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Why Do Emerging Economies Borrow Short Term?*

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Abstract

We argue that one reason why emerging economies borrow short term is that it is cheaper than borrowing long term. This is especially the case during crises, as in these episodes the relative cost of long-term borrowing increases. We construct a unique database of sovereign bond prices, returns, and issuances at different maturities for 11 emerging economies from 1990 to 2009 and present a set of new stylized facts. On average, these countries pay a higher risk premium on long-term than on short-term bonds. During crises, the difference between the two risk premia increases and issuance shifts towards shorter maturities. To illustrate our argument, we present a simple model in which the maturity structure is the outcome of a risk sharing problem between an emerging economy subject to rollover crises and risk averse international investors.

JEL Classification Codes: E43; F30; F32; F34; F36; G15

Keywords: emerging markets; debt crises; investor risk aversion; maturity structure; risk premium; term premium

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1 Introduction

During the past decades emerging economies have experienced recurring financial crises. A common factor across many of these crises has been a maturity mismatch between assets and liabilities leading to rollover problems.[1] When governments or the private sector have large stocks of short-term liabilities and prospects deteriorate, it becomes very costly to renew the debt, sometimes triggering outright default. Even worse, excessive reliance on short-term debt can open the door to self-fulfilling liquidity crises, which may be simply triggered by a shift in expectations. The risks associated with short-term debt have prompted several authors to suggest that countries should decrease their vulnerability to rollover problems by lengthening the maturity structure of their liabilities.[2] However, if it is so clear that short-term borrowing is risky, why do emerging economies keep borrowing short term?

A common view is that emerging economies borrow short term because of demand-side factors, in particular, to alleviate a moral hazard problem on the debtor side.[3] The early literature, such as Calvo (1988) and Blanchard and Missale (1994), focuses on the incentive for a government to lower the real value of public debt by creating inflation. These papers show that this incentive is lower when the debt is short term. More recent work by Rodrik and Velasco (1999) and Jeanne (2009) shows that, when facing early debt repayments, opportunistic governments have ex-post a lower incentive to default and a higher incentive to carry out revenue-raising reforms. Thus, short-term

[1] For example, large amounts of short-term debt had been accumulated by governments prior to the crises of Mexico 1994-95, Russia 1998, and Brazil 1998-99, by the private sector in Indonesia, South Korea, and Thailand before the 1997 East Asian crisis, and by banks in Iceland and the U.S. prior to the 2008-09 global financial crisis.

[2] This view is presented, among others, by Sachs, Tornell, and Velasco (1996), Furman and Stiglitz (1998), Obstfeld (1998), Radelet and Sachs (1998), Corsetti, Pesenti, and Roubini (1999), Eichengreen and Hausmann (1999), Feldstein (1999), and Cole and Kehoe (2000).

[3] Throughout the paper we refer to the borrowing country as the "demand side" of the international market for loans and to the lenders as the "supply side."

debt serves as a commitment device for debtors and increases welfare ex-ante.[4]

In this paper, we propose an alternative view based on supply-side factors. In particular, we argue that investors charge a higher risk premium on long-term bonds than on short-term bonds, making it cheaper for emerging economies to borrow short term. Moreover, the relative cost of borrowing long term increases significantly during crises, which prompts countries to reduce the amount of long-term borrowing.[5]

What do we mean by short-term borrowing being cheaper? We define the cost of borrowing as the expected repayment per dollar borrowed. Take a borrower that needs funds for 1 year. The borrower is considering two options: (i) issuing 1-year bonds or (ii) issuing 2-year bonds and buying them back in a year's time.[6] In both cases, with some probability the borrower will default within the year and fail to repay. If default does not occur, under option (i) the borrower will pay the yield on 1-year bonds. Under option (ii) the repayment will depend both on the 2-year bond yield and on the (random) price at which the borrower will buy back its bonds. Using this information, one can compute the expected repayment per dollar borrowed in the two cases, which is identical to the expected return per dollar loaned on the lenders' side. If the lenders are risk averse, the cost of borrowing using long-term bonds will, in general, be higher than the one using short-term bonds. Our analysis focuses on this difference, which is commonly referred to as the *term premium*. Since a positive term premium is also present for developed countries (although much smaller), we

[4] The role of short-term debt as a commitment device in the context of international lending has also been emphasized by Diamond and Rajan (2001), Tirole (2002, 2003), Rochet and Vives (2004), Arellano and Ramanarayanan (2008), Niepelt (2008), Alfaro and Kanczuk (2009), Chatterjee and Eyigungor (2009), and Hatchondo and Martinez (2009). Dell'Ariccia, Schnabel, and Zettelmeyer (2006) present some evidence consistent with the moral hazard view.

[5] González-Rozada and Levy Yeyati (2008), Borri and Verdelhan (2011), and Longstaff et al. (2011) show that supply-side or global factors are important determinants of emerging market risk premia. Other papers that emphasize supply-side factors are Calvo and Mendoza (2000), Kaminsky and Reinhart (2000), Caballero and Krishnamurthy (2001, 2003), Chang and Velasco (2001), Kaminsky, Lyons, and Schmukler (2004), Broner, Gelos, and Reinhart (2006), Volkan (2007), Pavlova and Rigobon (2008), and Lizarazo (2010).

[6] An actual debt buyback does not need to take place for this calculation to be correct. Instead of buying back the 2-year bonds in a year's time, the borrower can reduce its issuance of new 1-year bonds at that time.

focus on the difference between the term premium faced by emerging economies and the one faced by developed countries. We refer to this difference as the *excess term premium*.

To demonstrate the role of supply-side factors, we construct and analyze a new database of sovereign bond prices, returns, and issuance at different maturities for 11 emerging economies during the period 1990-2009. Our analysis yields three novel stylized facts. First, the excess term premium for emerging economies is positive on average. When comparing 3-year and 12-year maturities, the excess term premium is around 3% per year. Second, the excess term premium increases sharply during crises. When comparing 3-year and 12-year maturities, the excess term premium is about 30% during crises and less than 1% during non-crisis periods. Furthermore, this increase cannot be accounted for by changes in the volatility of returns since Sharpe ratios increase significantly during crises. Third, emerging economies reduce the maturity of debt issuance during crises. These stylized facts show that for emerging economies short-term borrowing is indeed cheaper than long-term borrowing. In addition, the fact that during crises the excess term premium increases while issuance shifts towards shorter maturities suggests that these episodes are associated with negative shifts in the supply of funds, possibly reflecting an increase in the risk aversion of lenders.

We present a stylized model to illustrate our arguments. The model derives the maturity structure as the outcome of a risk sharing problem between the government of an emerging economy and risk averse international investors. On the one hand, the price of long-term bonds is more volatile than the price of short-term bonds because it reflects news on the default probability over longer horizons. Risk averse investors thus require higher returns on long-term bonds to compensate for the higher price risk. This leads to a positive excess term premium or higher borrowing costs at longer maturities. On the other hand, issuing long-term bonds is safer for the government because it reduces the probability of a rollover crisis. The optimal maturity structure balances the government's preference for longer maturities against the lenders' preference for shorter maturities. The model illustrates the different effects of supply and demand shocks. Consider first a supply shock due to an increase in investor risk aversion. The higher risk aversion increases the excess term premium, to which the government responds by shifting bond issuance towards shorter maturities. Consider next a demand shock due to a fall in the government's expected fiscal resources. This makes rollover crises more likely and increases the government's demand for insurance, shifting bond issuance towards longer maturities.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 studies the behavior of the risk and excess term premia. Section 4 studies long- and short-term bond issuance. Section 5 presents the model. Section 6 concludes.

2 Bond data

We collect data on sovereign bond prices and issuance between 1990 (when the market for sovereign bonds emerged) and June 2009 for 11 emerging economies: Argentina, Brazil, Colombia, Hungary, Mexico, Poland, Russia, South Africa, Turkey, Uruguay, and Venezuela. The sample has a different starting date for each country, depending on when the data become available. As benchmark to calculate the excess term premium, we also collect data on "risk-less" (default-free) sovereign bonds issued by Germany and the U.S., denominated in euros, Deutsche marks (for the earlier period), and U.S. dollars. This choice is not very restrictive as most foreign currency bonds are issued in these currencies.

The choice of emerging economies is constrained by the data needed to estimate time series of the excess term premium, and consequently returns over time at different maturities. One important constraint is that we cannot combine bonds that differ along other dimensions. As a result, we only use non-collateralized sovereign bonds denominated in foreign currency.[7] Our sample is thus circumscribed to those emerging economies whose governments have borrowed heavily in foreign currency and that consequently have generated a rich pool of bonds.[8] Despite these limitations, our dataset is relatively large as it covers several emerging economies for over twenty years at a high frequency. Moreover, the bonds in our sample have a good degree of trading activity, with more than 95% of the bonds having data for more than 90% of the weeks in the sample.

We compile weekly (end-of-week) time series of bond prices, using all available bonds for each country. We also gather 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, currency denomination, and maturity date. With this information, we construct weekly time series of amount issued valued in U.S. dollars.[9] We use data from three different sources, Bloomberg, Datastream, and JP Morgan. On average, the bonds included in our analysis represent more than three quarters of these countries' global bond issuance activity (according to the Securities Data Corporation, SDC Database from Thompson Financial).

Table 1 lists the countries in the sample, along with the time periods used for the price and quantity data. The table also displays the number of bonds available to calculate bond prices

[7] We exclude bonds that are denominated in domestic currency (to avoid introducing currency risk), bonds issued by the private sector (to avoid introducing borrowers of different characteristics with different credit risk), bonds that have collateral or special guarantees, such as collateralized Brady bonds and those issued by Argentina during the large pre-default swap (to avoid introducing bonds with a different risk profile), and bonds issued during forced restructurings, such as those issued by Argentina and Russia post default and Uruguay post crisis.

[8] For the estimation of the excess term premium we only use bonds denominated in euros, Deutsche marks, and U.S. dollars. For the analysis of bond issuance, we also include bonds denominated in other foreign currencies. Our restrictions regarding currency denomination eliminate several countries, especially in Asia, that issue mostly domestic currency bonds.

[9] When estimating spreads and excess returns at different maturities, the series for Argentina and Uruguay stop in 2003. At that time, Argentina announced a debt restructuring and Uruguay restructured its debt; the bonds became very illiquid and trading and the number of bonds shrank significantly. In the case of Russia, we use non-defaulted foreign currency bonds. See Duffie, Pedersen, and Singleton (2003) for more details.

and the number of bonds issued during the sample period. For the price data, the table shows the average minimum maturity, maximum maturity, and 75th percentile maturity. Though most bonds have a maturity of less than 15 years, 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. The total number of bonds used in the paper to calculate the time series of returns is 1,030 and to study the issuance activity is 1,075.

