type of evidence would be consistent with the model presented above.

To construct excess returns (and term premia), it is convenient to estimate bond spread curves, with spreads defined as yields over risk-free yields. These curves allow us to obtain bond prices (and returns) at every maturity for every country, making cross-country and cross-maturity comparisons possible. This is important because each country has a different set of bonds at each point in time with a varying maturity structure, so obtaining time series of excess returns of certain maturities across countries would be impossible using the raw data. Before analyzing excess returns and excess term premia, we describe how we estimate spread curves.

[16] Note that the outstanding stock of bonds would show a different picture, as countries rollover short-term debt more frequently, increasing the amount issued at short maturities over the sample period.

4.1 Spread curves

To estimate spread curves, we follow a modified version of the procedure originally developed by Nelson and Siegel (1987). Let $\hat{P}_{j,t}$ be the estimated price at time t of bond j, which equals the present value of all promised future payments, $C_{j,t+\tau}$, at time $t+\tau$. These payments include all coupons and principal. The estimated price can then be written as

$$\hat{P}_{j,t}\left(\bar{a}_t\right) = \sum_{\tau=1}^{\infty} e^{-y_{t,\tau}(a_t)\tau} C_{j,t+\tau},$$

where $e^{-y_{t,\tau}(a_t)\tau}$ is the corresponding discount rate and $y_{t,\tau}$ is the associated estimated yield.

The methodology parametrizes yields as

$$y_{t,\tau}(\bar{a}_t) = a_{t,0} + a_{t,1}\left(\frac{1-e^{-a_{t,3}\tau}}{a_{t,3}\tau}\right) + a_{t,2}\left(\frac{1-e^{-a_{t,3}\tau}}{a_{t,3}\tau} - e^{-a_{t,3}\tau}\right),$$

where $\bar{a}_t \equiv (a_{t,0}, ..., a_{t,3})$.

This type of approximation has important advantages. The approximation is parsimonious and gives a good fit of the data. Moreover, the approximation can be interpreted as having three components. The constant can be thought as a long-term, level component. The second term can be viewed as a short-term component as it starts at 1 and decays monotonically and quickly to 0. The third term can be interpreted as a "hump" or medium-term component, which starts at 0, increases, and then goes to 0. Small values of $a_{t,3}$ generate a slow decay and can better fit the curve at long maturities. Following Diebold and Li (2002), we adopt this specific parametrization of the yield curve and fix $a_{t,3} = 0.005$; this helps in the convergence of the non-linear least squared (NLLS) estimation described below.[17]

We proceed with the estimation of spread curves in two steps. In a first step, we estimate the parameters $\{\bar{a}_t\}$ to compute separately yields on risk-free German and U.S. bonds, $y^*_{t,\tau}$, with maturity τ. To do so, we perform this estimation by NLLS, which minimizes for every time t the sum (over bonds) of the squared differences between theoretical prices and observed prices. The minimization is

[17] We chose this value of $a_{t,3}$ after experimenting with different alternatives, which generated similar results.

$$\min_{\bar{a}_t} \sum_{j=1}^{J} \left(P_{j,t} - \hat{P}_{j,t}\left(\bar{a}_t\right)\right)^2,$$

where $\hat{P}_{j,t}\left(\bar{a}_t\right)$ is the estimated price of bond j at time t. As a result of this estimation, we can obtain zero-coupon and coupon-paying bond yields for each time t.

In a second step, we use $y^*_{t,\tau}$ to conduct a similar estimation but this time calculating the parameters on zero-coupon spreads, $s_{t,\tau}$, where

$$s_{t,\tau} = y_{t,\tau} - y^*_{t,\tau}.$$

In other words, we substitute $y_{t,\tau}$ with $s_{t,\tau} + y^*_{t,\tau}$, where $y^*_{t,\tau}$ is estimated in the first step. As a result, we obtain a set of estimates of $\{\bar{a}^s_t\}$ that characterize spreads at different maturities for each point in time. This methodology allows us to include bonds denominated in different currencies, such that we can use most of the available information to obtain a better fit of the curve.[18]

This second step allows us to calculate a "spread price" or "stripped price" of different types of bonds, necessary to calculate excess returns in the next section. For example, the zero-coupon stripped price is

$$P^s_{t,\tau} = e^{-\tau s_{t,\tau}}.$$

Similarly, one can obtain the stripped price of coupon-paying bonds, assuming different coupon structures. The difference between stripped prices and typical bond prices is that we use spreads instead of yields as inputs.[19] Consequently, stripped prices measure the value of the risky portion of a bond. For example, in the case of a zero-coupon bond, the stripped price is the ratio of the bond price over the price of the risk-free bond.[20]

[18] For the countries and periods in which a comparison is feasible, we found similar results when estimating spreads by calculating first the yield curve for each country (using only bonds in one currency) and then subtracting the corresponding yield curve for Germany or the U.S. In addition, we compared our results with Emerging Market Bond Index (EMBI) spreads on long-term bonds, which are compiled by J.P. Morgan, obtaining similar values.

[19] We use the term "stripped prices" as the literature has called "stripped yields" the yields that do not contain the collateralized parts of bonds.

[20] Though our methodology also allows us to estimate actual prices, we do not calculate those prices because they will vary with the currency of denomination, while stripped prices abstract from this problem. Furthermore, as most of the variation in prices comes from changes in the defaultable part of bonds and not from changes in the underlying risk-free components, changes in stripped prices tend to be close to changes in actual prices.

Turning to the estimation results, Figure 2 displays the estimated zero-coupon spreads over time for each country. The figure shows spreads only at two maturities to illustrate how short- (3-year) and long-term (12-year) spreads move over time, but our methodology allows us to compute spreads for every maturity and, therefore, construct the entire spread curve over time. The figure shows some interesting facts. First, spread curves are, on average, upward sloping. Second, spreads become very high during periods of financial crises; witness, for example, the crises in Argentina, Russia, and Uruguay. In those episodes, spreads increase more than 25 percent or 2,500 basis points (the limit set to show the graphs). But in some particular days, they reach values higher than 70 percent. Third, during periods of high spreads, there is an inversion of the spread curve, with short-term spreads increasing more than long-term ones. Fourth, as expected, short-term spreads are more volatile than long-term spreads, as long-term spreads are approximately equal to the average of short-term spreads.

Figure 3 displays the behavior of short- and long-term bond prices estimated assuming a semi-annual coupon of 7.5 percent. To simplify the comparisons, prices are equal to 100 for each country at the beginning of the sample. As expected, the figure shows that prices of long-term bonds are more volatile than those of short-term bonds.[21] For example, during crises, the prices of long-term bonds fall much more than those of short-term bonds. After crises, their recovery is also much more pronounced. The next section shows how these changes impact returns.

4.2 Excess returns and excess term premia

We use the estimated stripped prices to obtain excess returns and excess term premia. Excess returns are defined as

$$er_{t+1,\tau} = \left(\frac{P^s_{t+1,\tau} - P^s_{t,\tau}}{P^s_{t,\tau}} \right).$$

[21] The fact that spreads on short-term bonds are more volatile than those on long-term bonds and that prices of long-term bonds are more volatile than those of short-term bonds is easy to understand with an example. Assume that spreads on zero-coupon short- and long-term bonds are equal to 0 at period 0. There is a shock after period 0 that moves short-term spreads to 10 percent in period 1 and, conditional on no default, to 5 percent in period 2. Then, the spread on long-term term bonds is 7.5 percent. The corresponding price of the short-term bond is 90 cents, while that of the long-term bond is 85 cents.

Excess returns are the returns of holding risky bonds minus the returns of comparable risk-free German and U.S. bonds.[22]

Excess term premia between long-term bonds with maturity τ_2 and short-term bonds with maturity τ_1 are defined as

$$z_{t,\tau_2,\tau_1} = er_{t,\tau_2} - er_{t,\tau_1}.$$

Excess term premia are the additional returns of holding long-term risky bonds vis-a-vis holding short-term risky bonds; these returns are in excess to what long-term risk-free bonds pay relative to short-term risk-free bonds. As the holding period is one week, the average z_{t,τ_2,τ_1} gives information on the average additional return of investing each period one dollar on a long-term bond vis-a-vis doing so on a short-term bond.[23]

Table 2 shows average annualized excess returns across all observations in the sample. The table displays values for bonds with different semiannual coupon payments and for bonds with maturities of 3, 6, 9, and 12 years, thus giving information on excess term premia.[24] We chose bonds with different coupons, as they represent the most typical bonds issued by emerging markets. Several findings from this table stand out. First, when considering all the observations in the sample, the table shows that the average excess return is positive for all coupon structures and maturity structures. Second, the excess term premia are also positive in all cases. Third, as coupon payments increase, the average excess return of bonds with maturities 6, 9, and 12 years decrease. This occurs because increasing the coupon payment shortens the duration of bonds.

We now turn to analyze in further detail how crises affect excess returns and excess term premia. To do so, we first need to define crises. The literature has used different definitions, with no definition being perfect as certain ad-hoc criteria need to be adopted. To partly overcome this problem, we use four different definitions of crises to gauge the robustness of our results. Since we are interested in studying conditional returns, we adopt definitions that avoid using ex-post data.

[22] Excess returns can also be computed by calculating the return on an emerging market bond over the return of a U.S. or German bond. Both methods yield similar results.

[23] A positive slope in the spread curve may suggest higher returns on long-term bonds than on short-term bonds. But this is not necessarily the case. For long-term bonds, returns depend not only on average spreads, but also on the evolution of spreads over time.

[24] Note that the coupon amounts expressed in the table correspond to the total annual payment, disbursed twice a year.

Crisis definition 1 is our benchmark definition; it sets the beginning of a crisis when 9-year spreads are greater than a threshold, which is defined as the average spread over the previous six months plus 300 basis points.[25] The end of the crisis is at the end of the first four-week period in which spreads have remained below the threshold used to determine the beginning of the crisis. Crisis definition 2 is similar to crisis definition 1 but uses 400 basis points to define the threshold. Crisis definitions 3 and 4 are similar but use a one-week period instead of a four-week period to end the crisis.

Table 3 displays the crisis periods obtained with crisis definition 1. All major crises are captured by the crisis definition. For example, the Mexican 94-95 crisis affected Argentina and Brazil. (Note that our sample does not contain spreads for Mexico during that period.) The Russian crisis affected all countries in the sample except Uruguay, which had its own crisis after Argentina defaulted on its debt in early 2002. The Argentine crisis starts when the government was forced to change its economic plan and the default became very likely. Brazil and Colombia also suffered crises in 2002.

Table 4 shows excess returns during crisis and non-crisis periods for all the crisis definitions using bond prices estimated assuming a 7.5 percent coupon. The table shows that excess returns are very large during crisis times and close to zero during non-crisis times.[26] Table 4 also shows that excess term premia increase during crisis times, with excess returns being much larger on long-term bonds than on short-term bonds. For example, according to definition 1, the average annual excess term premium between a 12-year bond and a 3-year bond is around 28 percentage points. The evidence presented in this table is consistent with the predictions of the model.

Table 5 displays excess returns by country according to crisis definition 1. The table shows that for most countries excess returns are large during crisis times and relatively low during non-crisis periods. There are two exceptions, excess returns are negative in Uruguay and, partly, in Argentina during crisis times. This is due to the fact that the observations for these countries finish in crisis times, with Argentina defaulting on its bonds. Note that in the case of Argentina, the negative excess returns generated by the default on the 3-year and 6-year maturities outweigh the large

[25] To classify the first observations of the sample for each country, we repeat the first price observed during the previous six months.

[26] Had we used a crisis definition based on ex-post data, we would have likely obtained lower and possibly negative crisis returns. However, using ex-post data is clearly misleading, since it amounts to considering an investment strategy where the investment is made only if it is known that conditions will worsen, eliminating the cases in which they end up improving.

positive excess returns obtained in the previous crisis periods.

In Table 6, we analyze more formally what explains excess term premia, trying to determine whether excess term premia are predictable. The table presents least squares regressions that use as dependent variables measures of excess term premia, defined as the difference between long-term (9-year and 12-year) excess returns and short- (3-year) and medium-term (6-year) excess returns. The independent variable is a dummy for the crisis periods. To make sure that the results do not depend on how crises are defined and to better understand how the term premia behave, we use alternatives variables; we work with spreads, defined as log (1+spreads), at different maturities.[27] The regressions pool all observations available across countries and over time. Regressions are reported with and without country and time effects. The regressions use robust estimates of the standard errors. To do so, we define clusters by the country and crisis indicators.[28] Observations are assumed to be independent across clusters but not necessarily independent within clusters. This allows for a general form of heteroskedasticity across observations and non-zero correlation within clusters.

The results in Table 6 show that the crisis dummy is statistically significant and positive in all regressions at the 1 percent level. In other words, excess term premia increase during crisis times. These results display in another way what has already been reported in Tables 4 and 5. For example, the regression for the 12-3 excess term premia with no country or time dummies show that the term premium increases by 0.449 percent per week percent during crisis times, which on an annualized basis corresponds to more than 26 percent. Remember that this is in addition to any term premium present in the German and U.S. yield curves. As one may question the crisis definition, we repeat these regressions but using spreads instead of the crisis dummy. These regressions confirm the results, showing that as spreads increase the excess term premia rise, with the results being significant across specifications. For example, the coefficient of 0.045 on the 6-year spread in the regression of the 12-3 excess term premia states that as annual spreads increase by 1 percentage point, the annual excess term premium increases by 2.4 percentage points. It is interesting to note that the results are robust to the inclusion of time dummies, which shows that the results reflect cross-sectional features of the data and not only aggregate shocks. In sum, these

[27] We have also tried with dummy variables that capture the other definitions of crises, obtaining similar results.