3 Bond returns: The cost of borrowing

As discussed in the Introduction, in order to evaluate the expected cost of borrowing at different maturities, we need to compute expected rates of return on short- and long-term bonds over a given time horizon. To do so, we begin by calculating *realized* rates of return. Let $P_{t,\tau}$ denote the price at time t of a bond of residual maturity τ. The rate of return on the bond is $r_{t+1,\tau} \equiv P_{t+1,\tau-1}/P_{t,\tau} - 1$, assuming no coupon payment at date $t+1$. We focus on weekly returns so 1 period corresponds to 1 week.[10]

Since our objective is to compare systematically the returns on bonds at certain maturities across countries and over time, we cannot simply use the raw data on bond prices given that each country has a different set of bonds at each point in time, with different maturity and coupon structures. Therefore, an important preliminary step is to estimate yield curves for zero-coupon bonds, which can then be used to construct price and return series for bonds of the same maturity. To do so, we follow a variant of the Nelson and Siegel (1987) methodology, described in detail in Appendix A, which uses the cross section of observed bond prices at various maturities to estimate a

[10] We also experimented with holding periods of 1 month, obtaining similar results.

yield curve at each point in time, for each country. With the latter we construct time series of prices and rates of returns at different maturities. The Nelson-Siegel procedure consists in minimizing the squared difference between actual and predicted bond prices over time for each country. As an alternative, we also estimated a modification to the Nelson-Siegel methodology proposed by Svensson (1994), which consists in minimizing the squared difference of actual and predicted yields to maturity (YTM).[11] The results obtained with the Svensson methodology are not reported, as they are very similar to the ones presented in the paper.[12]

3.1 Spreads and prices

We first present some descriptive facts about our estimated spreads and prices. The maturity-τ spread, $s_{t,\tau}$, is defined as the difference between the yield on an emerging market zero-coupon bond of maturity τ and the yield on a zero-coupon bond of the same maturity issued by the U.S. (for dollar denominated bonds) or Germany (for Deutsche marks or euro denominated bonds). Figure 1 displays the estimated spread series for each country for 3- and 12-year maturity bonds. First, spread curves are on average upward sloping. Second, spreads increase during financial crises. For example, during the crises in Argentina, Russia, and Uruguay, spreads jump to more than 25% (2,500 basis points). Furthermore, they all increase during the recent subprime crisis. Third, short-term spreads are more volatile than long-term spreads. During periods of very high spreads there is an inversion of the spread curve, with short-term spreads becoming higher than long-term ones.

[11] The Svensson (1994) procedure delivers a better fit for short-term yields, as short-term prices are less sensitive to the YTM, but a less reliable fit for long-term yields.

[12] Cortázar, Schwartz, and Naranjo (2007) discuss the difficulties of estimating the term structure in markets with infrequent trading and suggest an alternative methodology that uses data for more dates than the ones for which the yield curve is being estimated. We address this issue by working with countries with many bonds and liquid markets. Furthermore, to avoid the spurious volatility arising from changes in the sample of bonds used in each week when we calculate spreads, we interpolate the bond prices for the very few missing weeks. In this way, we are able to work with a complete panel of bonds from which to derive the spread curves. The working paper version of this paper shows similar results without this interpolation.

Figure 2 plots the price of a short-term (3-year) and of a long-term (12-year) bond with an annual coupon rate of 7.5% (paid semi-annually).[13] The figure shows that the prices of long-term bonds are substantially more volatile than those of short-term bonds. In particular, at the onset of crises the prices of long-term bonds fall much more than those of short-term bonds, while during recoveries the prices of long-term bonds increase much more than those of short-term bonds.

While most existing studies focus exclusively on spreads, this can be quite misleading. The main reason is that the slope of the spread curve is not directly informative of the expected cost of borrowing at different maturities, since the latter depends on the expected future behavior of spreads. In particular, an inverted spread curve during crises *does not* mean that borrowing long term becomes cheaper during crises. During crises spreads on long-term bonds do not go up as much as spreads on short-term bonds but, as Figure 2 illustrates, a given increase in spreads corresponds to a larger fall in prices for long-term bonds.[14] This fact and the fact that spreads and prices return to normal relatively quickly after a crisis imply that expected returns on long-term bonds increase *more* than expected returns on short-term bonds during crises and that the excess term premium increases. We document this below.[15]

[13] For prices and returns, we choose to use coupon-paying bonds because emerging markets almost never issue zero-coupon bonds. So the pricing errors for coupon-paying bonds are smaller than for zero-coupon bonds.

[14] Recall that for a zero-coupon bond of maturity τ, a spread increase of 1% corresponds approximately to a τ% drop in the bond price.

[15] Spread curves become inverted when the default hazard rate or the risk premium increase temporarily, in the same way that yield curves become inverted when interest rates are temporarily high. Spreads on long-term bonds reflect the expected short-term spreads during the lifetime of the bond, in addition to excess term premia. During crises, the default hazard rate is higher than expected future default hazard rates since defaults take place during crises and crises do not last forever. In addition, risk premia on short-term bonds are also temporarily higher during crises. Both of these facts imply that, even if excess term premia remained unaffected during crises, short-term spreads would increase more than long-term spreads. Of course, the increase in excess term premia during crises should weaken these effects. But the fact that this increase is sometimes not strong enough to prevent the inversion of the spread curves does not mean that the excess term premium does not increase during crises.

3.2 Risk premia and term premia

Having constructed series of realized returns for a bond of maturity τ, we compute unconditional expected returns taking unconditional averages of realized returns. Subtracting the expected return of a comparable risk-less bond—a U.S. bond or a German bond, depending on the currency denomination of the emerging market bond—we obtain the excess return:

$$er_\tau \equiv \frac{1}{T} \cdot \sum\nolimits_{t=1}^{T} er_{t,\tau} = \frac{1}{T} \cdot \sum\nolimits_{t=1}^{T} \left(r_{t,\tau} - r^*_{t,\tau} \right). \tag{1}$$

This excess return is the *risk premium* on a bond of maturity τ.

Define the term premium tp_{τ_2,τ_1} as the difference between the expected return on long-term bonds of maturity τ_2 and short-term bonds of maturity τ_1. The *excess term premium* etp_{τ_2,τ_1} is the difference between the term premium in emerging and developed economies:

$$etp_{\tau_2,\tau_1} \equiv tp_{\tau_2,\tau_1} - tp^*_{\tau_2,\tau_1} = er_{\tau_2} - er_{\tau_1}. \tag{2}$$

Table 2 shows average excess returns for bonds with maturities of 3, 6, 9, and 12 years and a coupon rate of 7.5%.[16] These bonds are representative of emerging market sovereign bonds both in terms of maturity and coupon. Table 2 shows that unconditional excess returns are positive for all maturities. More relevant for our analysis, excess returns increase with maturity so the excess term premium is also positive. The heterogeneity across countries is partly due to the relatively short time series and partly reflects true differences across countries in terms of the riskiness of their debt. To capture these differences, we split the countries in two groups, according to the volatility

[16] Rates of returns are expressed in annualized terms throughout the paper. Similar results were obtained with 5% and 10% coupon rates.

of returns. The five more volatile countries (the unstable group) display higher excess returns and a higher excess term premium. This shows that investors require higher returns to compensate for the higher volatility.

What do these results suggest regarding the cost of borrowing faced by emerging economies? On average, investors receive an annualized return 2 percentage points higher when investing in a 3-year emerging economy bond than when investing in a comparable German or U.S. bond and an annualized return 5 percentage points higher when investing in a 12-year bond. As a result, emerging economies pay a risk premium 3 percentage points higher when issuing 12-year bonds than when issuing 3-year bonds. This shows that, on average, borrowing long term is substantially more expensive than borrowing short term.

We next study whether the excess term premium is different during crisis and non-crisis times. To do so, we first need to define the crisis periods. Common crisis definitions used in the literature are not very useful for our purposes given that these indicators are typically on a yearly basis and often do not have an ending date. More importantly, these indicators cannot be used to estimate conditional returns as they are based partly on ex-post information. Thus, we create our own crisis indicators based only on ex-ante information. In other words, to determine whether there was a crisis at time t, we only use information available at time t. Our definition sets the beginning of a crisis when 9-year spreads are greater than a threshold, given by the average spread over the previous 6 months plus 300 basis points. The crisis ends at the end of the first 4-week period in which spreads remain below the threshold used to determine the beginning of the crisis. As alternatives, we also try three other crisis definitions using 400 basis points to define the threshold and a 1-week period to mark the end of the crisis.

The crisis periods obtained with our definition capture all major crises.[17] For example, the Mexican 94-95 crisis affected Argentina and Brazil (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 in early 2002. The Argentine crisis started when the government was forced to change its economic plan and default became very likely. Brazil and Colombia were also hit by crises in 2002. Starting in October 2008, all countries were hit by the subprime crisis originated in the U.S. The crises identified by our definition broadly coincide with those in the literature.[18]

Table 3 shows excess returns at different maturities, splitting the sample between non-crisis and crisis times according to the different crisis definitions. The results indicate that both excess returns and the excess term premium are very large during crises—e.g., the 12- to 3-year excess term premium is between 29% and 51% annually—and close to 0% during non-crisis times.

Tables 4A and 4B show more formally how excess returns across maturities change during crises. The tables present least squares regressions with the excess term premium as the dependent variable, defined as the difference for each observation between a long-term (9-year or 12-year) excess return and a short-term (3-year) or medium-term (6-year) excess return. The explanatory variable of interest is a dummy that takes the value 1 during crises and 0 otherwise. To ensure that the results are robust to our crisis definition, we also use log spreads, defined as $\log(1 + s_{t,\tau})$ at different maturities, as explanatory variables.[19] The regressions pool all observations across

[17] Our crisis periods are as follows, where we omit the day of the month and use EoS to denote the end of the sample. Argentina: Dec. 1994-Jan. 1996, Sep. 1998-Oct. 1998, Jul. 2001-May 2003 (EoS). Brazil: Jan. 1995-Oct. 1995, Aug. 1998-Apr. 1999, Jun. 2002-Apr. 2003, Oct. 2008-Jan. 2009. Colombia: Aug. 1998-Feb. 1999, May 2000-Jun. 2000, Aug. 2002-Nov. 2002, Oct. 2008-Feb. 2009. Hungary: Oct. 2008-Jan. 2009. Mexico: Aug. 1998-Nov. 1998, Oct. 2008-Dec. 2008. Russia: Jul. 1998-Jun. 2001, Nov. 2008-Feb. 2009. South Africa: Oct. 2008-Jan. 2009. Turkey: Aug. 1998-Nov. 1998, Oct. 2008-Dec. 2008. Uruguay: Apr. 2002-Aug. 2003 (EoS). Venezuela: Aug. 1998-May 1999, Oct. 2008-May 2009 (EoS).

[18] See, for example, Goldfajn and Valdés (1999) and Reinhart and Rogoff (2009).

[19] In unreported tests, we also used the alternative crisis definitions, obtaining similar results.

countries and over time and use country dummies.

The coefficients of the crisis dummy are positive and statistically significant. They are also economically significant. For example, the regression for the 12-3 excess term premium in Table 4A shows that the term premium increases by 0.45% per week during crisis times, which on an annualized basis corresponds to 26%. The table also shows that the excess term premium increases when spreads rise. For example, the coefficient of 0.034 on the 6-year spread in the regression of the 12-3 excess term premium states that when 6-year spreads increase by 1%, the excess term premium increases on an annual basis by 3 percentage points. Confirming the evidence presented in the previous tables, these regressions imply that the excess term premium is time-varying, increasing during periods of crises and high spreads. In Table 4B, we explore the robustness of our findings by adding macroeconomic controls. In particular, we control for the real exchange rate and terms of trade since they are associated with economic prospects. We also control for credit ratings by introducing an investment grade dummy.[20] Our results are not affected by the inclusion of these controls.