[28] Defining the clusters only by country or crisis indicators does not alter the results.

regressions confirm that excess term premia are predictable, increasing with spreads.

So far we have shown that excess returns and excess term premia increase during crises. To estimate to what degree this increase can be ascribed to an increase in the volatility of returns during crises, we plot in Figure 4 the excess returns against the standard deviation of excess return for crisis, non-crisis, and all periods. The figure shows that during non-crisis periods excess returns are close to zero, with the standard deviation increasing with maturity. On the other hand, during crisis periods, both excess returns and their standard deviation increase. More interestingly, the Sharpe ratio (i.e. the ratio of excess returns over their standard deviation) increase during crisis times. The average Sharpe ratio across maturities is 0.006 during non-crisis periods and larger than 0.06 during crisis periods, showing that the increase in excess returns cannot be accounted for by the increase in volatility. Moreover, the Sharpe ratio is higher for long-term bonds than for short-term bonds during crisis. This evidence is consistent with investors' "effective" risk aversion increasing as they get closer to their borrowing constraints during crises.

To interpret the evidence on excess returns and excess term premia we can start from a benchmark in which investors are risk neutral with respect to default episodes in emerging markets. This view is a version of the "pure expectation hypothesis" for emerging market spreads.[29] According to this view, spreads should only reflect the expected losses from default. As a result, according to this view, excess returns should be zero.[30]

A second, less restrictive, view holds that spreads may reflect a risk premium that may be different across maturities but is constant over time. This view is a version of the "expectation hypothesis" for emerging market spreads. According to this view, changes in spreads solely reflect innovations to the expected losses from default. As a result, excess returns should not be predictable based on information available at time t. In particular, they should not be predictable using information on the level of spreads or other crisis indicators at time t.

In the literature on emerging market borrowing, the idea that spreads mostly reflect the market assessment of the probability of default of a given country is still widely held. However, the evidence

[29] For some references on the topic and a definition of the "pure expectation hypothesis"and the "expectation hypothesis", see Cox, Ingersoll, and Ross (1985), Campbell, Lo, and MacKinlay (1997), Bekaert and Hodrick (2001), and Dai and Singleton (2002).

[30] We believe that our results are not due to a "peso problem." Our sample period covers several crises, including the Argentine default. Moreover, spreads tend to increase over our sample, which would tend to bias the results in the direction of negative excess returns.

presented in this section serves to show that neither version of the expectation hypothesis holds for emerging market spreads. The finance literature on the term structure in developed economies has gradually rejected both versions of the expectation hypothesis and has moved towards attempts at modeling and explaining patterns of time-varying risk premia.[31] Our model of the investor side provides a simple equilibrium framework that is consistent with the observed patterns of risk premia.[32]

5 Analysis of bond issuance

In this section, we analyze the empirical evidence on the quantity side. To do so, we study the behavior of issuance activity over time. In particular, we look at the time-varying pattern of issuance at different maturities and relate it to crisis periods and different measures of bond prices. We concentrate on two variables. First, we analyze the amount issued at different maturities. Second, we study the average maturity. In particular, we test how crisis times, spreads, and term premia affect these two variables.

To study the behavior of the amount issued, we estimate Tobit models by maximum likelihood, pooling all observations. These estimations take into account the fact that observations are left censored at zero, as countries do not issue negative amounts of bonds. The dependent variable is the weekly amount issued by maturity, normalized by the average weekly amount issued by each country. This normalization takes into consideration that the average amount issued varies across countries. We divide the amount issued in four groups: up to 3-year (short) maturity, between 3-year and 6-year (medium-short) maturity, between 6-year and 9-year (medium-long) maturity, and more than 9-year (long) maturity.[33] As explanatory variables, we use alternatively the crisis dummy, the 3-year spread, the 9-year spread, the country EMBI spread, and the predicted excess term premium for each country.[34] The EMBI spreads are widely used measures of long-term spreads in emerging markets. They not only provide a different estimate of spreads, but also extend the

[31] See references in Cochrane (1999).

[32] Clearly, to provide a quantitative assessment of these facts more work remains to be done both in the direction of no-arbitrage models and in the direction of equilibrium models. For no-arbitrage models see Duffie and Singleton (1999), Duffie, Pedersen, and Singleton (2003).

[33] The short maturity includes the 3-year issues, the medium-short maturity includes the 6-year issues, and the medium-long maturity includes the 9-year issues.

[34] Again, spreads are defined here as log(1+spreads).

sample for Mexico to cover the Mexican crisis (though they exclude Uruguay). The predicted excess term premium captures the cost of issuing long-term debt relative to short-term debt. This variable is computed by estimating the actual excess term premium on the 3-year and 9-year spreads and then obtaining the predicted value. As before, we compute robust standard errors using the country and crisis indicators as clusters.

The Tobit estimations are reported in Table 7. The estimations show that short-term issues are hardly affected by the regressors. Only the 3-year spread is statistically significant at 10 percent. However, medium- and long-term issues are more affected by the regressors. The point estimates are larger and the variables become more statistically significant. In the regressions for the long-term issues, all the regressors are significant at least at the 5 percent level. The coefficients reported, which are the marginal effects or the effects on the observed (not the latent) variable, also seem large. For example, an increase of 100 basis points in the 9-year spreads leads to a decline in the weekly issues of 0.223, where the average value of the normalized weekly issue is 1. In sum, the estimations in Table 7 suggest that during crises and, more generally, in periods of high spreads, countries tend to issue less, with longer-term issues being much more affected by the rise in spreads. Moreover, when the predicted term premium is high, long-term issues decline. The result that short-term issues are barely affected by the different variables can probably be explained by the fact that countries tend not to issue when spreads are high, but when they do issue they issue only short-term bonds. These two effects cancel out, leading to non-significant coefficients.[35]

To study the average maturity, we estimate a model that takes into account the incidental truncation of the data, since the average maturity is only available when countries issue bonds and, otherwise, there are missing observations. As noted by Heckman (1979) and others, ignoring the missing values might lead to a sample selection bias. We therefore estimate two equations simultaneously by maximum likelihood. One equation describes the probability of observing an average maturity each week. The second equation estimates how the average maturity is correlated with other factors. The regressors included in the selection equation are similar to those used for the Tobit models; they are, alternatively, the crisis dummy, the short-term and long-term spreads, and the country EMBI spread. For the main equation we use the long-term spread and, alternatively,

[35]Note that the negative sign of the coefficients is not likely due to reverse causality. If bond issuance had an impact on spreads, an increase in the demand for funds would push down prices and increase spreads, resulting in a positive coefficient. To the extent that reverse causality plays a role, it biases the results against our findings.

the predicted excess term premium. As the variables are not scaled, we include country dummies.[36] Again, we compute robust standard errors using the country and crisis indicators as clusters.

The results show that, as expected, countries are less likely to issue bonds during crisis times or, more generally, when spreads are high. Moreover, the average maturity shortens when the long-term spread increases and when the predicted excess term premium rises. These results are consistent with the pattern displayed in Figure 5, which shows the average maturity and spreads over time for each country. Again, these results show that issuance is negatively correlated with crises and, more generally, with the level of spreads.

The results in this section are consistent with crises being characterized by a deterioration in investors' liquidity positions. During crises, investors get closer to their borrowing constrains and, as a result, demand higher risk premia, especially on long-term bonds. Borrowers, in turn, respond by borrowing less and by decreasing the average maturity of bonds issued. Another way to summarize the evidence is that countries try to extend the maturity structure of their debt whenever market conditions permit it, i.e. when markets require a low term premium.

6 Conclusions

This paper studies the role of investor side factors, as opposed to debtor side factors, in emerging market borrowing. To do so, we first build a model of sovereign debt that introduces frictions on the investor side. We then present a number of new stylized facts on risk premia, term premia, and maturity structure of debt issuance in emerging economies, which are consistent with the model predictions. Taken together, the model and the empirical evidence highlight the importance of the investor side to understand why emerging markets borrow short term. Furthermore, the paper supports the idea that shocks to the balance sheets of investors are relevant in crisis episodes.

The distinction between investor side and debtor side factors is not just a semantic issue; it has important policy implications. For example, consider the moral hazard view according to which countries borrow short term as a way of committing to carrying out the right policies. According to this view, the cost of crises is what makes crises a strong disciplining device. In that case,

[36] Since many observations are missing and convergence is difficult to achieve, we do not include time dummies in the maximum likelihood estimations.

efforts to make crises less costly through loans from the international financial community or other liquidity providing mechanisms would exacerbate the moral hazard problem, and could end up being welfare reducing.[37] If, on the other hand, countries borrow short term because long-term debt is too expensive, those same crisis prevention mechanisms would be beneficial. The benefits would come not only from fewer and less severe crises, but also from cheaper long-term borrowing as a result of a reduction in the price risk of long-term debt.

There are several possible directions for future research. First, it would be interesting to extend the coverage of our analysis to contrast our results with those from other emerging economies, developed economies, domestic currency debt, and private borrowers.

As another extension, the empirical analysis could be carried out in a dynamic framework to study the stochastic properties of spreads at different maturities. Preliminary evidence suggests that long-term spreads "overreact" to movements in short-term spreads. More precisely, long-term spreads seem to react to innovations in short-term spreads as if these innovations were more persistent than what they actually are, leading to excess volatility.[38] It is interesting to note that this type of evidence seems at odds with what other authors have found when studying the dynamic behavior of yield curves in developed countries.[39]

Finally, the fact that the Sharpe ratio of long-term bonds is higher than that of short-term bonds suggests that the risk of long-term bonds is less diversifiable than that of short-term bonds. A possible explanation may lie on a higher sensitivity of long-term bonds to global factors (such as investors' risk appetite) and a higher sensitivity of short-term bonds to domestic factors (such as default probabilities). This hypothesis could be tested by estimating cross-country correlations at different maturities. A higher correlation at long maturities would thus not only explain the higher Sharpe ratios on long-term bonds, but also suggest a role for financial linkages as a source of contagion.

[37] See Jeanne (2000) for a discussion of this argument.
[38] See Broner, Lorenzoni, and Schmukler (2003).
[39] See Campbell and Shiller (1991).

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8 Appendix

Lemma 1. *Under assumption 2 the price of risky debt is π in period 1.*

Let the price of risky debt be $p_{S,1} = p_{L,1} = \pi$. If investors are constrained they liquidate all their bond holdings in period 1. If they are unconstrained their wealth is

$$w_0 + (\pi - p_L) D_L - a$$

and they are indifferent between risky debt and risk free bonds, therefore, the maximum demand for risky debt at the price π in period 1 is given by:

$$\frac{1}{\pi}\int_0^{w_0+(\pi-p_L)D_L} [w_0 + (\pi - p_L) D_L - a] \, g(a) \, da.$$

The supply of short-term debt in period 1 is equal to

$$D_{S,1} = (D_S - X)/\pi.$$

Therefore, the total supply of risky debt in period 1 is

$$\frac{D_0 - p_L D_L - X}{\pi} + D_L \leq \frac{D_0 - p_L D_L}{\pi} + D_L.$$

Consider the inequalities

$$\begin{aligned}
\frac{1}{\pi}\int_0^{w_0+(\pi-p_L)D_L} [w_0 + (\pi - p_L) D_L - a] \, g(a) \, da &\geq \frac{1}{\pi}\int_0^{A} [w_0 + (\pi - p_L) D_L - a] \, g(a) \, da = \\
&= \frac{w_0 + (\pi - p_L) D_L - E[a]}{\pi} \geq \\
&\geq \frac{D_0 + (\pi - p_L) D_L}{\pi} = \frac{D_0 - p_L D_L}{\pi} + D_L
\end{aligned}$$

where the first inequality follows from the fact that the integrand is negative in $(w_0 + (\pi - p_L) D_L, A]$ and the second inequality follows assumption 2. This shows that unconstrained investors have in fact sufficient wealth to buy all risky debt at price π.