To determine whether the increase in the excess term premium can be related to an increase in the volatility of returns during crises, Figure 3 plots the excess returns against the standard deviation of excess returns for crisis, non-crisis, and all periods. The figure shows that during non-crisis periods excess returns are close to 0, with the standard deviation increasing with maturity. During crisis periods, both excess returns and their standard deviations increase for all maturities. However, the increase in excess returns cannot be accounted for only by the increase in volatility.

[20] We focus on these macroeconomic variables since they are well measured at a relatively high frequency. The real exchange rate (with higher values implying appreciation) and terms of trade (the ratio between export prices and import prices) are available at a monthly level from the World Bank, Global Economic Monitor. We interpolate the series to obtain weekly observations. We also detrend the series and use values relative to a linear time trend. The investment grade dummy (equal to 1 when the foreign long-term credit rating is BBB- or above, and 0 otherwise) is constructed from daily data obtained from the Standard and Poors' ratings.

The Sharpe ratio (the ratio of excess returns over their standard deviation) increases substantially during crisis times. The average Sharpe ratio across maturities is 0.016 during non-crisis periods and 0.08 during crisis periods.

3.3 Remarks

We now briefly discuss two issues. First, can our results be due to a peso problem? As usual in studies that estimate ex-ante expected returns using average ex-post returns, it is possible that ex-post returns be positive only because defaults are underrepresented in our sample. This potential small sample problem could be important given that defaults are rare events.

We do not think, however, that our results on either excess returns or excess term premia are due to a small sample bias. To begin, our sample does include a number of default episodes and it is difficult to claim that the period 1990-2009 was particularly stable for emerging economies. Moreover, estimated excess term premia would actually be higher if there were more defaults in our sample. The reason is that while during crises long-term bonds trade at higher discounts relative to face value than short-term bonds, post-default workouts generally result in payments approximately proportional to face value. As a result, during defaults returns on long-term bonds are higher than returns on short-term bonds.[21] Finally, if excess term premia are positive, then excess returns are likely to be positive as well. The returns on short- and long-term bonds are highly correlated and, thus, should have a similar correlation with the investors' stochastic discount factor. A negative excess return at any maturity would imply a positive correlation between bond returns and the investors' stochastic discount factor and, as a result, a negative price of risk. Since the returns on

[21] This was in fact the case during the Argentine default. We studied the excess returns of buying Argentine bonds of different maturities before the default (declared on December 23, 2001) and holding them until after the default. For purchase dates between early November 2001 and 1 week before the default and selling dates between 1 week and 1 year after the default, the losses on short-term bonds were virtually always greater than those on long-term bonds, by around 10%.

long-term bonds are more volatile than those on short-term bonds, a negative price of risk would imply a negative excess term premium, contradicting our findings. Therefore, the fact that excess term premia are positive suggests that the price of emerging market risk and, thus, excess returns at all maturities are also positive.[22]

Second, does the fact that excess term premia are close to 0 during non-crisis times imply that our explanation of why emerging economies borrow short term only applies to crisis times? Is it cheaper to borrow short term only during crises? The answer is no. The reason is that there is a positive transition hazard rate from non-crisis to crisis times. As a result, when a country issues long-term bonds during non-crisis times, it has to compensate bondholders for the drop in bond prices that would take place if a crisis were to materialize. In other words, the spreads on long-term bonds issued during non-crisis times reflect not only the expected losses from default, but also the expected excess returns that would need to be paid during the lifetime of the bond. This is true irrespective of whether a crisis actually materializes.[23]

4 Bond issuance: Supply vs. demand shocks

In this section, we study how the pattern of bond issuance is affected by crises and sovereign spreads. We first analyze the amount issued at different maturities. We consider four groups

[22] The idea that the observed excess term premia carry information on the underlying excess returns seems very useful since estimates of the excess returns are typically very sensitive to the sample under study. For example, Eichengreen and Portes (1988) find that excess returns on sovereign bonds issued by foreign countries in Britain and the U.S. during the interwar years were close to 0. Klingen, Weder, and Zettelmeyer (2004) find that excess returns on sovereign lending by emerging economies were negative during the 1970s and 1980s, but positive during the 1990s.

[23] A caveat to this reasoning applies. This argument is valid only if there is some cost associated with repurchasing outstanding long-term bonds at the beginning of crises by issuing short-term bonds. In fact, during crises, emerging economies do not repurchase existing long-term bonds, while they very seldom issue new ones. It is difficult to explain this knife-edge result of no change in long-term indebtedness in the absence of some cost (signaling or otherwise) associated with retiring existing long-term bonds. In practice, there have been some attempts to buyback debt perceived to be "mispriced." An example is the buyback of Polish Brady bonds. However, these operations are rare, involve relatively small amounts, and tend to take place in non-crisis times.

of bonds: short-term bonds with maturities of less than 3 years, medium-short-term bonds with maturities between 3 and 6 years, medium-long-term bonds with maturities between 6 and 9 years, and long-term bonds with maturities greater than 9 years. We run separate regressions of issuance at each of these maturities, pooling data for all weekly observations of each country. Since the average amount issued varies across countries, this variable is normalized by the average weekly issuance for each country-maturity pair.[24] We use a Tobit model, estimated by maximum likelihood. These estimations take into account the fact that observations are left-censored at 0. We include country fixed effects. As explanatory variables we use alternatively the crisis dummy described above (crisis definition 1), the 3-year spread, and the 12-year spread. For spreads, we use log-spreads, defined as $\log(1 + s_{t,\tau})$.

The results are reported in Tables 5A and 5B. They show that short-term issues (up to 3-year maturity) are hardly affected by any of the conditioning variables. Although the coefficients are positive, they are not statistically significant. In contrast, medium- and long-term issues react in the opposite way and all the coefficients are statistically significant at the 1% or 5% level. Namely, during crises and when spreads increase countries issue less debt with more than 3-year maturity. The coefficients reported, which are the marginal effects or the effects on the observed (not the latent) variable, are also economically significant. For example, an increase of 100 basis points in 12-year spreads is associated with a decline of 0.156 in the weekly issuance of bonds with over 9-year maturity, where the average value of the normalized weekly issuance is 1 (Table 5A). In sum, the estimates show that during crises and, more generally, in periods of high spreads, countries tend to issue less medium- and long-term debt. Moreover, the longer the maturity of debt, the larger

[24] Alternatively, we have tried normalizing by the average issuance until each date of issuance and by a 1- and 2-year moving average. We have also estimated Probit regressions on a categorical variable that takes the value 1 when there is a positive issuance in that maturity category for that week, and 0 otherwise. The results are robust to these alternative specifications.

the effect of spreads on the amount issued. The fact that short-term issuances are barely affected by crises probably reflects the opposing effects of lower overall issuance and a shift towards shorter maturities.

In Table 5B, we repeat the regressions in Table 5A with the additional macroeconomic controls used in Table 4B: the real exchange rate, terms of trade, and the investment grade dummy. Adding these controls can help tell apart the effects of the relative costs of borrowing from other potential factors that may cause a country in distress to switch to shorter maturities. Table 5B shows that our results are not affected by the inclusion of these controls. Below, we try a more direct instrumental-variables approach to identify the effect of cost-of-borrowing considerations on maturity choice.

We next analyze the average maturity of the bonds issued. We calculate the average maturity for each emerging economy by aggregating all issuances over a 26-week rolling window. The explanatory variables are the same as in the analysis of issuance at different maturities. We include country fixed effects and use Newey-West standard errors to account for the lag structure introduced in the dependent variable. In addition to ordinary least squares (OLS), we run instrumental variable (IV) regressions in an attempt to identify the effect of exogenous supply shocks. Our instrument for supply shocks is the CSFB High Yield Index of the U.S. corporate sector, which is typically used to measure risk appetite. Our identification relies on taking this index as exogenous to events in individual emerging economies.

The results are reported in Tables 6A and 6B. The OLS regressions show that episodes of crises and high spreads are associated with a shortening of the maturity of bond issuance. In addition, this association is substantially stronger when we instrument crises and spreads with the CSFB High Yield Index. In Table 6B, we include the additional macroeconomic controls used in Tables 4B and 5B, showing that the results are robust to the inclusion of these controls.

The results reported in this section and Section 3 point towards the importance of supply factors in determining the maturity structure of emerging economies, especially during crises. First, the fact that excess term premia are on average positive implies that long-term borrowing is on average more expensive than short-term borrowing. Second, the fact that during crises the excess term premium increases while borrowing shifts toward shorter maturities implies that crises are characterized by negative shifts in the supply of funds.

In the next section we develop a simple model to further clarify our interpretation of the data in terms of supply and demand shocks. After presenting the model we will briefly go back to the interpretation of our empirical findings.

5 A simple model of debt maturity

In this section, we present a simple model of the term premia and the debt maturity. Although highly stylized, the model illustrates the mechanism proposed in the paper and helps interpret the empirical evidence. The model describes the government of a small open economy that borrows from a set of international investors. There are two crucial ingredients. First, it is costly for the government to make "emergency" fiscal adjustments to cover the shortfall between debt repayments and new debt issuance. This introduces a preference for long-term debt on the government side, since long-term debt helps avoid costly rollover crises. Second, international investors are risk averse. This makes them prefer short-term bonds over long-term bonds, as the latter expose them to price risk. The optimal maturity structure reflects the balance between the government's preference for long-term debt and the investors' preference for short-term debt.

5.1 Debtor country

There are three periods, 0, 1, and 2. The government starts period 0 with an initial stock of debt which is due in periods 1 and 2. The stock of 1-period (short-term) bonds due in period 1 is $\bar{d}_S$. The stock of 2-period (long-term) bonds due in period 2 is $\bar{d}_L$. In period 0, the government can adjust its debt maturity structure. The new stocks of short-term and long-term bonds, d_S and d_L, must satisfy the budget constraint

$$p_S \cdot d_S + p_L \cdot d_L = p_S \cdot \bar{d}_S + p_L \cdot \bar{d}_L, \tag{3}$$

where p_S and p_L are bond prices in period 0.

In period 1, the government repays its maturing short-term bonds and issues new short-term bonds, which are due in period 2. The difference between the value of the new short-term bonds and the repayment of maturing bonds is covered by a fiscal adjustment that results in a primary fiscal surplus x. The budget constraint is

$$x + p'_S \cdot d'_S = d_S, \tag{4}$$

where d'_S is the number of short-term bonds issued in period 1 and p'_S is their price. Short-term bonds issued in period 1 are junior to existing long-term bonds.[25] Default never takes place in period 1 as the government can always adjust x to repay its short-term debt.

In period 2, the government has access to an exogenous flow of fiscal revenue y. The fiscal revenue y is stochastic and can take two values, $\bar{y}$ and 0. The government assigns all necessary

[25] This assumption is standard and ensures that the government cannot dilute the claims of the holders of long-term bonds. It is also consistent with our assumption that defaults are due to governments' inability to repay as opposed to strategic considerations.

fiscal revenue to debt repayment and the reminder to public spending. We thus abstract from issues of strategic default and assume instead that the government defaults only when it is unable to repay.

Without loss of generality, we assume that the government never issues so much debt that it is unable to repay it in full when $y = \bar{y}$,[26] namely,

$$d_L + d'_S \leq \bar{y}. \tag{5}$$

When $y = \bar{y}$, thus, all debt is repaid and public spending equals $\bar{y} - d_L - d'_S$. When $y = 0$, on the other hand, the country defaults on all its debt and public spending equals 0.

Uncertainty about the fiscal revenue y is resolved as follows. In period 2, y is realized and is equal to $\bar{y}$ with probability π and 0 with probability $1 - \pi$. The probability π is publicly revealed in period 1. In period 0, agents have priors on π. The randomness of π as of period 0 implies that, even though the country never defaults in period 1, some information is revealed in period 1 about the probability of default in period 2. As we show below, the volatility of π and resulting price risk is the fundamental source of term premia in the model.

The government chooses its debt policy to maximize the expected public spending in period 2 minus the cost of fiscal adjustment in period 1,

$$E_0 \left[\pi \cdot \left(\bar{y} - d_L - d'_S \right) - g\left(x\right) \right], \tag{6}$$

where $g(x)$ is a strictly convex function that represents the cost of fiscal adjustment.

[26] This is without loss of generality because all the values of d'_S above the value that satisfies (5) with equality lead to the same revenues from selling short-term bonds in period 1 and to the same repayments in period 2. The reason is that in period 2 the government will repay long-term bonds in full, since they are senior, and default on the difference $d'_S + d_L - \bar{y}$, so short-term bond holders will get $d_L - \bar{y}$.

5.2 Investors and bond prices

International investors are risk averse and price assets using the stochastic discount factors m_1 and m_2, respectively, in periods 0 and 1. We assume that these stochastic discount factors are unaffected by the maturity structure chosen by the government, yet they are negatively correlated with bond returns.

We simplify notation by assuming that the risk-free short-term rate is 0 in both periods, that is, $E_0[m_1] = E_1[m_2] = 1$. Since default never occurs in period 1, the price of short-term bonds in period 0 is simply equal to $p_S = E_0[m_1]$ so that

$$p_S = 1. \tag{7}$$

On the other hand, the price of short-term bonds in period 1 is $p'_S = E_1[\chi \cdot m_2]$, where χ is an indicator variable which denotes repayment in period 2. As mentioned above, we assume that χ and m_2 are *negatively correlated*, so that $p'_S < \pi$. To simplify the analysis, we further assume that the risk premium on short-term bonds in period 1 is constant, so that

$$p'_S = \rho \cdot \pi \tag{8}$$

for some scalar $\rho < 1$.

The price of long-term bonds issued in period 0 is $p_L = E_0[p'_S \cdot m_1] = E_0[\rho \cdot \pi \cdot m_1]$. We again assume that π and m_1 are *negatively correlated*. As a result,

$$p_L = \sigma \cdot \rho \cdot \pi_0, \tag{9}$$

where $\pi_0 = E_0[\pi]$ and $\sigma < 1$. The risk premium on short-term bonds in period 0 is 0.[27] Thus, the term premium in period 0 equals the risk premium on long-term bonds, which is given by

$$E_0\left[p'_S/p_L - 1\right] = \sigma^{-1} - 1 > 0. \tag{10}$$

By assuming that m_1 and m_2 are exogenous and negatively correlated with bond returns we are implicitly assuming that the bonds issued by the country are a small fraction of the portfolio of international investors, yet their returns are positively correlated with the returns of this portfolio. This can by interpreted in different ways. International investors might simply be the world representative consumer, whose consumption growth is correlated with events in our small open economy (e.g., a world recession increases the probability of default in the country). However, such correlation is likely to be small. More realistically, the correlation likely reflects market segmentation. Our preferred interpretation is that international investors consist of a group of specialized investors who invest heavily in assets issued by emerging markets. Still, our results do not depend on which particular interpretation is chosen. We turn next to the optimal response of the debtor country.

5.3 Risk sharing and optimal maturity

Consider the government's optimal debt policy. The government problem is to choose d_L, d_S, and d'_S to maximize the objective function (6) subject to the budget constraints (3), (4), and (5).

We solve this problem backward, solving first the government problem in period 1. Let x^*

[27] We have made assumptions that guarantee that default never takes place in period 1 only for simplicity. If default in period 1 were possible, both short-term and long-term bonds issued in period 0 would carry a positive risk premium, but our results would be unaffected. The reason is that long-term bonds would still be riskier than short-term bonds as, conditional on no default, the price risk associated with the realization of p'_S would only affect the returns of long-term bonds.

denote the size of the fiscal surplus in period 1 that satisfies $\rho \cdot g'(x^*) = 1$. The maximum amount of short-term debt that the government can issue in period 1 is $\bar{y} - d_L$, which is valued at $\rho \cdot \pi \cdot (\bar{y} - d_L)$ by investors since $p'_S = \rho \cdot \pi$. We distinguish two cases. If π is large enough so that $\rho \cdot \pi \cdot (\bar{y} - d_L) + x^* \geq d_S$, the constraint (5) does not bind, and it is optimal for the government to set the fiscal surplus $x = x^*$ and to issue an amount $d'_S = (d_S - x^*) / (\rho \cdot \pi)$ of new short-term bonds to repay those that are maturing. The government's payoff is then

$$\pi \cdot \left(\bar{y} - d_L - \frac{d_S - x^*}{\rho \cdot \pi} \right) - g(x^*) . \tag{11}$$

If, instead, π is so small that $\rho \cdot \pi \cdot (\bar{y} - d_L) + x^* < d_S$ then the constraint (5) binds, the government issues $d'_S = \bar{y} - d_L$ short-term bonds and covers the residual with the fiscal surplus $x = d_S - \rho \cdot \pi \cdot (\bar{y} - d_L) > x^*$. The government's payoff is then

$$-g\left(d_S - \rho \cdot \pi \cdot (\bar{y} - d_L)\right) . \tag{12}$$

This second case is what we call a "rollover crisis," in which a fiscal adjustment is needed to satisfy the country's short-term obligations.

Summing up, the government's indirect utility function in period 1 can be written as:

$$V(z) \equiv \begin{cases} \dfrac{z + x^*}{\rho} - g(x^*) & \text{if } z + x^* \geq 0 \\ -g(-z) & \text{if } z + x^* < 0 \end{cases} , \tag{13}$$

where $z \equiv \rho \cdot \pi \cdot (\bar{y} - d_L) - d_S$. Note that the function $V(\cdot)$ is increasing and concave.

Using the period-0 budget constraint and the fact that $p_L = \sigma \cdot \rho \cdot \pi_0$, we can write the government's problem in period 0 as

$$\max_{d_L} E_0 \left[V \left(\rho \cdot \pi \cdot (\bar{y} - d_L) - \bar{d}_S + \sigma \cdot \rho \cdot \pi_0 \cdot \left(d_L - \bar{d}_L \right) \right) \right]. \tag{14}$$

In this form, the government's problem has the features of a risk sharing problem. The government faces uncertainty regarding the realization of π. By issuing more long-term bonds, the government transfers more of this risk to investors, since this reduces the volatility of the required fiscal adjustment. However, issuing more long-term bonds is costly, because investors require compensation for its associated price risk, as $E_0 [\sigma \cdot \rho \cdot \pi_0] = \sigma \cdot \rho \cdot \pi_0 < \rho \cdot \pi_0 = E_0 [\rho \cdot \pi]$. Next, we analyze this risk sharing problem in more detail.

5.4 Comparative statics: Supply and demand factors

We carry out two comparative static exercises. First, we consider the effects of an increase in investor risk aversion. Next, we consider the effects of a reduction in expected fiscal revenue due to a fall in π_0. As we show, both exercises can be associated with a crisis, since bond prices fall and spreads increase. However, we interpret the first case as a supply-driven crisis and the second case as a demand-driven crisis.

We make two simplifying assumptions. First, we assume that the solution is interior so that the optimal level of long-term debt d_L^* satisfies the first-order condition

$$E_0 \left[V' \left(\rho \cdot \pi \cdot (\bar{y} - d_L^*) - \bar{d}_S + \sigma \cdot \rho \cdot \pi_0 \cdot \left(d_L^* - \bar{d}_L \right) \right) \cdot (\sigma \cdot \pi_0 - \pi) \right] = 0. \tag{15}$$

Second, we assume that the maturity structure at the beginning of period 0 is optimal at the initial equilibrium, namely $d_L^* = \bar{d}_L$. This assumption simplifies the analysis because it eliminates the income effects associated with changes in bond prices. It also seems reasonable to assume that the existing maturity structure is not too different from the optimal one in the absence of unexpected shocks.

Proposition 1. *A temporary increase in the risk aversion of international investors, i.e., a reduction in σ, leads to (i) higher spreads, i.e. lower p_L; (ii) higher risk and term premia, i.e., higher $E_0 [p'_S / p_L - 1]$; and (iii) a shortening of the maturity structure, i.e., higher d^*_S and lower d^*_L.*

The proof is simple. Results (i) and (ii) follow immediately from Equations (8), (9), and (10). Result (iii) is proved in the Appendix.

The intuition behind these effects is straightforward. As investors become more risk averse they demand a higher compensation for being subject to price risk. This increases the term premium. The government responds by shifting its maturity structure away from more expensive long-term debt and towards cheaper short-term debt. Paraphrasing, as investors become more risk averse they demand a higher insurance premium, prompting the country to purchase less insurance.

Proposition 2. *Assume that the function $V(\cdot)$ displays non-increasing absolute risk aversion.*[28] *Then a reduction in the expected probability of repayment π_0, keeping fixed the distribution of period-0 news $\pi - \pi_0$, leads to (i) higher spreads, i.e., lower p_L; (ii) unchanged risk and term premia, i.e., unchanged $E_0 [p'_S / p_L - 1]$; and (iii) a lengthening of the maturity structure, i.e., lower d^*_S and higher d^*_L.*

The proof is simple. Results (i) and (ii) follow immediately from Equations (8), (9), and (10). Result (iii) is proved in the Appendix.

[28] The function $V(\cdot)$ is defined in (13). To ensure that it displays non-increasing absolute risk aversion it is sufficient to assume that $|g''(\cdot) / g'(\cdot)|$ is non-decreasing.

The intuition behind these effects is also straightforward. As the expected fiscal revenue in period 2 decreases, the probability of suffering a liquidity crisis increases. This makes the government effectively more risk averse. It responds by shifting its maturity structure away from riskier short-term debt and towards safer long-term debt. Spreads increase because the probability of default increases, but risk and term premia are unaffected. Paraphrasing, as the government becomes more risk averse it purchases more insurance.

More generally, demand shocks are likely to also increase risk and term premia, something we assumed away for simplicity. One reason is that, as bonds become riskier, the required risk premium is likely to increase. Another reason is that, for a country that is not very small, its shift towards long-term debt would increase the exposure of investors to price risk, for which they would require compensation.

5.5 Interpreting the evidence

Although the model is highly stylized, it clearly illustrates some interesting forces that determine the maturity choice of emerging economies in a world in which international investors are risk averse. It also helps to interpret the empirical evidence in the previous sections. First of all, by introducing risk averse investors, the model can account for the changes in risk premia and term premia documented in Section 3.

Second, the model highlights the different implications of demand and supply shocks from a risk sharing perspective. On the one hand, crises driven by demand shocks, such as increases in current financing needs or reductions in future expected government revenues, lead to a shift in bond issuance towards longer maturities as the government tries to reduce the likelihood of rollover difficulties. On the other hand, crises driven by supply shocks, such as increases in investor risk aversion, lead to an increase in excess term premia and to a shift in bond issuance towards shorter maturities.