Figure 1
Comparative Statics

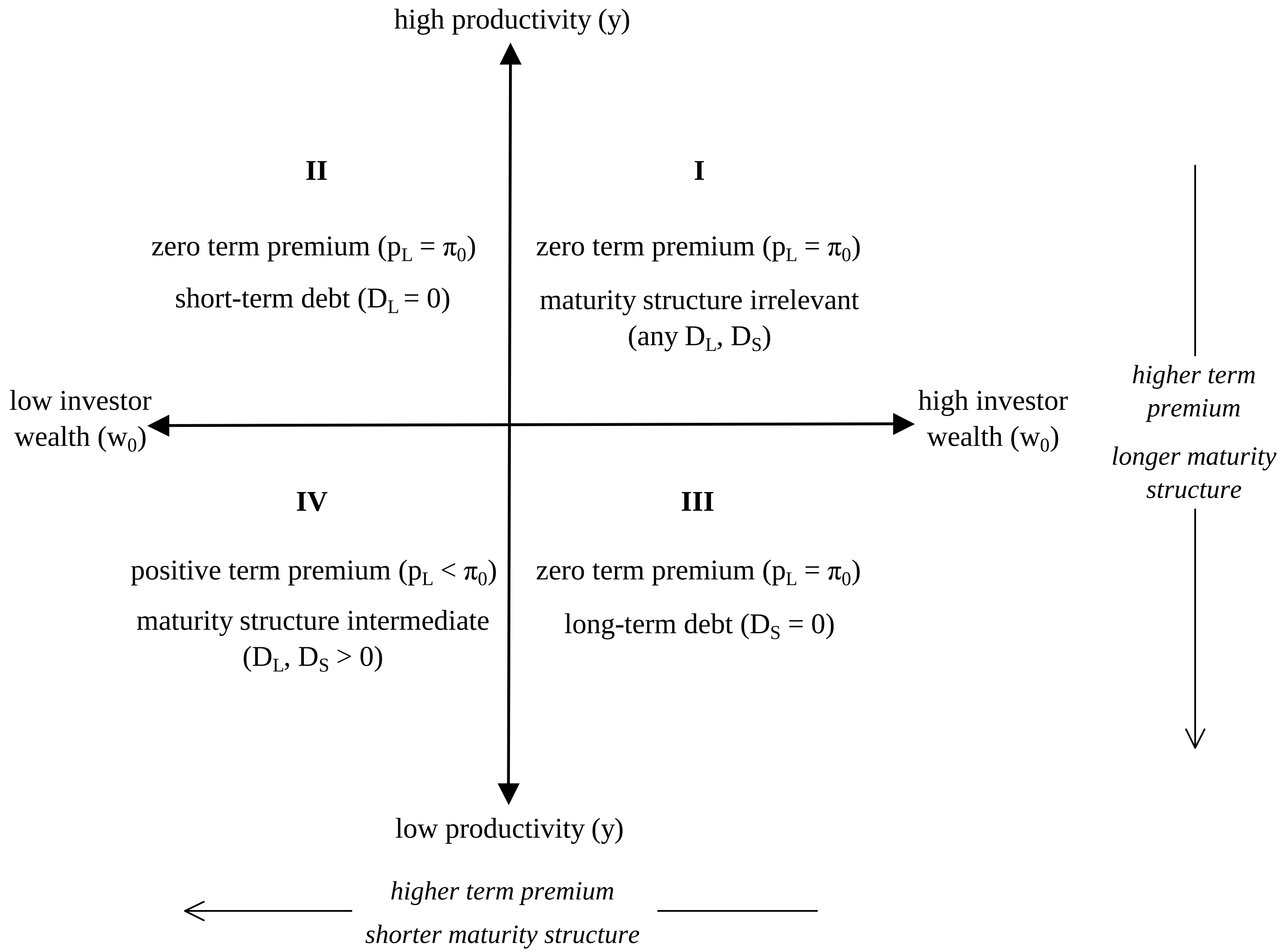
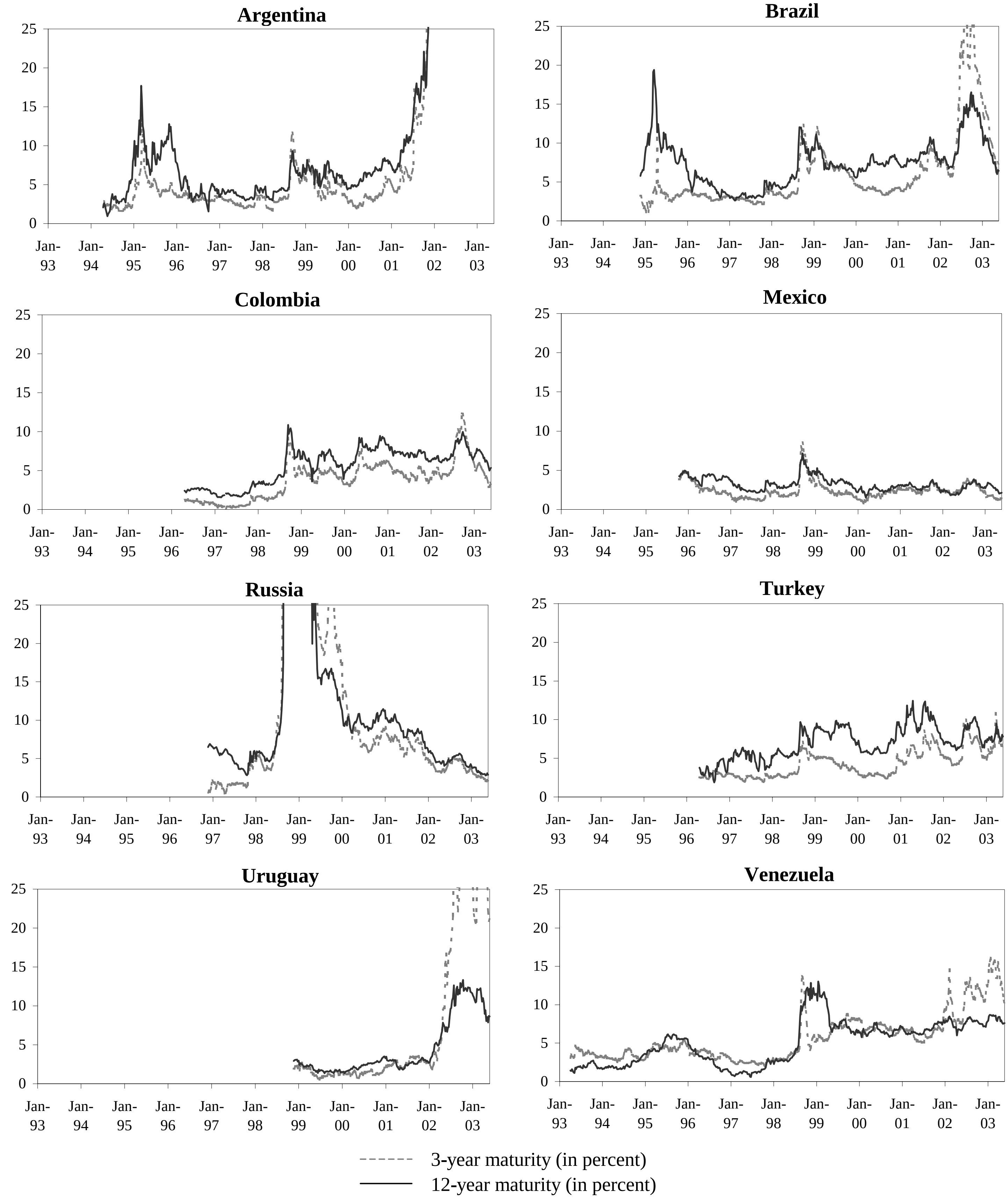
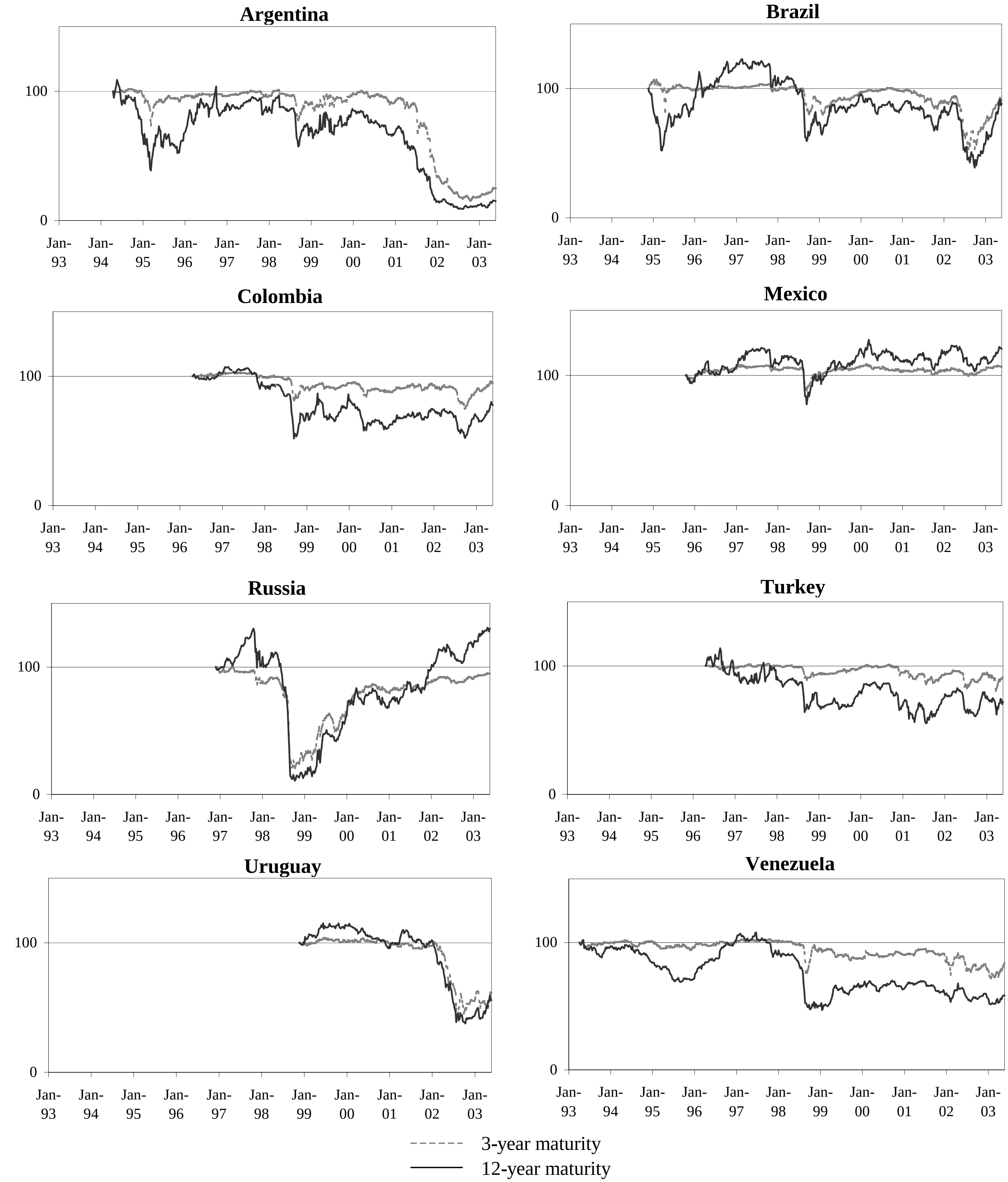


Figure 2
Short- and Long-Term Spreads



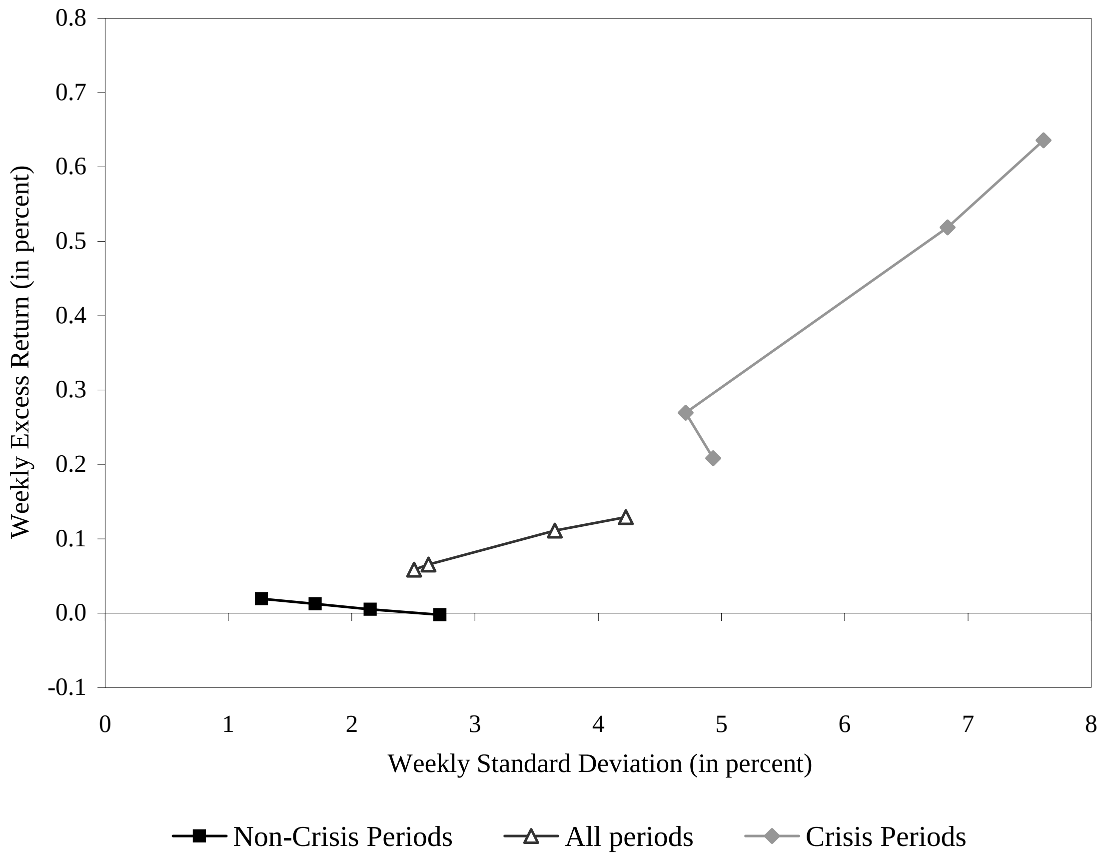
The figures show spreads of 3-year and 12-year maturities over time by country.