The IV estimates presented in Section 4 supports our view that during supply-driven crises the increase in investor risk aversion pushes emerging economies towards shorter maturities. The OLS evidence shows that, on average, debt issuance shifts towards shorter maturities during crises, but not as much as in a "pure" supply-driven crisis. This suggests that while in the typical crisis supply factors play an important role, demand factors are also present.

Of course, our model omits important ingredients. Most importantly, it does not incorporate problems of moral hazard and strategic default. However, we expect that our main conclusion will survive in richer models incorporating both moral hazard and supply-side factors. In particular, such models would be unable to account for the high risk and term premia observed in the data especially during crises without supply factors playing an important role in the market for emerging market debt.

6 Final remarks

The paper provides a new explanation to why emerging economies borrow short term: borrowing short term is cheaper. We construct a new database of sovereign bond prices, returns, and issuance and report several new stylized facts. We show that emerging economies on average pay positive risk and excess term premia on their debt, both of which increase dramatically during crises. We also show that the maturity of debt issuance shortens during crises. We present a stylized model that shows that the debt maturity can be interpreted as the outcome of a risk sharing problem between an emerging economy and risk averse investors. The model highlights the tradeoff between cheaper short-term borrowing and safer long-term borrowing, and endogenously derives the maturity structure and the cost of borrowing at different maturities.

Put together, our evidence shows that supply factors play a crucial role in the determination of the optimal maturity structure. It also shows that crises in emerging economies are characterized by negative shifts in the supply of international funds to these countries. While the evidence does not rule out the importance of other factors, it does show that conventional models that focus solely on debtor-side factors such as moral hazard miss crucial aspects of the data.

The findings in this paper have important policy implications. One example is the question of how the international financial system should deal with financial crises. For example, from a pure moral hazard perspective, the costs of crises make these episodes a strong disciplining device. Efforts to limit the costs of crises through loans from the international financial community, or other liquidity-providing mechanisms, would exacerbate the moral hazard problem, and could end up reducing welfare. If, on the other hand, countries borrow short term because of the high cost of long-term borrowing, those same crisis-prevention mechanisms would improve welfare. The benefits would come not only from fewer and less severe crises, but also from cheaper long-term borrowing as a result of the reduction in the price risk of long-term debt.

Our empirical results and our emphasis on excess returns as measures of the cost of borrowing is also relevant for the growing literature on business cycles in emerging economies. A first strand of this literature tries to account for the joint behavior of emerging markets' borrowing and interest rates in models with strategic default and risk neutral bondholders.[29] Due to the assumption of risk neutrality, these models cannot account for the high volatility of spreads observed in emerging economies. Our finding that the increase in spreads during crises is partly driven by increases in

[29] See Aguiar and Gopinath (2006), Arellano (2008), Mendoza and Yue (2008), and Yue (2010).

risk premia is a potential solution to this puzzle. As richer quantitative models are developed that allow for risk averse international lenders, it is necessary to have an empirical benchmark to assess their implications in terms of the risk premia at various maturities and over the cycle. The evidence in this paper provides a new set of stylized facts that can be used to evaluate such models.[30] A second strand of the literature analyzes the relation between interest rates and output volatility assuming no default.[31] These papers fully attribute observed changes in contractual interest rates to changes in the discount factor or in the risk premium required by international investors. The approach in this paper can be fruitfully applied in this context, by providing better estimates of the magnitude and volatility of the cost of borrowing for emerging economies.

[30] Recent papers that consider the role of risk averse lenders are Volkan (2007), Lizarazo (2010), and Borri and Verdelhan (2011).

[31] See Neumeyer and Perri (2005), Oviedo (2005), Uribe and Yue (2006), Chang and Fernández (2010), and Fernández-Villaverde et al. (2010).

Appendix A: Estimating spread curves

To estimate spread curves, we follow a modified version of the procedure developed by Nelson and Siegel (1987) to estimate yields. At date t we have a sample of J coupon bonds, with various coupon and maturity characteristics. Let $\hat{P}_{t,j}$ be the estimated price at time t of the emerging market bond j with coupons $\{c_{j,t+k}\}_{k=1}^{\tau}$ and maturity τ_j. Price $\hat{P}_{t,j}$ can be written as

$$\hat{P}_{t,j}(\bar{a}_t) = \sum_{k=1}^{\tau_j} e^{-k \cdot y_{t,k}(\bar{a}_t)} \cdot c_{j,t+k} + e^{-\tau_j \cdot y_{t,\tau_j}(\bar{a}_t)}, \tag{16}$$

where $y_{t,k}(\bar{a}_t)$ is the yield on a zero-coupon bond of maturity k; $\bar{a}_t \equiv (a_{t,0}, ..., a_{t,3})$ is a vector of time-varying parameters.

We decompose the yield $y_{t,k}(\bar{a}_t)$ as $y_{t,k}(\bar{a}_t) = y^*_{t,k}(\bar{a}^*_t) + s_{t,k}(\bar{a}_t)$, where $y^*_{t,k}$ is the zero-coupon yield on a default-free German or U.S. bond (depending on the currency denomination of the original bond) and $s_{t,k}$ is the zero-coupon spread. We express the spread $s_{t,k}$ as

$$s_{t,k}(\bar{a}_t) = a_{t,0} + a_{t,1} \cdot \left(\frac{1 - e^{-k \cdot a_{t,3}}}{k \cdot a_{t,3}} \right) + a_{t,2} \cdot \left(\frac{1 - e^{-k \cdot a_{t,3}}}{k \cdot a_{t,3}} - e^{-k \cdot a_{t,3}} \right). \tag{17}$$

We proceed with the estimation in two steps. First, we compute the yields on default-free bonds, $y^*_{t,k}$. We use German and U.S. bond prices and estimate the parameters $\bar{a}^*_t$ with an expression analogous to (17). In the second step, we use the yields $y^*_{t,k}$ derived in the first step and expression (17) to estimate the parameters $\bar{a}_t$. In both steps, we use non-linear least squares (NLLS) period by period. For example, in the second step, we take the J bonds available for a given emerging country at each date t and find the $\bar{a}_t$ that minimizes $\sum_{j=1}^{J}(P_{t,j} - \hat{P}_{t,j}(\bar{a}_t))^2$, where $P_{t,j}$ is the price of bond j at time t.

The approximation is parsimonious and gives a good fit of the data. Moreover, it allows us to include bonds denominated in different currencies, using most of the available information to obtain a better fit of the curve.[32] Finally, expression (17) has a simple interpretation. Spreads can be viewed as having three components. The constant is a long-term, level component. The second term is 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. We adopt this specific parametrization of the yield curve and fix $a_{t,3} = 0.005$ following Diebold and Li (2006); this helps in the convergence of the NLLS estimation described above.[33]

Once we have computed yields and spreads, we calculate prices and excess returns. The price of any coupon bond can simply be obtained using (16). But to compute excess returns, one needs to compare the returns of an emerging market bond to those of a comparable risk-less bond. Using bonds with the same maturity and coupon structure can be misleading because the yields on emerging market bonds tend to be much higher than those on risk-less bonds, affecting significantly the payments profile and duration. In particular, the high yield on an emerging market bond means that its short-run payments carry more weight in the bond valuation. Therefore, its duration is much shorter than that of a similar U.S. bond.

We deal with this problem using two different approaches that lead to similar expressions for excess returns and very similar results. The first approach consists in calculating separately the returns on an emerging market bond and on a comparable German or U.S. bond. Then, one subtracts

[32] 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.

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

the returns on the risk-less bonds from those on the risky bonds. The difficulty lies in constructing the comparable risk-less bond. We proceed in the following way. We take a given coupon bond for the emerging economy, and construct a portfolio of risk-less bonds with the same time profile of payments. For a given emerging market bond with coupons $\{c_{t+k}\}$ and maturity τ, we derive the weights $\omega_{t,k} = \left(e^{-k \cdot y_{t,k}} / P_t\right) \cdot c_{t+k}$ for $k = 1, ..., n-1$, and $\omega_{t,n} = (e^{-\tau \cdot y_{t,\tau}} / P_t) \cdot (c_{t+\tau} + 1)$. Then we construct a portfolio of risk-less zero-coupon bonds $\{\theta_{t,k}\}$, such that $(e^{-k \cdot y^*_{t,k}} / P^*_t) \cdot \theta_{t,k} = \omega_{t,k}$ for each k. The price of this portfolio will be $P^*_t = \sum_{k=1}^{n} e^{-k \cdot y^*_{t,k}} \cdot \theta_{t,k}$. In this way, the emerging market bond and the risk-less bond have an identical time profile of payments and an identical duration, equal to $\sum_{k=1}^{n} k \cdot \omega_{t,k}$. The realized excess returns in period t take the form $er_{t,\tau} = P_{t+1,\tau-1} / P_{t,\tau} - P^*_{t+1,\tau-1} / P^*_{t,\tau} = \sum_{k=1}^{n} \omega_{t,k} \cdot [e^{-((k-1) \cdot (y_{t+1,k-1} + s_{t+1,k-1}) - k \cdot (y_{t,k} + s_{t,k}))} - e^{-((k-1) \cdot y_{t+1,k-1} - k \cdot y_{t,k})}]$.[34] Since the expression in brackets represents the excess returns on a zero-coupon bond, the expression for excess returns is a weighted average of excess returns on zero-coupon bonds.

The second approach uses only spreads $s_{t,k}$. We compute the "spread-based" prices $P^s_{t,\tau} = \sum_{k=1}^{\tau} e^{-k \cdot s_{t,k}(\bar{a}_t)} \cdot c_{t+k} + e^{-\tau \cdot s_{t,\tau}(\bar{a}_t)}$, and obtain the excess returns $\widehat{er}_{t,\tau} = P^s_{t+1,\tau-1} / P^s_{t,\tau} - 1$. The spread-based excess returns $\widehat{er}_{t,\tau}$ can also be interpreted as a weighted average of returns on zero-coupon bonds, but the weights $\omega_{t,k}$ are slightly different from those in the first approach. Both approaches are valid since they generate excess returns that can be obtained with the appropriate portfolio of emerging market and risk-free bonds. Their interpretation are slightly different: while the first approach is easier to interpret in terms of the financial strategy involved, the second one is easier to interpret in terms of the behavior of spreads.

Using prices derived from spreads to calculate excess returns has an important practical advantage. Since we work with bonds denominated in different currencies, we avoid the need to report

[34] This expression holds for a bond that pays no coupon in period $t+1$. If the bond pays a coupon in period $t+1$ the expression is easy to adjust.

every result for both dollar and Deutsche mark or euro bonds. The reason is that while $P_{t,\tau}$ depends on the currency of choice, $P^s_{t,\tau}$ can be computed only from spreads. All the results reported in the paper are based on spread-based prices. We have also computed excess returns using the first method and obtained very similar results.[35]

Appendix B: Proofs for Section 5

Proof of Proposition 1

A simple application of the implicit function theorem to Equation (15) leads to

$$\frac{d}{d\sigma}d_L^* = -\frac{\partial E_0 \left[V'(z) \cdot (\sigma \cdot \pi_0 - \pi)\right] / \partial \sigma}{\partial E_0 \left[V'(z) \cdot (\sigma \cdot \pi_0 - \pi)\right] / \partial d_L^*}, \tag{18}$$

where $z = \rho \cdot \pi \cdot (\bar{y} - d_L^*) - \bar{d}_S + \sigma \cdot \rho \cdot \pi_0 \cdot \left(d_L^* - \bar{d}_L\right)$.