Figure 3
Short- and Long-Term Prices



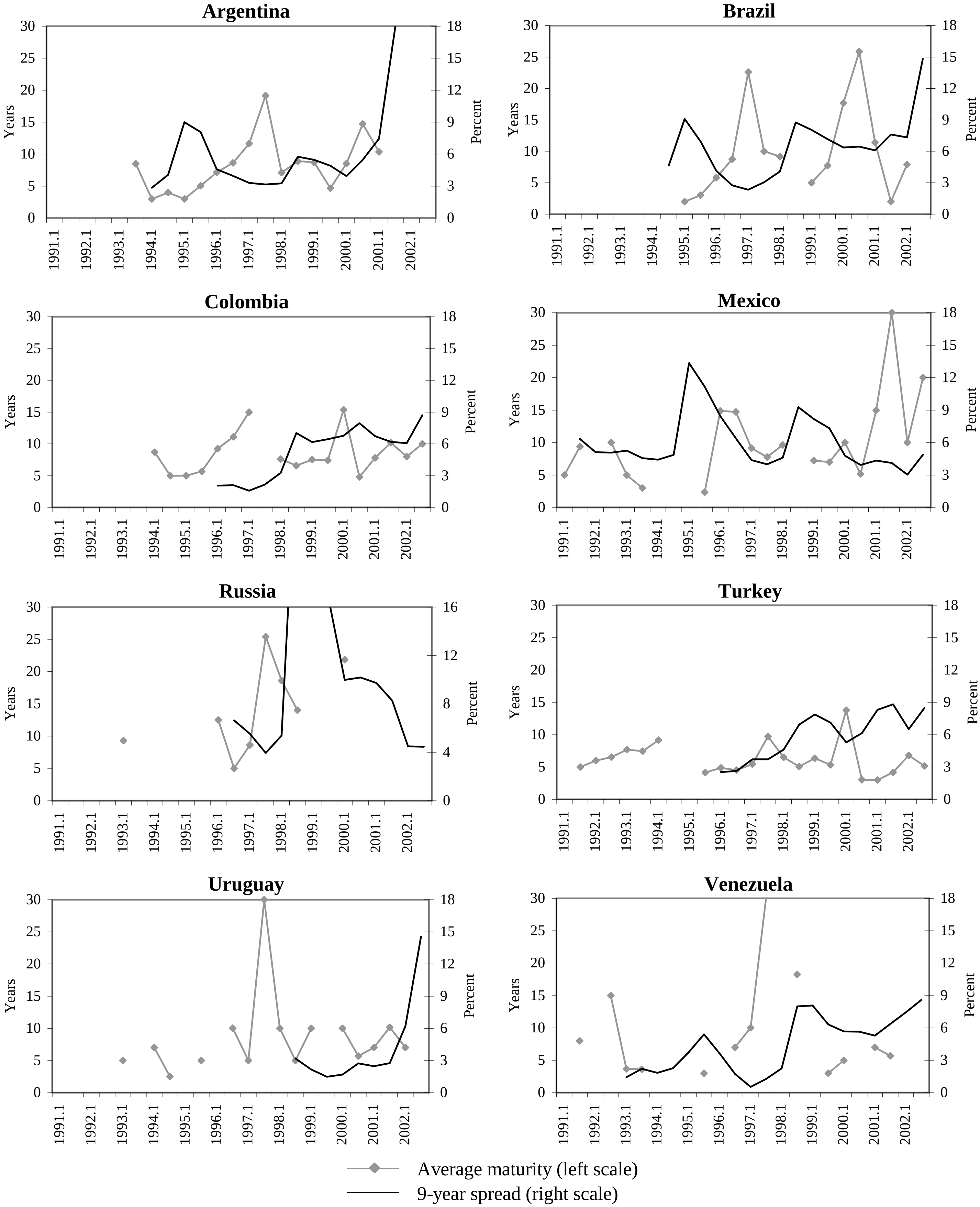
The figures show indices of prices of 3-year and 12-year maturities over time by country. Prices are estimated assuming a coupon rate of 7.5 percent. Indices are constructed by fixing the first observation in each country equal to 100.

Figure 4
Sharpe Ratio During Crisis and Non-Crisis Periods



The figure shows the Sharpe ratio corresponding to maturities of 3, 6, 9, and 12 years during crisis periods, non-crisis periods, and all periods. Excess returns are estimated using a holding period of one week and assuming a coupon rate of 7.5 percent. Crisis and non-crisis periods are determined according to definition 1.

Figure 5
Average Maturity and Spreads



The figures show the average maturity of bonds issued in each semester and the estimated spread of maturity of 9 years by country. In the case of Mexico, the EMBI spread is used instead of the estimated spread.

Table 1
Data Description

Price Data					
		Number of	Maturities		
Country	Sample Period	Bonds	Minimum	Maximum	75th Percentile
Argentina	Apr 1994 - May 2003	63	1.0	23.6	8.3
Brazil	Nov 1994 - May 2003	38	1.5	29.5	13.4
Colombia	Apr 1996 - May 2003	21	1.3	25.7	9.7
Mexico	Oct 1995 - May 2003	26	1.5	27.5	12.7
Russia	Nov 1996 - May 2003	21	2.2	24.2	10.7
Turkey	Apr 1996 - May 2003	49	0.8	17.9	5.3
Uruguay	Nov 1998 - May 2003	10	1.8	26.4	9.2
Venezuela	Apr 1993 - May 2003	22	1.4	26.2	15.7
Germany	Apr 1993 - May 2003	229	0.6	20.0	5.9
U.S.	Apr 1993 - May 2003	51	1.5	29.4	23.2

Quantity Data						
			Average Amount Issued by Maturity (USD Thousands)			
Country	Sample Period	Number of Bonds	Up to 3 Years	From 3 to 6 Years	From 6 to 9 Years	Over 9 Years
Argentina	Jul 1993 - Dec 2002	146	17,731	59,388	29,898	60,008
Brazil	Jul 1994 - Dec 2002	45	7,557	29,273	9,246	57,959
Colombia	Jan 1993 - Dec 2002	41	1,087	9,080	3,797	13,567
Mexico	Jan 1991 - Dec 2002	54	5,941	14,798	7,887	39,836
Russia	Jan 1993 - Dec 2002	27	3,513	10,010	12,839	49,757
Turkey	Jan 1990 - Dec 2002	77	4,944	22,436	8,294	17,415
Uruguay	Jan 1993 - Dec 2002	18	195	1,811	970	3,899
Venezuela	Jul 1991 - Dec 2002	24	2,406	1,524	2,239	9,305

The tables describe the price and quantity data used in the paper. The top table shows the sample periods, number of bonds, and maturities covered by the price data. Maturities are expressed in years. Minimum, maximum, and 75th percentile correspond to the average of minimum, maximum, and 75th percentile of the maturities in each week within the sample time period. The bottom table shows the sample periods, number of bonds, and average amount issued by maturity covered by the quantity data. Maturity up to 3 years includes bonds of 3-year maturity, maturity from 3 to 6 years includes bonds of 6-year maturity, and maturity from 6 to 9 years includes bonds of 9-year maturity. USD stands for U.S. dollars.

Table 2
Excess Returns
Annualized Means Over Comparable German and U.S. Bonds, In Percent

	Coupon = 5%				Coupon = 7.5%				Coupon = 10%			
	er3	**er6**	**er9**	**er12**	**er3**	**er6**	**er9**	**er12**	**er3**	**er6**	**er9**	**er12**
Average	2.90	3.49	6.74	8.26	3.08	3.45	5.93	6.95	3.23	3.44	5.46	6.27
Argentina	-7.08	-4.21	0.55	0.48	-6.34	-4.02	-0.31	-0.98	-5.71	-3.85	-0.81	-1.63
Brazil	6.02	6.34	9.28	12.69	6.04	6.21	8.60	11.34	6.06	6.12	8.16	10.52
Colombia	4.67	4.41	4.11	4.50	4.61	4.34	4.03	4.28	4.57	4.30	3.99	4.15
Mexico	3.56	5.25	6.72	7.89	3.52	5.08	6.40	7.43	3.49	4.95	6.17	7.11
Russia	14.84	18.73	39.72	45.96	15.09	18.03	33.43	37.57	15.31	17.54	30.01	33.53
Turkey	4.09	3.78	4.52	6.92	4.09	3.77	4.32	6.11	4.09	3.77	4.21	5.63
Uruguay	-2.72	-5.21	-5.33	-5.74	-2.51	-4.93	-5.22	-5.69	-2.32	-4.70	-5.11	-5.61
Venezuela	2.50	1.05	1.10	1.74	2.63	1.21	1.18	1.59	2.74	1.35	1.25	1.53

The table shows the annualized means of excess returns over comparable German and U.S. bonds by country and across countries. Excess returns are estimated using a holding period of one week and for coupon rates of 5, 7.5, and 10 percent.

Table 3
Crisis Periods

Crisis Definition 1

	Start date	End date
Argentina		
Crisis 1	12/30/94	01/12/96
Crisis 2	09/04/98	11/06/98
Crisis 3	07/13/01	-
Brazil		
Crisis 1	01/20/95	10/06/95
Crisis 2	08/21/98	04/23/99
Crisis 3	06/14/02	04/06/03
Colombia		
Crisis 1	08/28/98	02/26/99
Crisis 2	05/05/00	06/23/00
Crisis 3	07/26/02	11/15/02
Mexico		
Crisis 1	08/28/98	11/06/98
Russia		
Crisis 1	07/10/98	06/29/01
Turkey		
Crisis 1	08/28/98	11/13/98
Uruguay		
Crisis 1	04/19/02	-
Venezuela		
Crisis 1	08/14/98	03/03/00

We use four different crisis definitions. Crisis definition 1 sets the beginning of a crisis when 9-year spreads are greater than a threshold, which is defined as the average spread over the previous six months plus 300 basis points. The end of the crisis is at the end of the first four-week period in which spreads have remained below the threshold used to determine the beginning of the crisis. Crisis definition 2 is similar to crisis definition 1 but uses 400 basis points to define the threshold. Crisis definitions 3 and 4 are similar but use a one-week period instead of a four-week period to end the crisis.

Table 4
Excess Returns During Crisis and Non-Crisis Periods
Annualized Means Over Comparable German and U.S. Bonds, In Percent

	er3	**er6**	**er9**	**er12**
All Periods	3.08	3.45	5.93	6.95
Crisis Definition 1				
Threshold + 300 basis points, ending crisis after four weeks of low spreads				
Crisis Periods	11.43	15.03	30.88	39.06
Non-Crisis Periods	1.02	0.65	0.26	-0.11
Crisis Definition 2				
Threshold + 400 basis points, ending crisis after four weeks of low spreads				
Crisis Periods	11.47	16.85	42.50	55.70
Non-Crisis Periods	1.85	1.54	1.20	0.94
Crisis Definition 3				
Threshold + 300 basis points, ending crisis after one week of low spreads				
Crisis Periods	10.31	13.39	33.38	42.67
Non-Crisis Periods	1.86	1.80	1.73	1.66
Crisis Definition 4				
Threshold + 400 basis points, ending crisis after one week of low spreads				
Crisis Periods	11.67	20.32	52.03	66.03
Non-Crisis Periods	2.05	1.52	1.24	1.20

The table shows the annualized means of excess returns over comparable German and U.S. bonds during crisis and non-crisis periods across countries. Results are presented for the four crisis definitions. Excess returns are estimated using a holding period of one week and assuming a coupon rate of 7.5 percent.

Table 5
Excess Returns During Crisis and Non-Crisis Periods by Country
Annualized Means Over Comparable German and U.S. Bonds, In Percent

	Crisis Definition 1			
	er3	**er6**	**er9**	**er12**
Average				
Crisis Periods	11.43	15.03	30.88	39.06
Non-Crisis Periods	1.02	0.65	0.26	-0.11
Argentina				
Crisis Periods	-10.03	-3.47	11.81	15.87
Non-Crisis Periods	-4.36	-4.30	-6.10	-8.78
Brazil				
Crisis Periods	18.36	25.98	41.73	58.11
Non-Crisis Periods	1.95	-0.10	-1.30	-1.85
Colombia				
Crisis Periods	22.96	33.98	39.79	42.73
Non-Crisis Periods	1.85	0.10	-0.95	-1.02
Mexico				
Crisis Periods	81.03	82.56	90.33	113.92
Non-Crisis Periods	1.88	3.43	4.64	5.32
Russia				
Crisis Periods	35.06	31.06	62.37	70.75
Non-Crisis Periods	0.38	7.93	12.80	14.35
Turkey				
Crisis Periods	21.66	61.44	109.15	162.47
Non-Crisis Periods	3.55	2.24	1.90	2.91
Uruguay				
Crisis Periods	-6.03	-9.76	-6.61	-4.78
Non-Crisis Periods	-1.35	-3.34	-4.78	-5.98
Venezuela				
Crisis Periods	5.61	6.89	13.61	23.21
Non-Crisis Periods	2.09	0.20	-0.95	-1.95

The table shows the annualized means of excess returns over comparable German and U.S. bonds during crisis and non-crisis periods by country. Crisis and non-crisis periods are determined according to definition 1. Excess returns are estimated using a holding period of one week and assuming a coupon rate of 7.5 percent.