To prove that this expression is positive when evaluated at a σ such that $d_L^* = \bar{d}_L$, we show that both the numerator and the denominator on the right-hand side are positive. The numerator is equal to $E_0 \left[V'(z) \cdot \pi_0\right] > 0$, since the first term of the derivative is 0 when $d_L^* = \bar{d}_L$. The denominator is equal to $-E_0 \left[V''(z) \cdot \rho \cdot (\sigma \cdot \pi_0 - \pi)^2\right] > 0$. As a result, d_L^* *decreases* in response to a decrease in σ. The positive effect on d_S^* follows from Equation (3) and the fact that the initial σ is such that $d_L^* = \bar{d}_L$.

[35] If we restricted ourselves to zero-coupon bonds, the excess returns obtained using the two approaches would be identical. However, almost all the emerging market bonds used in the estimation of the yield curve are coupon bonds, so we prefer to derive returns for coupon bonds.

Proof of Proposition 2

Let $\tilde{\pi} = \pi - \pi_0$. Then the optimality condition (15) can be rewritten as

$$E_0 \left[V'(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi}) \right] = 0, \tag{19}$$

where we define $z = \rho \cdot \pi_0 \cdot (\bar{y} - d_L^*) + \rho \cdot \tilde{\pi} \cdot (\bar{y} - d_L^*) - \bar{d}_S + \sigma \cdot \rho \cdot \pi_0 \cdot \left(d_L^* - \bar{d}_L \right)$. Applying the implicit function theorem we obtain

$$\frac{d}{d\pi_0} d_L^* = - \frac{\partial E_0 \left[V'(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi}) \right] / \partial \pi_0}{\partial E_0 \left[V'(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi}) \right] / \partial d_L}. \tag{20}$$

To prove that this expression is negative when evaluated at a π_0 such that $d_L^* = \bar{d}_L$, we show that in the right hand side the numerator is negative and the denominator is positive. The denominator is positive because it is the same as the denominator in the proof of Proposition 1. The numerator is equal to $\rho \cdot \left(\bar{y} - \bar{d}_L \right) \cdot E_0 \left[V''(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi}) \right] + (\sigma - 1) \cdot E_0 \left[V'(z) \right]$, where we use the fact that the expression is evaluated at a π_0 such that $d_L^* = \bar{d}_L$. This expression can be rewritten as $-\rho \cdot \left(\bar{y} - \bar{d}_L \right) \cdot E_0 \left[\left| V''(z) / V'(z) \right| \cdot V'(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi}) \right] + (\sigma - 1) \cdot E_0 \left[V'(z) \right] < 0$, where the inequality follows from the fact that the first term in the expression is non-positive and the second term is negative. The latter is obvious. The former follows from Equation (19), from the fact that $V'(z) \cdot ((\sigma - 1) \cdot \pi_0 - \tilde{\pi})$ is decreasing in $\tilde{\pi}$, and from the fact that $\left| V''(\cdot) / V'(\cdot) \right|$ is non-increasing as we assume non-increasing absolute risk aversion. As a result, d_L^* *increases* in response to a decrease in π_0. The negative effect on d_S^* follows from Equation (3) and the fact that the initial π_0 is such that $d_L^* = \bar{d}_L$.

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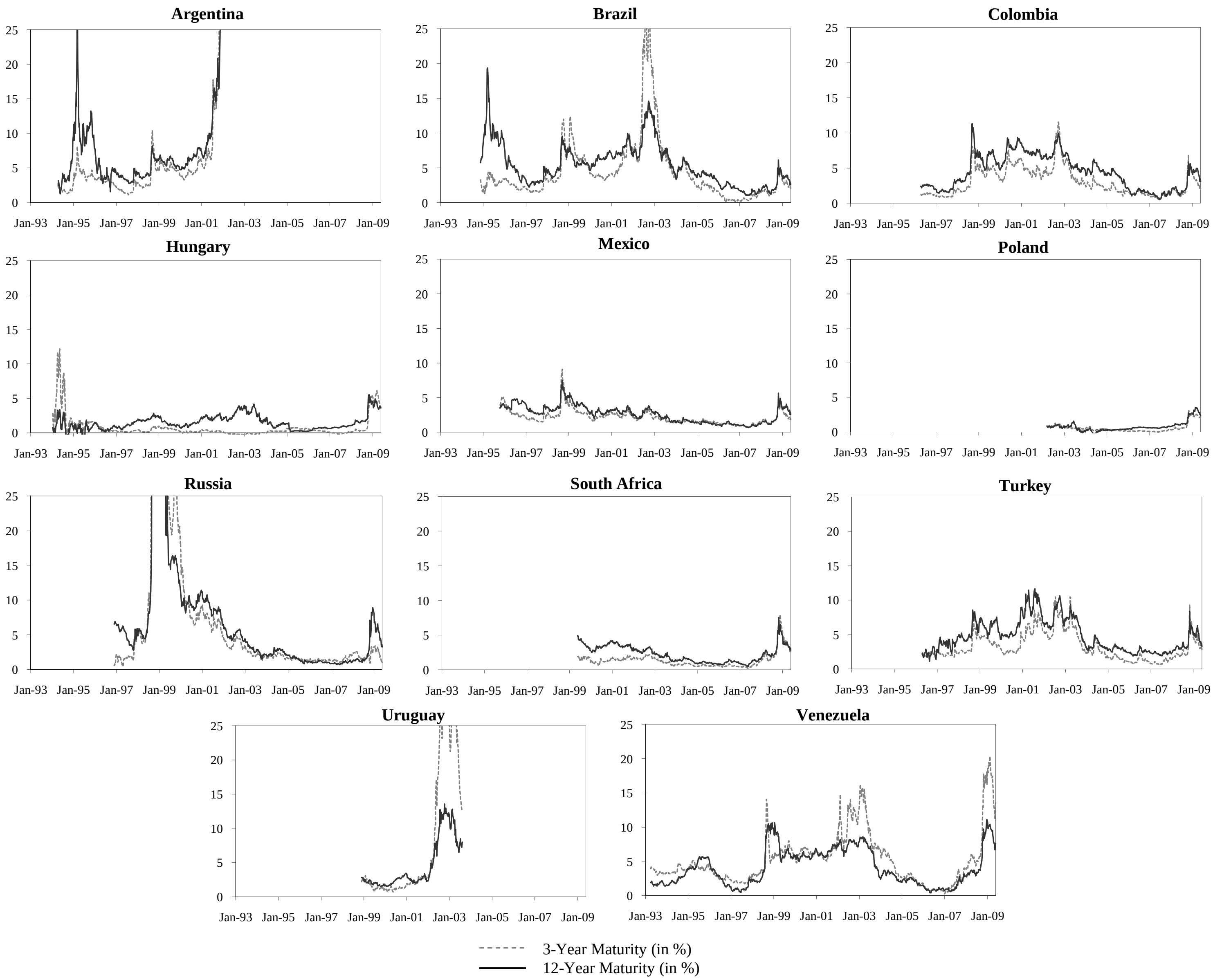
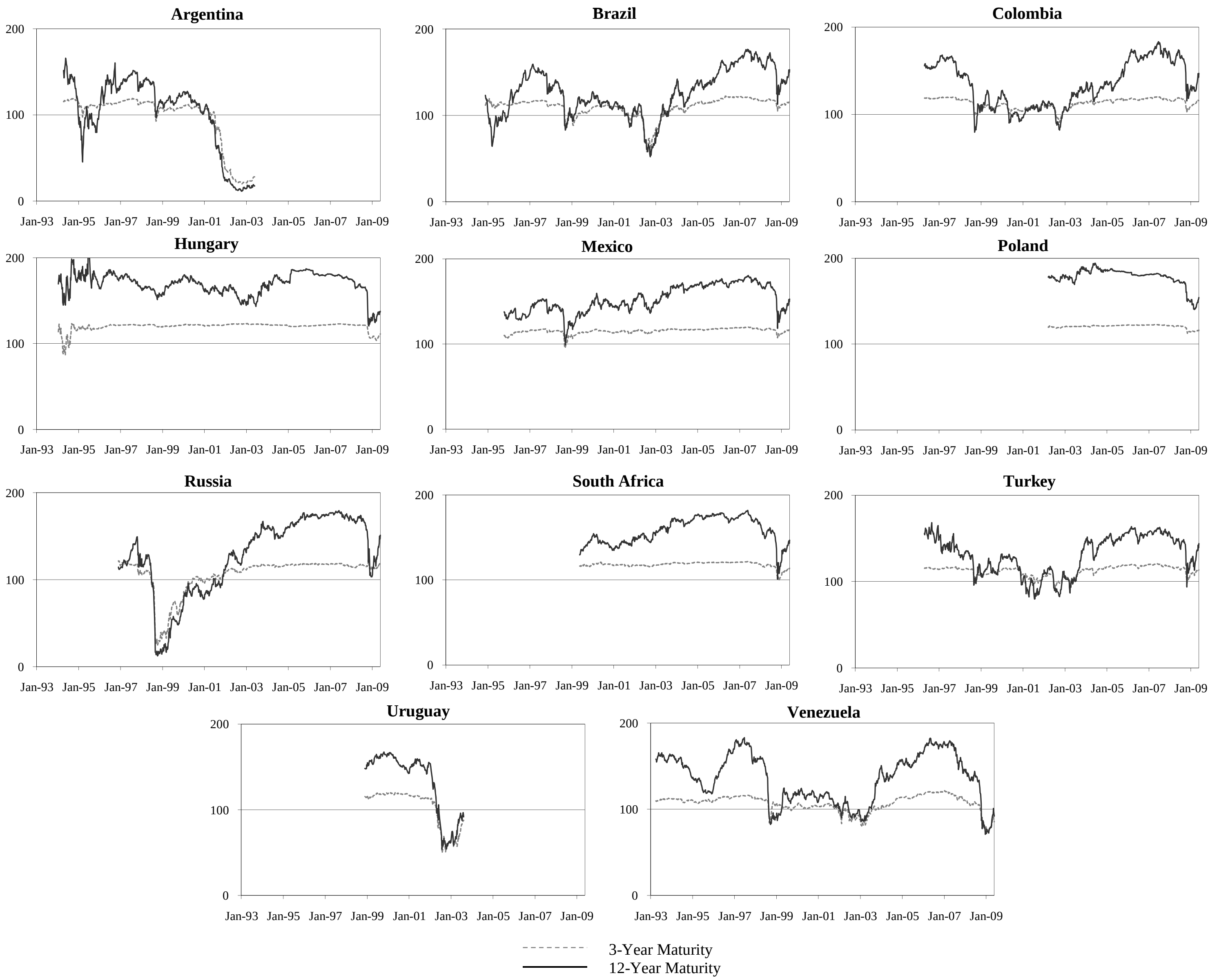
Figure 1
Short- and Long-Term Bond Spreads



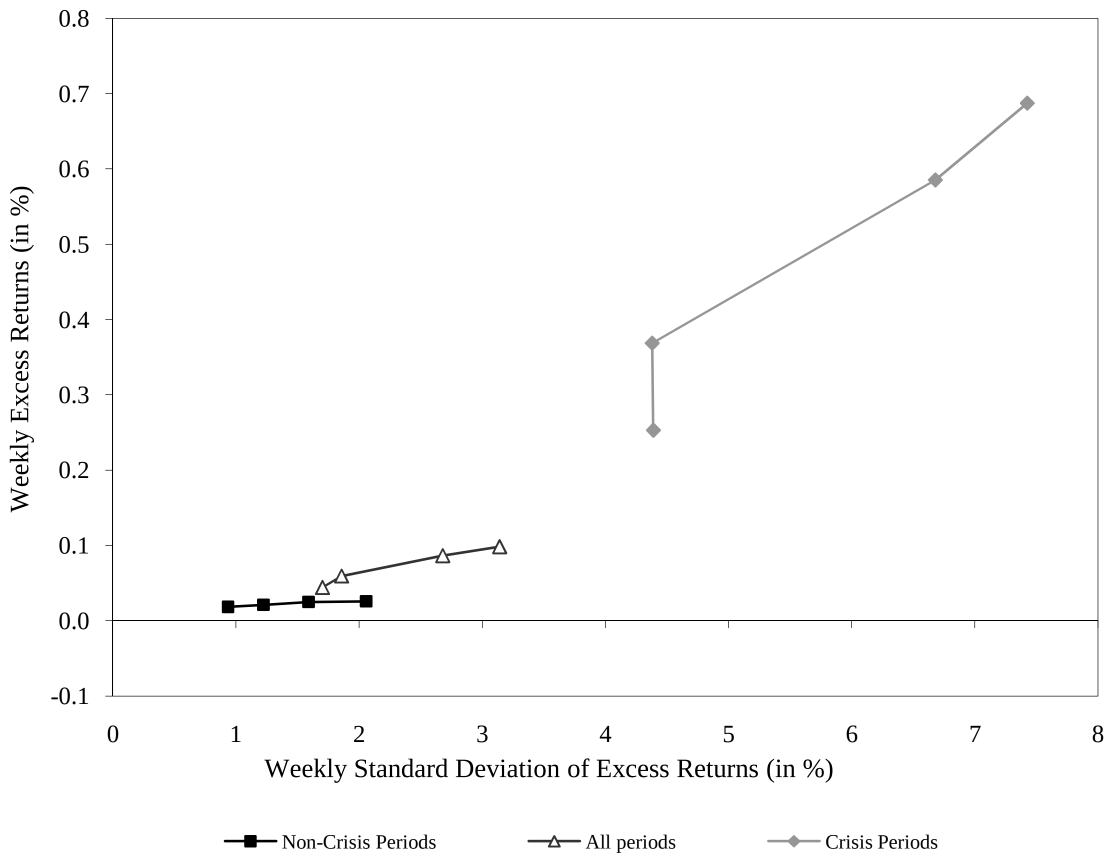
The figures show bond spreads of 3- and 12-year maturities over time by country. Bond spreads are estimated as the difference between the yields of emerging market zero-coupon bonds of 3- and 12-year maturity and the yield of equal-maturity German or U.S. risk-less zero-coupon bonds.

Figure 2
Short- and Long-Term Bond Prices



The figures show bond prices of 3- and 12-year maturities over time by country. Bond prices are estimated assuming a coupon rate of 7.5%.

Figure 3
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 1 week and assuming a coupon rate of 7.5%.

Table 1
Bond Data Description

Price Data					
		Number of	Maturities (Years)		
Country	Sample Period	Bonds	Minimum	Maximum	75th Percentile
Argentina	Apr. 1994 - May 2003	59	1.0	30.0	10.0
Brazil	Nov. 1994 - Jun. 2009	44	1.5	40.0	10.1
Colombia	Apr. 1996 - Jun. 2009	28	1.3	31.0	10.3
Hungary	Feb. 1990 - Jun. 2009	38	2.0	20.0	10.0
Mexico	Oct. 1995 - Jun. 2009	39	1.5	32.0	12.0
Poland	Oct. 1994 - Jun. 2009	26	3.0	50.0	13.7
Russia	Nov. 1996 - Jun. 2009	16	2.2	30.0	15.0
South Africa	Oct. 1991 - Jun. 2009	15	5.0	20.0	10.0
Turkey	Apr. 1996 - Jun. 2009	75	0.8	30.2	10.0
Uruguay	Nov. 1998 - May 2003	14	1.8	30.0	11.6
Venezuela	Apr. 1993 - Jun. 2009	40	0.5	30.4	12.8
Germany	Apr. 1993 - Jun. 2009	451	0.3	32.4	7.0
U.S.	Apr. 1993 - Jun. 2009	185	1.5	30.0	5.0

Quantity (Issuance) Data						
			Average Amount Issued by Maturity (USD Millions)			
		Number of	Up to	From 3 to 6	From 6 to 9	Over
Country	Sample Period	Bonds	3 Years	Years	Years	9 Years
Argentina	Jul. 1993 - May 2003	194	238	511	526	1,361
Brazil	Jul. 1994 - Jun. 2009	74	471	757	1,351	2,371
Colombia	Jan. 1993 - Jun. 2009	52	139	249	379	708
Hungary	Feb. 1990 - Jun. 2009	111	100	265	396	544
Mexico	Jan. 1991 - Jun. 2009	77	595	655	477	1,423
Poland	Oct. 1994 - Jun. 2009	55	-	600	471	1,091
Russia	Jan. 1993 - Jun. 2009	32	158	1,124	1,570	2,022
South Africa	Oct. 1991 - Jun. 2009	25	-	413	402	819
Turkey	Jan. 1990 - Jun. 2009	136	1,411	501	502	1,161
Uruguay	Jan. 1993 - May 2003	264	8	158	132	510
Venezuela	Jul. 1991 - Jun. 2009	55	327	198	603	930

The tables describe the price and quantity data used in the paper. The top panel 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 minimum, maximum, and 75th percentile maturity within the sample period. The bottom panel 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 %)

	No. of Obs.	er3	er6	er9	er12
All Countries	6,746	2.32	3.13	4.60	5.25
Stable Countries	3,933	1.91	2.16	2.75	3.37
Volatile Countries	2,813	2.89	4.50	7.23	7.94
Argentina	475	-7.74	-4.35	-2.28	-4.96
Brazil	757	4.82	6.48	8.90	10.89
Colombia	683	3.53	4.66	5.57	6.16
Hungary	801	0.31	0.88	1.57	2.17
Mexico	710	2.45	3.35	4.18	4.74
Poland	375	0.14	-0.49	-0.84	-0.85
Russia	652	8.28	10.60	17.86	19.96
South Africa	522	1.41	2.08	3.30	4.81
Turkey	683	3.82	5.12	6.13	7.13
Uruguay	246	2.16	-1.00	-1.99	-2.04
Venezuela	842	2.80	1.61	1.73	2.16

The table shows the annualized average excess returns over comparable German and U.S. bonds by country and for stable, volatile, and all countries. Stable (volatile) countries are those with volatility equal to or below (above) the across-country median volatility. Volatility for each country is calculated as the average across the volatilities of the four maturity categories. Stable countries are Colombia, Hungary, Mexico, Poland, South Africa, and Venezuela. Volatile countries are Argentina, Brazil, Russia, Turkey, and Uruguay. Excess returns are estimated using a holding period of 1 week and for a coupon rate of 7.5%. er3, er6, er9, and er12 stand for 3-, 6-, 9-, and 12-year excess returns.

Table 3

Excess Returns during Crisis and Non-Crisis Periods

Annualized Means over Comparable German and U.S. Bonds (in %)

	No. of Obs.	er3	er6	er9	er12
All Periods	6,746	2.32	3.13	4.60	5.25
Crisis Definition 1					
Threshold + 300 basis points, ending crisis after 4 weeks of low spreads					
Crisis Periods	742	14.02	21.08	35.45	42.78
Non-Crisis Periods	6,004	0.96	1.10	1.30	1.34
Crisis Definition 2					
Threshold + 400 basis points, ending crisis after 4 weeks of low spreads					
Crisis Periods	481	11.84	21.47	43.29	53.02
Non-Crisis Periods	6,265	1.62	1.84	2.09	2.26
Crisis Definition 3					
Threshold + 300 basis points, ending crisis after 1 week of low spreads					
Crisis Periods	503	13.66	21.80	41.73	51.17
Non-Crisis Periods	6,243	1.46	1.75	2.06	2.21
Crisis Definition 4					
Threshold + 400 basis points, ending crisis after 1 week of low spreads					
Crisis Periods	398	9.23	21.64	48.79	60.06
Non-Crisis Periods	6,348	1.90	2.06	2.30	2.51

The table shows the annualized average 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 1 week and assuming a coupon rate of 7.5%. er3, er6, er9, and er12 stand for 3-, 6-, 9-, and 12-year excess returns.

Table 4A
Excess Term Premium

	Dependent Variable: er9-er3				
Crisis Dummy	0.330 ***				
	[0.053]				
3-Year Spread		0.013 ***			
		[0.002]			
6-Year Spread			0.033 ***		
			[0.004]		
9-Year Spread				0.052 ***	
				[0.006]	
12-Year Spread					0.048 ***
					[0.006]
R-squared	0.003	0.003	0.005	0.011	0.014
Number of Observations	6,746	6,746	6,746	6,746	6,746
	Dependent Variable: er12-er3				
Crisis Dummy	0.451 ***				
	[0.062]				
3-Year Spread		0.014 ***			
		[0.004]			
6-Year Spread			0.034 ***		
			[0.004]		
9-Year Spread				0.056 ***	
				[0.006]	
12-Year Spread					0.053 ***
					[0.006]
R-squared	0.004	0.002	0.004	0.008	0.011
Number of Observations	6,746	6,746	6,746	6,746	6,746
	Dependent Variable: er12-er6				
Crisis Dummy	0.337 ***				
	[0.047]				
3-Year Spread		0.015 *			
		[0.009]			
6-Year Spread			0.025 ***		
			[0.008]		
9-Year Spread				0.055 ***	
				[0.018]	
12-Year Spread					0.061 **
					[0.022]
R-squared	0.002	0.002	0.002	0.009	0.017
Number of Observations	6,746	6,746	6,746	6,746	6,746

The tables report ordinary least squares regressions of weekly excess term premium on the crisis dummy and on spreads of different maturities. The long-short excess returns are the differences between the 9-year excess return and the 3-year excess return (er9-er3), the 12-year excess return and the 3-year excess return (er12-er3), and the 12-year excess return and the 6-year excess return (er12-er6). The crisis dummy corresponds to crisis definition 1. All regressions include country dummies. Excess returns are estimated using a holding period of 1 week and assuming a coupon rate of 7.5%. Cluster-robust standard errors are in brackets. Clusters are defined by country and crisis periods. *, **, and ***: significant at 10%, 5%, and 1%, respectively.