Table 6
Excess Term Premia

	Dependent Variable: er9-er3				Dependent Variable: er12-er3					Dependent Variable: er12-er6			
Crisis Dummy	0.325 ***				0.449 ***					0.381 ***			
	[5.809]				[7.151]					[6.868]			
3-Year Spread		0.015 ***				0.016 ***							
		[4.816]				[5.539]							
6-Year Spread			0.040 ***				0.045 ***				0.035 ***		
			[10.219]				[9.576]				[6.052]		
9-Year Spread				0.062 ***				0.069 ***				0.072 ***	
				[8.229]				[10.587]				[3.753]	
12-Year Spread									0.060 ***				0.075 ***
									[10.562]				[3.498]
Country Dummies	no	no	no	no	no	no	no	no	no	no	no	no	no
Time Dummies	no	no	no	no	no	no	no	no	no	no	no	no	no
Observations	3153	3153	3153	3153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153
R-squared	0.002	0.003	0.006	0.013	0.003	0.002	0.005	0.01	0.013	0.002	0.003	0.013	0.022
Number of Countries	8	8	8	8	8	8	8	8	8	8	8	8	8

	Dependent Variable: er9-er3				Dependent Variable: er12-er3					Dependent Variable: er12-er6			
Crisis Dummy	0.290 ***				0.407 ***					0.295 ***			
	[4.441]				[6.985]					[5.188]			
3-Year Spread		0.013 ***				0.012 ***							
		[6.096]				[4.766]							
6-Year Spread			0.040 ***				0.039 ***				0.029 ***		
			[6.317]				[6.353]				[7.855]		
9-Year Spread				0.072 ***				0.073 ***				0.083 ***	
				[5.714]				[6.436]				[3.243]	
12-Year Spread									0.062 ***				0.087 ***
									[8.442]				[3.569]
Country Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Time Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153	3,153
R-squared	0.265	0.265	0.267	0.273	0.286	0.285	0.287	0.291	0.293	0.225	0.226	0.234	0.243
Number of Countries	8	8	8	8	8	8	8	8	8	8	8	8	8

The tables report ordinary least squares regressions of weekly excess term premia on a crisis dummy and on spreads of different maturities. The excess term premia are the differences between the 9-year excess return and the 3-year excess return (er9-er3), between the 12-year excess return and the 3-year excess return (er12-er3), and between the 12-year excess return and the 6-year excess return (er12-er6). Excess returns are estimated using a holding period of one week and assuming a coupon rate of 7.5 percent. The crisis dummy corresponds to crisis definition 1. The standard errors are robust to heteroskedasticity and serial correlation. Observations are assumed to be independent across clusters but not within clusters. Clusters are defined by country and crisis periods. Regressions in the bottom table include country and time dummies. Robust t statistics are in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7
Amount Issued

	Dependent Variable: Issues of Maturity Up to 3 Years					Dependent Variable: Issues of Maturity Between 3 and 6 Years				
Crisis Dummy	-0.528					-2.947 ***				
	[1.087]					[2.662]				
3-Year Spread		-0.066 *					-0.189 **			
		[1.729]					[2.311]			
9-Year Spread			-0.043					-0.133 **		
			[1.097]					[2.321]		
EMBI				-0.027					-0.121	
				[1.007]					[1.619]	
Predicted Excess Term Premium					0.087					-0.455
(er9-er3)					[0.183]					[0.816]
Observations	2,996	2,996	2,996	2,647	2,996	2,996	2,996	2,996	2,647	2,996
Uncensored Observations	46	46	46	48	46	109	109	109	86	109

	Dependent Variable: Issues of Maturity Between 6 and 9 Years					Dependent Variable: Issues of Maturity Over 9 Years				
Crisis Dummy	-1.973 ***					-2.180 ***				
	[3.008]					[4.500]				
3-Year Spread		-0.145 *					-0.257 **			
		[1.940]					[2.227]			
9-Year Spread			-0.141 ***					-0.223 ***		
			[2.729]					[4.501]		
EMBI				-0.148 *					-0.223 **	
				[1.933]					[2.172]	
Predicted Excess Term Premium					-0.692					-1.230 ***
(er9-er3)					[1.434]					[3.975]
Observations	2,996	2,996	2,996	2,647	2,996	2,996	2,996	2,996	2,647	2,996
Uncensored Observations	56	56	56	48	56	103	103	103	87	103

The tables report the marginal coefficients of Tobit regressions of the amount issued at different maturities on a crisis dummy, short-term and long-term spreads, the EMBI, and the predicted excess term premium. Regressions are estimated by maximum likelihood. The dependent variables are normalized by the average weekly amount issued, short-term or long-term respectively, for each country. Maturity up to 3 years includes bonds of 3-year maturity, maturity from 3 to 6 years includes bonds of 6-year maturity, and maturity from 6 to 9 years includes bonds of 9-year maturity. The independent variables are in logs. The crisis dummy corresponds to crisis definition 1. The standard errors are robust to heteroskedasticity and serial correlation. Observations are assumed to be independent across clusters but not within clusters. Clusters are defined by country and crisis periods. Regressions using the EMBI do not include Uruguay due to data availability. Robust z statistics are in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8
Average Maturity

Dependent Variable: Average Maturity of Issues				
Main Equation				
9-Year Spread	-0.476 **	-0.590 ***	-0.332 **	-0.399 **
	[2.287]	[4.730]	[2.116]	[2.000]
Selection Equation				
Crisis Dummy	-0.149 **			
	[2.033]			
3-Year Spread		-0.032 ***		
		[2.985]		
9-Year Spread			-0.089 ***	
			[4.550]	
EMBI				-0.066 ***
				[3.704]
Country Dummies	yes	yes	yes	yes
Observations	2,996	2,996	2,996	2,338

Dependent Variable: Average Maturity of Issues				
Main Equation				
Predicted Excess Term Premium	-2.724 **	-2.696 ***	-5.554 ***	-2.103 ***
(er9-er3)	[2.316]	[3.238]	[4.904]	[3.029]
Selection Equation				
Crisis Dummy	-0.191 **			
	[2.212]			
3-Year Spread		-0.031 ***		
		[3.005]		
9-Year Spread			-0.065 ***	
			[3.352]	
EMBI				-0.066 ***
				[3.764]
Country Dummies	yes	yes	yes	yes
Observations	2,996	2,996	2,996	2,338

The tables report selection bias regressions of the average maturity of issues on long-term spreads and the predicted excess term premia. In the selection equation, the decision to issue is explained by a crisis dummy, short- and long-term spreads, and the EMBI. Regressions are estimated by maximum likelihood. The independent variables are in logs. The crisis dummy corresponds to crisis definition 1. The standard errors are robust to heteroskedasticity and serial correlation. Observations are assumed to be independent across clusters but not within clusters. Clusters are defined by country and crisis periods. All regressions include country dummies. Regressions using the EMBI do not include Uruguay due to data availability. Robust z statistics are in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 1
Description of Bonds Included in the Emerging Market Sample