Table 4B
Excess Term Premium

	Dependent Variable: er9-er3				
Crisis Dummy	0.297 ***				
	[0.065]				
3-Year Spread		0.011 ***			
		[0.002]			
6-Year Spread			0.032 ***		
			[0.004]		
9-Year Spread				0.054 ***	
				[0.008]	
12-Year Spread					0.048 ***
					[0.007]
Real Exchange Rate	-0.003 **	-0.003 **	-0.002	-0.001	-0.001
	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]
Terms of Trade	-0.188	-0.156	-0.112	-0.049	-0.043
	[0.115]	[0.127]	[0.131]	[0.154]	[0.154]
Investment Grade Dummy	0.016	0.017	0.060	0.093	0.069
	[0.050]	[0.049]	[0.062]	[0.079]	[0.073]
R-squared	0.004	0.003	0.005	0.011	0.014
Number of Observations	6,705	6,705	6,705	6,705	6,705
	Dependent Variable: er12-er3				
Crisis Dummy	0.411 ***				
	[0.078]				
3-Year Spread		0.011 **			
		[0.004]			
6-Year Spread			0.031 ***		
			[0.005]		
9-Year Spread				0.056 ***	
				[0.008]	
12-Year Spread					0.052 ***
					[0.007]
Real Exchange Rate	-0.004 **	-0.004 **	-0.003	-0.001	-0.001
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Terms of Trade	-0.272	-0.247	-0.204	-0.132	-0.120
	[0.178]	[0.188]	[0.187]	[0.200]	[0.200]
Investment Grade Dummy	0.013	0.007	0.049	0.088	0.064
	[0.067]	[0.062]	[0.074]	[0.091]	[0.085]
R-squared	0.005	0.003	0.004	0.009	0.012
Number of Observations	6,705	6,705	6,705	6,705	6,705
	Dependent Variable: er12-er6				
Crisis Dummy	0.305 ***				
	[0.047]				
3-Year Spread		0.0132			
		[0.009]			
6-Year Spread			0.021 **		
			[0.008]		
9-Year Spread				0.057 **	
				[0.020]	
12-Year Spread					0.063 **
					[0.024]
Real Exchange Rate	-0.003	-0.003	-0.003	0.000	0.001
	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]
Terms of Trade	-0.199	-0.159	-0.154	-0.053	-0.006
	[0.145]	[0.137]	[0.137]	[0.160]	[0.178]
Investment Grade Dummy	0.007	0.012	0.030	0.089	0.081
	[0.046]	[0.052]	[0.055]	[0.093]	[0.099]
R-squared	0.003	0.003	0.003	0.009	0.017
Number of Observations	6,705	6,705	6,705	6,705	6,705

The tables report ordinary least squares regressions of weekly excess term premium on the crisis dummy and on spreads of different maturities. The real exchange rate, terms of trade, and an investment grade dummy are included as control variables. The long-short excess returns are the differences between the 9-year excess return and the 3-year excess return (er9-er3), the 12-year excess return and the 3-year excess return (er12-er3), and the 12-year excess return and the 6-year excess return (er12-er6). The crisis dummy corresponds to crisis definition 1. All regressions include country dummies. Excess returns are estimated using a holding period of 1 week and assuming a coupon rate of 7.5%. Cluster-robust standard errors are in brackets. Clusters are defined by country and crisis periods. *, **, and ***: significant at 10%, 5%, and 1%, respectively.

Table 5A
Amount Issued

	Issues of Maturity up to 3 Years		
Crisis Dummy	1.620		
	[1.106]		
3-Year Spread		0.033	
		[0.043]	
12-Year Spread			0.016
			[0.052]
Pseudo R-squared	0.060	0.058	0.057
Number of Observations	5,858	5,849	5,849
Number of Uncensored Observations	98	98	98
	Issues of Maturity between 3 and 6 Years		
Crisis Dummy	-2.878 ***		
	[1.039]		
3-Year Spread		-0.061 ***	
		[0.021]	
12-Year Spread			-0.063 **
			[0.030]
Pseudo R-squared	0.039	0.034	0.032
Number of Observations	6,757	6,746	6,746
Number of Uncensored Observations	144	142	142
	Issues of Maturity between 6 and 9 Years		
Crisis Dummy	-1.617 **		
	[0.638]		
3-Year Spread		-0.071 ***	
		[0.020]	
12-Year Spread			-0.082 ***
			[0.025]
Pseudo R-squared	0.026	0.025	0.024
Number of Observations	6,757	6,746	6,746
Number of Uncensored Observations	95	95	95
	Issues of Maturity over 9 Years		
Crisis Dummy	-1.823 ***		
	[0.652]		
3-Year Spread		-0.122 ***	
		[0.046]	
12-Year Spread			-0.156 ***
			[0.056]
Pseudo R-squared	0.015	0.015	0.015
Number of Observations	6,757	6,746	6,746
Number of Uncensored Observations	211	209	209

The tables report the marginal coefficients of weekly Tobit regressions of the amount issued at different maturities on the crisis dummy and 1-week lagged short- and long-term spreads. Regressions are estimated by maximum likelihood. The dependent variables are normalized by the average amount issued per maturity for each country throughout the sample period. 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 crisis dummy corresponds to crisis definition 1. The explanatory variables are in logs. All regressions include country dummies. Cluster-robust standard errors are in brackets. Clusters are defined by country, crisis, and year. *, **, and ***: significant at 10%, 5%, and 1%, respectively.

Table 5B
Amount Issued

	Issues of Maturity up to 3 Years			Issues of Maturity between 3 and 6 Years		
Crisis Dummy	-0.086			-2.958 ***		
	[0.694]			[1.021]		
3-Year Spread		-0.028			-0.069 ***	
		[0.026]			[0.023]	
12-Year Spread			-0.046			-0.068 **
			[0.041]			[0.030]
Real Exchange Rate	-0.014	-0.021	-0.021	-0.002	0.001	0.003
	[0.013]	[0.014]	[0.014]	[0.010]	[0.011]	[0.011]
Terms of Trade	-4.242 **	-4.862 **	-4.775 **	-0.127	-0.357	-0.271
	[2.011]	[2.083]	[2.037]	[0.722]	[0.756]	[0.759]
Investment Grade Dummy	-3.570 ***	-3.692 ***	-3.553 ***	-0.905	-0.931	-0.900
	[1.232]	[1.229]	[1.195]	[0.615]	[0.606]	[0.590]
Pseudo R-squared	0.082	0.083	0.083	0.041	0.035	0.034
Number of Observations	5,816	5,808	5,808	6715	6705	6705
Number of Uncensored Observations	98	98	98	144	142	142

	Issues of Maturity between 6 and 9 Years			Issues of Maturity over 9 Years		
Crisis Dummy	-2.288 ***			-1.810 ***		
	[0.829]			[0.643]		
3-Year Spread		-0.114 ***			-0.151 ***	
		[0.031]			[0.055]	
12-Year Spread			-0.117 ***			-0.186 ***
			[0.030]			[0.065]
Real Exchange Rate	-0.010	-0.010	-0.009	0.006	0.003	0.004
	[0.010]	[0.009]	[0.009]	[0.007]	[0.007]	[0.007]
Terms of Trade	-1.810 *	-2.208 **	-2.076 **	-0.954 *	-1.145 *	-1.149 *
	[1.012]	[1.065]	[1.047]	[0.558]	[0.609]	[0.592]
Investment Grade Dummy	-1.238 ***	-1.372 ***	-1.241 ***	-0.896 **	-0.973 **	-0.966 **
	[0.430]	[0.446]	[0.426]	[0.384]	[0.410]	[0.401]
Pseudo R-squared	0.034	0.033	0.031	0.017	0.018	0.019
Number of Observations	6,715	6,705	6,705	6,715	6,705	6,705
Number of Uncensored Observations	94	94	94	211	209	209

The tables report the marginal coefficients of weekly Tobit regressions of the amount issued at different maturities on the crisis dummy and 1-week lagged short- and long-term spreads. The real exchange rate, terms of trade, and an investment grade dummy are included as control variables. Regressions are estimated by maximum likelihood. The dependent variables are normalized by the average amount issued per maturity for each country throughout the sample period. 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 crisis dummy corresponds to crisis definition 1. The explanatory variables are in logs. All regressions include country dummies. Cluster-robust standard errors are in brackets. Clusters are defined by country, crisis, and year. *, **, and ***: significant at 10%, 5%, and 1%, respectively.

Table 6A
Average Maturity

	OLS	IV	OLS	IV	OLS	IV
	Dependent Variable: Average Maturity of Issues					
Main Equation						
Crisis Dummy	-3.598 **	-10.600 **				
	[1.510]	[5.398]				
3-Year Spread			-0.232 **	-0.532 **		
			[0.099]	[0.246]		
12-Year Spread					-0.455 **	-0.584 **
					[0.198]	[0.265]
First Stage						
High Yield Index		0.025 ***		0.488 ***		0.445 ***
(Instrument)		[0.004]		[0.080]		[0.070]
R-squared	0.122	0.080	0.124	0.125	0.140	0.150
Number of Observations	4,773	4,379	4,773	4,379	4,773	4,379

This table reports ordinary least squares and two-stage least squares instrumental variables (IV) regressions of the average maturity of issues on the crisis dummy and short- and long-term spreads. For the IV regressions, crisis and spread variables are instrumented by the Credit Suisse First Boston (CSFB) High Yield Index, which is a measure of the average spread on high-yield debt securities in the U.S. corporate sector. The crisis dummy corresponds to crisis definition 1. Variables are semi-annual averages calculated using a 26-week rolling window. All regressions include country dummies. Newey-West standard errors are used to correct for the autocorrelation introduced in the series by the rolling window. Standard errors are also robust to heteroskedasticity. The spread variables are in logs. Standard errors are in brackets. *, **, and ***: significant at 10%, 5%, and 1%, respectively.

Table 6B
Average Maturity

	Dependent Variable: Average Maturity of Issues					
	OLS	IV	OLS	IV	OLS	IV
Main Equation						
Crisis Dummy	-3.395 **	-10.220 *				
	[1.650]	[5.561]				
3-Year Spread			-0.195 *	-0.501 **		
			[0.103]	[0.253]		
12-Year Spread					-0.410 **	-0.544 **
					[0.202]	[0.271]
Real Exchange Rate	0.005	-0.019	0.004	-0.024	0.004	-0.008
	[0.026]	[0.033]	[0.025]	[0.029]	[0.024]	[0.027]
Terms of Trade	6.529 ***	6.968 ***	6.213 ***	6.515 ***	5.966 ***	6.662 ***
	[2.181]	[2.178]	[2.196]	[2.157]	[2.205]	[2.129]
Investment Grade Dummy	1.020	1.284	0.652	0.553	0.578	0.614
	[1.100]	[1.367]	[1.159]	[1.428]	[1.122]	[1.393]
First Stage						
High Yield Index		0.024 ***		0.485 ***		0.446 ***
(Instrument)		[0.004]		[0.073]		[0.063]
Real Exchange Rate		-0.002 *		-0.054 **		-0.021
		[0.001]		[0.021]		[0.013]
Terms of Trade		-0.031		-1.529 *		-1.137
		[0.059]		[0.867]		[0.776]
Investment Grade Dummy		-0.024		-1.956 **		-1.688 ***
		[0.049]		[0.792]		[0.432]
R-squared	0.143	0.112	0.142	0.152	0.155	0.173
Number of Observations	4,770	4,376	4,770	4,376	4,770	4,376

This table reports ordinary least squares and two-stage least squares instrumental variables (IV) regressions of the average maturity of issues on the crisis dummy and short- and long-term spreads, including the real exchange rate, terms of trade, and an investment grade dummy as control variables. For the IV regressions, crisis and spread variables are instrumented by the Credit Suisse First Boston (CSFB) High Yield Index, which is a measure of the average spread on high-yield debt securities in the U.S. corporate sector. The crisis dummy corresponds to crisis definition 1. Variables are semi-annual averages calculated using a 26-week rolling window. All regressions include country dummies. Newey-West standard errors are used to correct for the autocorrelation introduced in the series by the rolling window. Standard errors are also robust to heteroskedasticity. The spread variables are in logs. Standard errors are in brackets. *, **, and ***: significant at 10%, 5%, and 1%, respectively.