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
					Argentina			
1	10/15/92	10/15/97	250,000	USD	Eurobond	8.25	A	Price / Quantity
2	08/02/93	08/02/96	150,000	USD	Eurobond	6.875	S	Price / Quantity
3	08/02/93	08/02/00	100,000	USD	Eurobond	8.25	S	Price / Quantity
4	10/05/93	10/05/98	608,580	DM	Eurobond	8	A	Price / Quantity
5	11/05/93	03/29/05	8,466,548	USD	Brady Bond	Floating	S	Price
6	12/20/93	12/20/03	2,050,000	USD	Global	8.375	S	Price / Quantity
7	03/04/94	03/06/95	350,000	USD	Eurobond	Floating	N.A.	Quantity
8	04/01/94	04/01/04	100,000	USD	Eurobond	7.9	A	Quantity
9	07/11/94	07/11/97	312,538	DM	Eurobond	8	A	Quantity
10	08/22/94	08/27/97	100,000	USD	Eurobond	Floating	Q	Price / Quantity
11	08/26/94	08/26/97	67,688	ATS	Eurobond	8	A	Quantity
12	10/14/94	10/14/97	73,562	CAD	Eurobond	10.5	A	Quantity
13	10/21/94	10/21/97	288,453	ITL	Eurobond	13.45	A	Quantity
14	11/01/94	11/01/99	500,000	USD	Global	10.95	S	Price / Quantity
15	11/01/94	11/01/01	52,000	USD	Domestic	Floating	A	Quantity
16	12/09/94	12/09/97	75,720	ESP	Eurobond	12.8	A	Quantity
17	12/15/94	12/15/99	149,815	JPY	Eurobond	7.1	A	Quantity
18	12/19/94	12/19/97	199,753	JPY	Eurobond	6	A	Quantity
19	12/28/94	12/28/10	23,674	USD	Domestic	Floating	M	Quantity
20	01/06/95	01/06/98	187,463	FRF	Eurobond	9.875	A	Quantity
21	08/29/95	08/29/00	795,153	DM	Eurobond	9.25	A	Price / Quantity
22	11/09/95	11/09/98	130,905	CHF	Eurobond	7.125	A	Quantity
23	11/14/95	11/14/02	704,460	EUR	Eurobond	10.5	A	Quantity
24	11/23/95	11/14/02	177,493	DM	Eurobond	10.5	A	Quantity
25	11/29/95	03/25/99	441,534	JPY	Eurobond	5	A	Quantity
26	12/06/95	12/28/98	49,297	ATS	Eurobond	8.5	A	Quantity
27	12/27/95	06/27/97	137,504	JPY	Eurobond	3.25	S	Quantity
28	02/06/96	02/06/03	676,200	EUR	Eurobond	10.25	A	Quantity
29	02/20/96	02/23/01	1,100,000	USD	Global	9.25	S	Price / Quantity
30	03/06/96	03/06/01	321,473	ITL	Eurobond	13.25	A	Quantity
31	04/04/96	04/04/06	74,993	JPY	Eurobond	7.4	A	Quantity
32	04/10/96	04/10/06	676,652	DM	Eurobond	11.25	A	Price / Quantity
33	04/15/96	09/01/02	99,341	EUR	Eurobond	12.625	A	Quantity
34	04/18/96	04/18/01	95,200	ATS	Eurobond	9	A	Quantity
35	04/25/96	04/25/06	74,444	JPY	Eurobond	7.4	A	Quantity
36	05/07/96	03/27/01	845,499	JPY	Eurobond	5.5	A	Quantity
37	05/15/96	05/15/06	65,761	JPY	Eurobond	7.4	A	Quantity
38	05/20/96	05/20/99	326,146	DM	Eurobond	7	A	Price / Quantity
39	05/20/96	05/20/11	645,360	EUR	Eurobond	11.75	A	Quantity
40	06/25/96	06/25/99	227,505	ITL	Eurobond	11	A	Quantity
41	07/05/96	07/05/99	147,589	NLG	Eurobond	7.625	A	Quantity
42	08/14/96	08/14/01	155,302	GBP	Eurobond	11.5	A	Quantity
43	08/15/96	08/19/99	500,000	USD	Eurobond	Floating	Q	Price / Quantity
44	09/19/96	09/19/03	248,363	DM	Eurobond	9	A	Price / Quantity
45	09/19/96	09/19/16	248,363	DM	Eurobond	12	A	Quantity
46	10/09/96	10/09/06	1,300,000	USD	Global	11	S	Price / Quantity
47	11/05/96	11/05/03	329,903	ITL	Eurobond	11	A	Quantity
48	11/12/96	03/24/05	445,407	JPY	Eurobond	6	A	Quantity
49	11/13/96	11/13/26	329,078	DM	Eurobond	11.75	A	Quantity
50	12/04/96	12/04/03	230,357	CHF	Eurobond	7	A	Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
51	12/05/96	12/20/02	444,286	JPY	Eurobond	5	S	Quantity
52	12/13/96	12/13/98	500,000	USD	Domestic	8	S	Quantity
53	12/20/96	12/20/02	439,504	JPY	Eurobond	5	N.A.	Quantity
54	12/23/96	02/23/05	643,561	DM	Eurobond	8.5	A	Price / Quantity
55	01/03/97	01/03/07	385,990	ITL	Eurobond	10	A	Quantity
56	01/30/97	01/30/17	3,287,500	USD	Global	11.375	S	Price / Quantity
57	03/18/97	03/18/04	898,382	DM	Eurobond	7	A	Price / Quantity
58	04/09/97	03/18/04	83,852	ATS	Eurobond	7	A	Quantity
59	05/08/97	05/27/04	449,785	JPY	Eurobond	4.4	S	Quantity
60	05/09/97	05/09/02	2,292,000	USD	Domestic	8.75	S	Quantity
61	05/23/97	05/23/02	138,569	ESP	Eurobond	7.5	A	Quantity
62	05/27/97	05/27/04	295,869	ITL	Eurobond	Floating	Q	Quantity
63	05/27/97	05/27/04	420,198	JPY	Eurobond	4.4	S	Quantity
64	06/25/97	06/25/07	330,785	GBP	Eurobond	10	A	Quantity
65	08/11/97	08/11/07	416,948	ITL	Eurobond	7.625	A	Quantity
66	09/19/97	09/19/27	2,500,000	USD	Global	9.75	S	Quantity
67	10/17/97	10/16/98	500,000	USD	Domestic	0	Z	Price
68	10/21/97	03/18/04	435,325	ITL	Eurobond	7	A	Quantity
69	10/24/97	03/18/04	217,845	ITL	Eurobond	7	A	Quantity
70	10/30/97	10/30/09	570,169	DM	Eurobond	8	A	Price / Quantity
71	12/16/97	11/30/02	500,000	USD	Yankee	9.5	S	Quantity
72	12/22/97	12/22/00	158,580	ITL	Eurobond	8	A	Quantity
73	01/14/98	01/20/01	1,563,000	USD	Domestic	Floating	N.A.	Quantity
74	02/04/98	02/04/03	663,790	EUR	Eurobond	8.75	A	Quantity
75	02/26/98	02/26/08	822,684	EUR	Eurobond	Step Down	A	Price / Quantity
76	03/12/98	10/30/09	416,914	ITL	Eurobond	8	A	Quantity
77	04/03/98	02/26/08	244,577	EUR	Eurobond	8	A	Price / Quantity
78	04/03/98	02/26/08	249,335	EUR	Eurobond	8	A	Quantity
79	04/13/98	04/10/05	1,000,000	USD	Global	Floating	S	Quantity
80	04/21/98	04/21/08	820,829	EUR	Global	8.125	A	Price / Quantity
81	07/06/98	07/06/10	556,615	EUR	Eurobond	8.25	A	Price / Quantity
82	07/08/98	07/08/05	565,384	ITL	Eurobond	Floating	Q	Quantity
83	07/21/98	07/21/03	1,000,000	USD	Domestic	Floating	Q	Quantity
84	07/29/98	07/29/05	414,863	DM	Eurobond	7.875	A	Price / Quantity
85	07/30/98	07/30/10	554,485	EUR	Eurobond	8.5	A	Price / Quantity
86	10/16/98	09/19/27	293,450	USD	Domestic	9.9375	S	Quantity
87	11/19/98	11/19/08	299,618	DM	Eurobond	9	A	Price / Quantity
88	11/19/98	12/04/05	1,000,000	USD	Global	11	S	Quantity
89	12/04/98	12/04/05	1,000,000	USD	Global	11	S	Price / Quantity
90	01/15/99	04/15/07	48,918	USD	Domestic	Floating	Q	Quantity
91	02/04/99	02/04/03	214,198	EUR	Eurobond	8.75	A	Quantity
92	02/25/99	02/25/02	112,061	EUR	Domestic	8	A	Quantity
93	02/25/99	02/25/19	1,000,000	USD	Global	12.125	S	Price / Quantity
94	02/25/99	02/25/19	1,000,000	USD	Global	12.125	S	Quantity
95	02/26/99	02/26/08	393,623	EUR	Eurobond	Step Down	A	Price / Quantity
96	03/01/99	03/01/29	125,000	USD	Yankee	8.875	S	Quantity
97	03/04/99	03/04/04	433,182	EUR	Eurobond	9.5	A	Price / Quantity
98	03/15/99	04/06/04	300,000	USD	Private Placement	Floating	Q	Quantity
99	03/19/99	03/17/00	1,168,544	USD	Domestic	0	Z	Price
100	04/06/99	04/10/04	300,000	USD	Eurobond	Floating	Q	Price / Quantity
101	04/06/99	02/26/08	270,304	EUR	Eurobond	8	A	Price / Quantity
102	04/07/99	04/07/09	1,226,354	USD	Global	11.75	S	Price / Quantity
103	04/26/99	04/26/06	483,316	EUR	Eurobond	9	A	Price / Quantity
104	05/10/99	03/18/04	439,464	EUR	Eurobond	7	A	Price / Quantity
105	05/24/99	05/24/01	1,270,080	USD	Domestic	9.5	S	Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
106	05/24/99	05/24/04	2,640,292	USD	Domestic	11.25	S	Quantity
107	05/26/99	05/26/09	694,155	EUR	Eurobond	9	A	Price / Quantity
108	06/10/99	06/10/02	208,677	EUR	Eurobond	7.125	A	Quantity
109	07/01/99	07/01/04	681,842	EUR	Eurobond	8.5	A	Price / Quantity
110	07/22/99	07/22/03	103,489	EUR	Eurobond	Floating	S	Quantity
111	08/11/99	08/11/09	158,724	JPY	Eurobond	3.5	A	Quantity
112	09/03/99	09/03/01	585,504	EUR	Eurobond	8.5	A	Price / Quantity
113	10/14/99	05/14/01	321,199	EUR	Eurobond	7.3	Z	Quantity
114	10/15/99	10/16/00	250,000	USD	Global	0	Z	Quantity
115	10/15/99	04/15/01	250,000	USD	Global	0	Z	Quantity
116	10/15/99	10/15/01	250,000	USD	Global	0	Z	Quantity
117	10/15/99	10/15/02	250,000	USD	Global	0	Z	Quantity
118	10/15/99	10/15/03	250,000	USD	Global	0	Z	Quantity
119	10/15/99	10/15/04	250,000	USD	Global	0	Z	Quantity
120	10/21/99	10/21/02	523,341	EUR	Eurobond	9.25	A	Quantity
121	11/12/99	11/10/00	1,141,458	USD	Domestic	0	Z	Price
122	11/19/99	02/26/08	1,488,544	EUR	Eurobond	8	A	Price / Quantity
123	11/26/99	11/26/03	260,308	EUR	Eurobond	9.75	A	Price / Quantity
124	12/07/99	12/07/04	412,672	EUR	Eurobond	10	A	Price / Quantity
125	12/09/99	12/07/04	101,792	EUR	Eurobond	10	A	Quantity
126	12/11/99	01/07/05	254,091	EUR	Eurobond	10	A	Quantity
127	12/17/99	12/17/03	183,135	JPY	Eurobond	5.4	S	Quantity
128	12/22/99	12/22/04	202,196	EUR	Eurobond	Floating	Q	Quantity
129	01/07/00	01/07/05	657,455	EUR	Eurobond	10	A	Price / Quantity
130	01/07/00	01/07/05	253,362	EUR	Eurobond	N.A.	N.A.	Quantity
131	01/26/00	01/26/07	776,156	EUR	Eurobond	10.25	A	Price / Quantity
132	02/03/00	02/01/20	1,250,000	USD	Global	12	S	Price / Quantity
133	02/21/00	05/21/03	1,684,938	USD	Domestic	11.75	S	Quantity
134	02/21/00	05/21/05	1,763,641	USD	Domestic	12.125	S	Quantity
135	03/15/00	03/15/10	1,000,000	USD	Global	11.375	S	Price / Quantity
136	03/17/00	03/16/01	1,109,683	USD	Domestic	0	Z	Price
137	04/04/00	10/04/04	479,039	EUR	Eurobond	8.125	A	Price / Quantity
138	05/24/00	05/24/05	674,068	EUR	Eurobond	9	A	Price / Quantity
139	06/14/00	06/14/04	561,979	JPY	Eurobond	5.125	S	Quantity
140	06/15/00	06/15/15	2,402,700	USD	Global	11.75	S	Price / Quantity
141	06/20/00	06/20/03	940,083	EUR	Eurobond	9	A	Price / Quantity
142	07/14/00	07/13/01	1,251,560	USD	Domestic	0	Z	Price
143	07/20/00	07/20/04	949,065	EUR	Eurobond	9.25	A	Price / Quantity
144	07/21/00	07/21/30	1,250,000	USD	Global	10.25	S	Price / Quantity
145	09/07/00	09/07/07	435,722	EUR	Eurobond	10	A	Price / Quantity
146	09/26/00	09/26/05	575,595	JPY	Eurobond	4.85	S	Quantity
147	11/10/00	11/09/01	1,000,979	USD	Domestic	0	Z	Price
148	02/21/01	02/21/12	1,593,951	USD	Global	12.375	S	Price / Quantity
149	02/22/01	02/22/07	300,000	USD	Eurobond	11	S	Price / Quantity
150	06/19/01	06/19/31	8,935,311	USD	Global	12	S	Price / Quantity
151	06/19/01	06/19/31	200,000	USD	Eurobond	9.5	A	Quantity
152	06/19/01	06/19/18	7,691,791	USD	Global	12.25	S	Price / Quantity
153	06/19/01	06/19/18	463,729	EUR	Eurobond	10	A	Quantity
					Brazil			
1	10/15/88	10/15/99	670,000	USD	Restructured Debt	Floating	S	Price
2	08/31/89	09/15/13	1,000,000	USD	Restructured Debt	6	S	Price
3	11/26/92	01/01/01	7,104,960	USD	Brady Bond	Floating	S	Price
4	04/15/94	04/15/06	4,799,521	USD	Brady Bond	Floating	S	Price
5	04/15/94	04/15/09	1,737,355	USD	Brady Bond	Floating	S	Price

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
6	04/15/94	04/15/09	2,174,663	USD	Brady Bond	Floating	S	Price
7	04/15/94	04/15/14	7,387,519	USD	Brady Bond	8	S	Price
8	04/15/94	04/15/24	3,593,064	USD	Brady Bond	Floating	S	Price
9	04/15/94	04/15/24	10,631,926	USD	Brady Bond	Floating	S	Price
10	10/15/94	04/15/12	8,489,909	USD	Brady Bond	Floating	S	Price
11	06/19/95	06/19/97	946,415	JPY	Eurobond	6	A	Quantity
12	06/21/95	07/20/98	719,756	DM	Eurobond	9	A	Price / Quantity
13	10/19/95	01/06/01	70,715	DM	Eurobond	10	A	Price
14	03/22/96	03/22/01	283,509	JPY	Eurobond	5.5	S	Quantity
15	05/08/96	04/15/05	164,668	EUR	Eurobond	11	A	Price / Quantity
16	06/11/96	06/11/99	154,223	GBP	Eurobond	9.75	A	Quantity
17	10/09/96	09/15/07	1,281,699	USD	Eurobond	Floating	S	Quantity
18	11/05/96	11/05/01	750,000	USD	Global	8.875	S	Price / Quantity
19	02/05/97	02/26/07	601,900	EUR	Eurobond	8	A	Price / Quantity
20	02/26/97	02/26/07	590,338	EUR	Eurobond	8	N.A.	Quantity
21	04/25/97	05/21/02	174,124	EUR	Eurobond	6.625	A	Price / Quantity
22	04/30/97	05/21/02	208,699	EUR	Eurobond	6.625	A	Price / Quantity
23	05/07/97	05/21/02	166,905	EUR	Eurobond	6.625	A	Price / Quantity
24	06/03/97	06/26/17	442,219	EUR	Eurobond	11	A	Price / Quantity
25	06/09/97	05/15/27	3,500,000	USD	Global	10.125	S	Quantity
26	07/30/97	07/30/07	253,245	GBP	Eurobond	10	A	Quantity
27	03/03/98	03/03/03	538,100	EUR	Eurobond	8.625	A	Price / Quantity
28	04/06/98	04/07/08	1,000,000	USD	Eurobond	0	Z	Quantity
29	04/07/98	04/07/08	1,250,000	USD	Global	9.375	S	Quantity
30	04/23/98	04/23/08	413,289	DM	Eurobond	Step Down	A	Quantity
31	04/30/99	04/15/04	3,046,172	USD	Global	11.625	S	Price / Quantity
32	07/29/99	07/29/02	750,778	EUR	Eurobond	9.5	A	Quantity
33	09/10/99	09/30/04	523,596	EUR	Eurobond	11.125	A	Price / Quantity
34	10/25/99	10/15/09	4,000,000	USD	Global	14.5	S	Price / Quantity
35	10/29/99	11/17/06	735,812	EUR	Eurobond	12	A	Price / Quantity
36	11/13/99	11/26/01	606,366	EUR	Eurobond	8.25	A	Price / Quantity
37	01/15/00	02/04/10	741,988	EUR	Eurobond	11	A	Price / Quantity
38	01/26/00	01/15/20	1,000,000	USD	Global	12.75	S	Price / Quantity
39	03/06/00	03/06/30	1,000,000	USD	Global	12.25	S	Price / Quantity
40	06/21/00	07/05/05	709,622	EUR	Eurobond	9	A	Quantity
41	06/23/00	07/05/05	1,170,631	EUR	Eurobond	9	A	Price / Quantity
42	07/26/00	07/26/07	1,500,000	USD	Global	11.25	S	Price / Quantity
43	08/17/00	08/17/40	5,157,311	USD	Global	11	S	Price / Quantity
44	09/20/00	10/05/07	423,765	EUR	Eurobond	9.5	A	Price / Quantity
45	11/29/00	03/22/06	600,646	JPY	Eurobond	4.75	S	Quantity
46	01/10/01	01/24/11	937,124	EUR	Eurobond	9.5	A	Price / Quantity
47	01/11/01	01/11/06	1,500,000	USD	Global	10.25	S	Price / Quantity
48	03/17/01	04/10/07	651,090	JPY	Eurobond	4.75	S	Quantity
49	03/22/01	04/15/24	2,150,000	USD	Global	8.875	S	Price / Quantity
50	05/09/01	07/05/05	424,012	EUR	Eurobond	9	A	Quantity
51	05/17/01	07/15/05	1,000,000	USD	Global	9.625	S	Price / Quantity
52	08/02/01	08/28/03	177,576	JPY	Eurobond	3.75	S	Quantity
53	01/11/02	01/11/12	1,250,000	USD	Global	11	S	Price / Quantity
54	03/12/02	03/12/08	1,250,000	USD	Global	11.5	S	Quantity
55	04/02/02	04/02/09	445,859	EUR	Eurobond	11.5	A	Price / Quantity
56	04/16/02	04/15/10	1,000,000	USD	Global	12	S	Quantity
					Colombia			
1	05/11/93	05/11/98	125,000	USD	Eurobond	7.125	S	Price / Quantity
2	01/14/94	01/14/99	89,678	JPY	Eurobond	3.55	S	Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
3	02/23/94	02/23/04	250,000	USD	Yankee	7.25	S	Price / Quantity
4	10/06/94	10/06/99	175,000	USD	Yankee	8.75	S	Price / Quantity
5	02/15/95	02/15/00	100,000	USD	Eurobond	9.25	A	Quantity
6	08/02/95	08/02/02	126,920	JPY	Eurobond	4.1	S	Quantity
7	11/28/95	12/21/00	104,113	DM	Eurobond	7.25	A	Price / Quantity
8	12/21/95	12/22/00	147,326	JPY	Eurobond	3	S	Quantity
9	02/15/96	02/15/03	200,000	USD	Global	7.25	S	Price / Quantity
10	02/15/96	02/15/16	200,000	USD	Global	8.7	S	Price / Quantity
11	06/13/96	06/14/01	400,000	USD	Eurobond	8	A	Price / Quantity
12	10/07/96	10/07/16	125,000	USD	Eurobond	8.66	S	Quantity
13	11/21/96	11/21/01	181,916	DM	Eurobond	Floating	Q	Quantity
14	02/24/97	02/15/07	750,000	USD	Global	7.625	S	Price / Quantity
15	02/24/97	02/15/27	250,000	USD	Global	8.375	S	Price / Quantity
16	02/11/98	02/11/08	164,830	GBP	Eurobond	9.75	A	Quantity
17	03/06/98	03/06/02	222,433	ITL	Eurobond	7	A	Quantity
18	04/02/98	04/01/08	500,000	USD	Global	8.625	S	Price / Quantity
19	06/15/98	06/15/03	150,000	USD	Private Placement	7.27	S	Quantity
20	06/25/98	06/15/03	150,000	USD	Eurobond	7.27	S	Price / Quantity
21	07/14/98	07/14/03	135,000	USD	Eurobond	7.7	S	Price / Quantity
22	08/13/98	08/13/05	500,000	USD	Yankee	Floating	Q	Quantity
23	03/09/99	03/09/04	500,000	USD	Global	10.875	S	Price / Quantity
24	04/23/99	04/23/09	500,000	USD	Global	9.75	S	Price / Quantity
25	11/30/99	04/25/05	500,000	USD	Eurobond	9.75	N.A.	Quantity
26	11/30/99	04/23/09	500,000	USD	Global	9.75	S	Quantity
27	02/25/00	02/25/20	1,075,000	USD	Global	11.75	S	Price / Quantity
28	03/17/00	03/09/28	22,285	USD	Global	11.85	S	Quantity
29	06/09/00	06/30/03	427,948	EUR	Eurobond	11	A	Price / Quantity
30	07/28/00	06/30/03	139,210	EUR	Eurobond	11	A	Quantity
31	10/05/00	10/20/05	513,629	EUR	Eurobond	11.25	A	Price / Quantity
32	10/13/00	10/17/05	300,000	USD	Eurobond	Floating	Q	Quantity
33	10/20/00	10/20/05	252,786	EUR	Eurobond	11.25	A	Quantity
34	01/25/01	01/31/08	648,145	EUR	Eurobond	11.375	A	Price / Quantity
35	04/09/01	04/09/11	875,000	USD	Global	9.75	S	Quantity
36	04/12/01	04/27/05	243,041	JPY	Eurobond	5.5	S	Quantity
37	05/12/01	05/31/11	344,828	EUR	Eurobond	11.5	A	Price / Quantity
38	06/13/01	06/13/06	450,000	USD	Global	10.5	S	Price / Quantity
39	11/21/01	01/23/12	900,000	USD	Global	10	S	Price / Quantity
40	07/09/02	07/09/10	507,029	USD	Global	10.5	S	Quantity
41	12/09/02	01/15/13	625,000	USD	Global	10.75	S	Quantity
					Mexico			
1	03/28/90	12/31/19	1,516,473	EUR	Brady Bond	5.01	S	Price
2	03/13/91	03/13/96	187,243	DM	Eurobond	10.5	A	Quantity
3	07/16/91	07/16/01	150,000	USD	Eurobond	9.5	S	Quantity
4	08/21/91	08/21/96	91,747	ESP	Eurobond	14.25	A	Quantity
5	09/29/91	09/01/08	96,500	GBP	Eurobond	16.5	S	Quantity
6	12/03/91	12/03/98	182,252	GBP	Eurobond	12.25	A	Quantity
7	09/24/92	09/15/02	250,000	USD	Yankee	8.5	S	Price / Quantity
8	03/16/93	03/16/98	200,000	USD	Eurobond	7.25	A	Price / Quantity
9	04/02/93	08/12/00	58,895	USD	Eurobond	6.97	S	Price
10	07/23/93	07/23/96	92,825	JPY	Eurobond	4.9	S	Quantity
11	01/25/95	01/29/03	846,891	EUR	Eurobond	10.375	A	Price / Quantity
12	07/20/95	07/21/97	1,000,000	USD	Eurobond	Floating	S	Price
13	07/21/95	07/21/97	418,403	USD	Eurobond	Step Down	A	Quantity
14	08/17/95	08/17/98	1,057,666	JPY	Eurobond	5	A	Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
15	10/05/95	11/02/00	705,975	DM	Eurobond	9.375	A	Price / Quantity
16	12/05/95	11/27/96	1,500,000	USD	Eurobond	0	Z	Quantity
17	12/12/95	03/12/97	294,652	JPY	Eurobond	2.85	A	Quantity
18	12/12/95	12/12/97	127,683	JPY	Eurobond	3	A	Quantity
19	01/29/96	01/29/03	684,158	DM	Eurobond	10.375	A	Quantity
20	02/06/96	02/06/01	1,000,000	USD	Global	9.75	S	Price / Quantity
21	05/07/96	05/15/26	1,750,000	USD	Global	11.5	S	Price / Quantity
22	06/06/96	06/06/06	918,628	JPY	Eurobond	6.75	S	Quantity
23	09/10/96	09/10/04	1,002,904	DM	Eurobond	Step Up	A	Quantity
24	09/24/96	09/15/16	1,200,000	USD	Global	11.375	S	Price / Quantity
25	09/30/96	09/30/02	637,841	JPY	Eurobond	5	N.A.	Quantity
26	11/21/96	11/21/01	330,447	ITL	Eurobond	Floating	Q	Quantity
27	01/14/97	01/15/07	1,250,000	USD	Global	9.875	S	Price / Quantity
28	01/14/97	01/15/07	500,000	USD	Eurobond	9.875	S	Quantity
29	02/05/97	02/24/09	902,850	EUR	Eurobond	8.25	A	Price / Quantity
30	02/20/97	02/20/07	302,076	EUR	Eurobond	9.125	A	Price / Quantity
31	02/24/97	02/24/09	885,506	EUR	Eurobond	8.25	A	Quantity
32	03/11/97	03/11/04	407,692	JPY	Eurobond	4	N.A.	Quantity
33	04/24/97	04/24/02	796,761	JPY	Eurobond	3.1	N.A.	Quantity
34	05/08/97	05/08/17	297,195	ITL	Eurobond	11	A	Quantity
35	05/30/97	05/30/02	489,966	GBP	Eurobond	8.75	A	Quantity
36	06/27/97	06/27/02	1,000,000	USD	Eurobond	Floating	Q	Quantity
37	07/16/97	07/16/04	286,671	ITL	Eurobond	8.375	A	Quantity
38	07/23/97	07/23/08	418,543	DM	Eurobond	8	A	Quantity
39	09/10/97	10/01/04	446,235	EUR	Eurobond	7.625	A	Price / Quantity
40	10/29/97	06/02/03	360,573	CAD	Global	7	S	Quantity
41	03/12/98	03/12/08	1,250,000	USD	Global	8.625	S	Price / Quantity
42	06/08/98	06/08/03	100,867	PTE	Eurobond	Floating	S	Quantity
43	02/19/99	02/17/09	1,250,000	USD	Global	10.375	S	Price / Quantity
44	04/06/99	04/06/05	1,000,000	USD	Global	9.75	S	Price / Quantity
45	04/07/99	04/07/00	227,952	USD	Eurobond	Floating	S	Quantity
46	04/07/99	04/07/04	500,000	USD	Eurobond	Floating	Q	Price
47	04/07/99	04/07/04	394,926	EUR	Eurobond	Floating	Q	Quantity
48	06/23/99	07/06/06	420,643	EUR	Global	7.375	A	Price / Quantity
49	01/28/00	02/01/10	1,500,000	USD	Global	9.875	S	Price / Quantity
50	03/02/00	03/08/10	966,277	EUR	Eurobond	7.5	A	Price / Quantity
51	08/01/00	02/01/06	1,500,000	USD	Global	8.5	S	Price / Quantity
52	09/20/00	09/29/04	467,158	JPY	Eurobond	2.25	S	Quantity
53	01/16/01	01/14/11	1,500,000	USD	Global	8.375	S	Price / Quantity
54	03/13/01	03/13/08	659,805	EUR	Eurobond	7.375	A	Quantity
55	03/30/01	12/30/19	3,300,000	USD	Global	8.125	S	Price / Quantity
56	08/13/01	08/15/31	3,250,000	USD	Global	8.3	S	Price / Quantity
57	01/14/02	01/14/12	1,250,000	USD	Global	7.5	S	Price / Quantity
58	09/24/02	09/24/22	1,750,000	USD	Global	8	S	Quantity
					Russia			
1	05/14/93	05/14/94	266,000	USD	Domestic	3	A	Quantity
2	05/14/93	05/14/96	1,518,000	USD	Domestic	3	A	Quantity
3	05/14/93	05/14/99	1,307,000	USD	Domestic	3	A	Quantity
4	05/14/93	05/14/03	2,627,000	USD	Domestic	3	A	Price / Quantity
5	05/14/93	05/14/08	2,502,000	USD	Domestic	3	A	Price / Quantity
6	05/14/96	05/14/06	1,750,000	USD	Domestic	3	A	Price / Quantity
7	05/14/96	05/14/11	1,750,000	USD	Domestic	3	A	Price / Quantity
8	11/27/96	11/27/01	1,000,000	USD	Eurobond	9.25	S	Price / Quantity
9	03/13/97	03/25/04	1,177,126	EUR	Eurobond	9	A	Price / Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
10	03/19/97	03/19/15	58,932	DM	Eurobond	Floating	A	Quantity
11	03/25/97	03/25/04	1,187,936	EUR	Eurobond	9	A	Quantity
12	06/26/97	06/26/07	2,400,000	USD	Private Placement	10	S	Price
13	06/26/97	06/26/07	2,400,000	USD	Eurobond	10	S	Price / Quantity
14	12/06/97	12/06/99	50,000	USD	Eurobond	Floating	N.A.	Quantity
15	03/12/98	03/12/18	54,744	DM	Eurobond	Step Down	A	Quantity
16	03/31/98	03/31/05	680,108	EUR	Eurobond	9.375	A	Price / Quantity
17	03/31/98	03/31/05	687,815	EUR	Eurobond	9.375	A	Quantity
18	04/24/98	04/30/03	418,403	EUR	Eurobond	9	A	Price / Quantity
19	06/10/98	06/10/03	1,250,000	USD	Private Placement	11.75	S	Price / Quantity
20	06/10/98	06/10/03	1,250,000	USD	Eurobond	11.75	S	Price / Quantity
21	06/24/98	06/24/08	150,000	USD	Eurobond	12.75	N.A.	Quantity
22	06/24/98	06/24/28	2,500,000	USD	Private Placement	12.75	S	Price / Quantity
23	06/24/98	06/24/28	2,500,000	USD	Eurobond	12.75	S	Price / Quantity
24	07/24/98	07/24/05	2,968,968	USD	Private Placement	8.75	S	Price
25	07/24/98	07/24/05	2,968,967	USD	Eurobond	8.75	S	Price / Quantity
26	07/24/98	07/24/18	3,466,671	USD	Private Placement	11	S	Price
27	07/24/98	07/24/18	3,466,671	USD	Eurobond	11	S	Price / Quantity
28	02/01/00	11/14/07	1,322,000	USD	Domestic	3	S	Price
29	03/31/00	03/31/30	1,840,000	USD	Private Placement	Step Up	S	Quantity
30	03/31/00	03/31/30	1,840,000	USD	Eurobond	Step Up	S	Quantity
31	08/25/00	03/31/10	2,534,000	USD	Private Placement	8.25	S	Price
32	08/25/00	03/31/10	2,534,000	USD	Eurobond	8.25	S	Price / Quantity
					Turkey			
1	01/01/50	02/06/03	1,000,000	EUR	Eurobond	7.25	A	Price
2	12/22/88	12/22/98	150,000	USD	Eurobond	11.125	A	Price / Quantity
3	04/27/89	04/27/99	200,000	USD	Eurobond	11.5	S	Price / Quantity
4	06/07/89	06/07/99	280,000	USD	Eurobond	5.5	A	Price / Quantity
5	09/14/89	09/14/99	200,000	USD	Eurobond	10.25	S	Quantity
6	11/22/89	11/22/95	250,000	USD	Eurobond	9.75	N.A.	Quantity
7	02/21/90	03/15/97	200,000	USD	Eurobond	10.75	A	Price / Quantity
8	04/04/90	04/24/97	147,001	DM	Eurobond	10	A	Price
9	08/16/90	08/16/95	150,000	USD	Eurobond	10.375	N.A.	Quantity
10	10/28/91	10/28/96	328,235	DM	Eurobond	10.75	A	Price / Quantity
11	03/03/92	03/20/97	250,000	USD	Eurobond	8.5	S	Price / Quantity
12	06/25/92	06/15/99	250,000	USD	Eurobond	9	S	Price / Quantity
13	07/06/92	07/27/99	268,294	DM	Eurobond	10.25	A	Price / Quantity
14	07/16/92	08/06/97	200,000	USD	Eurobond	8.125	A	Price / Quantity
15	09/24/92	09/24/99	407,432	JPY	Eurobond	6.8	N.A.	Quantity
16	01/19/93	02/18/00	243,665	DM	Eurobond	9.5	A	Price / Quantity
17	02/25/93	02/25/00	826,720	JPY	Eurobond	6.3	S	Quantity
18	06/10/93	06/10/03	326,067	JPY	Eurobond	7	N.A.	Quantity
19	06/28/93	07/09/03	585,783	EUR	Eurobond	8.75	A	Price / Quantity
20	10/19/93	10/29/98	610,493	DM	Eurobond	7.25	A	Price / Quantity
21	10/27/93	10/27/03	187,481	GBP	Eurobond	9	A	Quantity
22	11/30/93	11/30/98	278,287	JPY	Eurobond	4	S	Quantity
23	11/30/93	11/30/01	463,811	JPY	Eurobond	5.1	S	Quantity
24	03/01/94	03/01/02	428,006	JPY	Eurobond	5.45	N.A.	Quantity
25	03/01/94	03/01/04	286,766	JPY	Eurobond	5.75	S	Quantity
26	07/25/95	08/21/98	345,994	DM	Eurobond	8	A	Price / Quantity
27	07/27/95	07/27/98	573,254	JPY	Eurobond	4.5	S	Quantity
28	09/19/95	10/05/98	300,000	USD	Eurobond	8.75	S	Price / Quantity
29	11/06/95	05/06/05	263,350	USD	Eurobond	3	S	Price / Quantity
30	01/16/96	02/16/06	94,793	JPY	Eurobond	7.2	A	Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
31	02/05/96	02/14/01	341,041	DM	Eurobond	7.5	A	Price / Quantity
32	04/23/96	04/23/01	697,913	JPY	Eurobond	5.7	S	Quantity
33	05/22/96	06/11/99	500,000	USD	Eurobond	8.25	S	Price / Quantity
34	05/30/96	05/30/02	281,833	JPY	Eurobond	6	A	Quantity
35	08/13/96	09/04/00	431,656	DM	Eurobond	8	A	Price / Quantity
36	12/05/96	12/05/01	483,406	DM	Eurobond	7.625	A	Price / Quantity
37	01/29/97	02/17/04	301,397	DM	Eurobond	7.75	A	Price / Quantity
38	02/24/97	03/18/02	177,144	EUR	Eurobond	9	A	Price / Quantity
39	03/14/97	06/26/03	57,626	DM	Eurobond	8.5	A	Quantity
40	05/20/97	05/23/02	400,000	USD	Eurobond	10	S	Price / Quantity
41	06/03/97	06/24/02	578,935	DM	Eurobond	7.25	A	Price / Quantity
42	08/18/97	08/18/00	100,000	USD	Eurobond	Floating	S	Quantity
43	09/17/97	09/19/07	600,000	USD	Eurobond	10	S	Price / Quantity
44	09/19/97	09/19/07	600,000	USD	Private Placement	10	S	Quantity
45	10/10/97	10/22/07	1,285,709	EUR	Eurobond	8.125	A	Price / Quantity
46	02/06/98	02/06/03	551,222	DM	Eurobond	7.25	A	Quantity
47	02/13/98	02/23/05	400,000	USD	Private Placement	9.875	S	Price / Quantity
48	02/13/98	02/23/05	450,000	USD	Eurobond	9.875	S	Price / Quantity
49	04/20/98	04/20/06	552,154	DM	Eurobond	Step Down	A	Quantity
50	05/12/98	05/12/03	300,000	USD	Eurobond	8.875	S	Price / Quantity
51	11/20/98	11/30/01	475,737	DM	Eurobond	9.5	A	Price / Quantity
52	12/11/98	12/15/08	600,000	USD	Eurobond	12	S	Price / Quantity
53	12/15/98	12/15/03	200,000	USD	Eurobond	12	N.A.	Quantity
54	02/06/99	02/17/03	449,102	DM	Eurobond	9.25	A	Price / Quantity
55	02/25/99	03/15/04	1,105,154	EUR	Eurobond	9.5	A	Price / Quantity
56	06/19/99	06/15/09	1,250,000	USD	Eurobond	12.375	S	Price / Quantity
57	08/05/99	08/25/05	427,656	EUR	Eurobond	9.625	A	Price / Quantity
58	10/30/99	11/05/04	500,000	USD	Eurobond	11.875	S	Price / Quantity
59	11/13/99	11/30/06	773,914	EUR	Eurobond	9.625	A	Price / Quantity
60	12/03/99	12/17/02	404,000	EUR	Eurobond	7.75	A	Price / Quantity
61	01/11/00	01/15/30	1,500,000	USD	Eurobond	11.875	S	Price / Quantity
62	01/27/00	02/09/10	977,359	EUR	Eurobond	9.25	A	Price / Quantity
63	03/31/00	04/14/05	561,209	EUR	Eurobond	7.75	A	Price / Quantity
64	06/09/00	06/15/10	1,500,000	USD	Eurobond	11.75	S	Price / Quantity
65	06/13/00	06/13/03	474,809	EUR	Eurobond	Floating	Q	Quantity
66	06/15/00	06/15/10	750,000	USD	Eurobond	11.75	N.A.	Quantity
67	06/17/00	07/14/04	516,674	JPY	Eurobond	3.25	S	Quantity
68	08/07/00	08/07/03	177,949	EUR	Eurobond	Floating	S	Quantity
69	11/07/00	11/27/03	467,022	JPY	Eurobond	3	S	Quantity
70	01/31/01	02/16/04	697,492	EUR	Eurobond	8.25	A	Price / Quantity
71	10/24/01	02/07/05	713,349	EUR	Eurobond	11	A	Price / Quantity
72	11/21/01	11/27/06	1,000,000	USD	Eurobond	11.375	S	Price / Quantity
73	01/17/02	01/23/12	1,000,000	USD	Eurobond	11.5	S	Price / Quantity
74	03/13/02	03/19/08	600,000	USD	Eurobond	9.875	S	Price / Quantity
75	04/19/02	05/08/07	614,058	EUR	Eurobond	9.75	A	Price / Quantity
76	05/14/02	05/14/07	200,000	USD	Eurobond	11.5	S	Quantity
77	11/13/02	01/13/08	1,100,000	USD	Eurobond	10.5	S	Quantity
78	01/14/03	01/14/13	1,500,000	USD	Eurobond	11	S	Quantity
79	01/24/03	01/24/08	535,720	EUR	Eurobond	9.875	A	Quantity
					Uruguay			
1	04/23/93	04/23/98	100,000	USD	Eurobond	7.5	S	Quantity
2	03/07/94	03/07/01	100,000	USD	Eurobond	7.25	S	Quantity
3	10/24/94	04/24/97	101,604	JPY	Eurobond	5	S	Quantity
4	08/08/95	09/08/00	136,774	DM	Eurobond	8	A	Price / Quantity

Bond	Issue Date	Maturity Date	Amount Issued (USD Thousands)	Currency	Market	Coupon	Coupon Frequency	Data Available
5	09/19/96	09/26/06	100,000	USD	Eurobond	8.375	S	Price / Quantity
6	09/20/96	09/26/06	100,000	USD	Private Placement	8.375	S	Quantity
7	04/24/97	04/24/02	79,676	JPY	Eurobond	2.5	N.A.	Quantity
8	07/09/97	07/15/27	510,000	USD	Eurobond	7.875	S	Price / Quantity
9	04/06/98	04/07/08	250,000	USD	Eurobond	7	S	Price / Quantity
10	11/14/98	11/18/03	175,000	USD	Eurobond	7.875	S	Price / Quantity
11	04/30/99	05/04/09	250,000	USD	Eurobond	7.25	S	Price / Quantity
12	06/20/00	06/22/10	300,000	USD	Eurobond	8.75	S	Price / Quantity
13	09/13/00	09/26/05	196,824	EUR	Eurobond	7	A	Price / Quantity
14	11/23/00	05/29/07	156,149	CLP	Eurobond	Floating	S	Quantity
15	02/27/01	03/14/06	257,023	JPY	Eurobond	Step Up	S	Quantity
16	06/08/01	06/28/11	170,032	EUR	Eurobond	7	A	Price / Quantity
17	11/20/01	01/20/12	355,000	USD	Eurobond	7.625	S	Price / Quantity
18	03/25/02	03/25/09	250,000	USD	Eurobond	7.875	S	Quantity
					Venezuela			
1	11/14/88	11/14/93	60,606	DM	Eurobond	8.25	A	Price
2	12/22/88	12/22/98	167,000	USD	Eurobond	Floating	S	Price
3	12/22/88	12/30/03	167,000	USD	Eurobond	Floating	S	Price
4	12/18/90	03/30/20	329,059	EUR	Brady Bond	6.66	S	Price
5	12/18/90	03/31/20	719,600	USD	Brady Bond	6.75	S	Price
6	08/21/91	09/11/96	150,000	USD	Eurobond	9.75	A	Price / Quantity
7	09/18/91	12/18/07	100,000	USD	Restructured Debt	9	S	Quantity
8	11/18/91	12/02/96	127,429	DM	Eurobond	10.5	A	Price / Quantity
9	12/18/92	12/18/07	30,000	USD	Private Placement	8.75	S	Quantity
10	03/08/93	03/11/96	150,000	USD	Eurobond	9.125	S	Price / Quantity
11	05/05/93	05/05/98	155,661	DM	Eurobond	10.25	A	Price / Quantity
12	05/11/93	05/27/96	150,000	USD	Eurobond	9	S	Price / Quantity
13	09/13/93	09/20/95	250,000	USD	Eurobond	6.75	S	Price / Quantity
14	09/16/93	10/15/00	183,148	DM	Eurobond	8.75	A	Price / Quantity
15	09/20/93	09/20/95	50,000	USD	Eurobond	Floating	N.A.	Quantity
16	12/07/93	12/07/95	83,155	ATS	Eurobond	8	N.A.	Quantity
17	12/14/95	12/14/98	347,044	DM	Eurobond	10	A	Price / Quantity
18	09/12/96	10/04/03	427,590	EUR	Eurobond	10.25	A	Price / Quantity
19	06/10/97	06/18/07	315,000	USD	Global	9.125	S	Price / Quantity
20	06/10/97	06/18/07	315,000	USD	Private Placement	9.125	S	Price / Quantity
21	09/11/97	09/15/27	4,000,000	USD	Global	9.25	S	Price / Quantity
22	07/31/98	08/15/18	500,000	USD	Eurobond	13.625	S	Price / Quantity
23	10/29/98	10/29/08	109,532	DM	Eurobond	Step Up	A	Quantity
24	12/23/99	12/23/02	190,762	EUR	Eurobond	9.875	A	Quantity
25	03/03/00	03/23/05	481,554	EUR	Eurobond	10.5	A	Price / Quantity
26	02/09/01	03/05/08	550,785	EUR	Eurobond	11	A	Price / Quantity
27	03/05/01	03/05/08	181,830	EUR	Eurobond	11	A	Quantity
28	06/28/01	07/25/11	213,613	EUR	Eurobond	11.125	A	Price / Quantity
29	12/07/01	06/30/03	222,892	EUR	Eurobond	10.5	A	Price / Quantity

The table describes the bonds used in the paper by country. For the currency, ATS stands for Austrian schilling, CAD for Canadian dollar, CHF for Swiss franc, CLP for Chilean peso, DM for Deutsche mark, ESP for Spanish peseta, EUR for Euro, FRF for French franc, GBP for British pound, ITL for Italian lira, JPY for Japanese yen, NLG for Dutch guilder, PTE for Portuguese escudo, and USD for U.S. dollar. For the coupon frequency, A stands for annual, M for monthly, Q for quarterly, S for semi-annual, Z for zero-coupon bond, and N.A. for not available. The last column of the table reports whether the bond is used in the price section, in the quantity section, or in both sections of the paper.