

**Flight to Quality:  
Investor Risk Tolerance and the Spread of Emerging Market Crises**

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March 2000**

**1. Introduction**

The financial crises of the 1990s have raised new concerns about the operation of international capital markets. Prominent among these are worries about sharp changes in investor sentiment and their cross-border repercussions. The Mexican crisis dramatically altered investor sentiment toward emerging markets and echoed through Latin America, showing up in Argentina as the Tequila Effect. The spillover from the Thai crisis was limited initially to the Asian Tigers, but by the end of 1997 a wide variety of other developing countries was affected. And Russia's default in the summer of 1998, in conjunction with the all-but-failure of Long-Term Capital Management, precipitated a flight to quality with a strong negative impact on market sentiment toward the entire population of emerging-market borrowers.

While the fact of these spillovers is not in dispute, questions remain about their nature, incidence, and implications. One such question concerns the channels through which financial distress is transmitted across borders, and in particular the relative importance of competitive

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<sup>1</sup>Prepared for the World Bank-ADB-IMF Conference on "International Financial Contagion: How It Spreads and How It Can Be Stopped." The first two authors are affiliated with the University of California, Berkeley, the third with the World Bank. This research was supported by the Research Committee of the World Bank and by the Ford Foundation (through the Berkeley Program on International Financial Architecture). We thank conference participants, and especially our discussant Roberto Rigobon, for helpful comments.

depreciation, wake-up call, and deleveraging effects.<sup>2</sup> Another concerns the characteristics of the borrowers most susceptible to spillover effects and the role of budget deficits, current account balances, short-term debt, the exchange-rate regime, and international reserves in heightening or reducing a country's vulnerability to external events.<sup>3</sup> A third issue is the extent to which policy initiatives -- everything from greater transparency to capital controls -- can be used to limit the spread of instability.<sup>4</sup> There exist substantial literatures on all these aspects of market volatility and its transmission, although intellectual consensus remains elusive.

Another aspect of the problem, but one that has not received commensurate attention, is which aspects of credit-market access are impaired by these sharp shifts in investor sentiment. Three relevant dimensions are the *availability* of funds, the *cost* of funds, and the *maturity* of funds. Most market commentary tends to focus on the cost of borrowing, since emerging-market spreads are readily available and respond to events in an immediate, visible way. In contrast, analysts concerned with macroeconomic implications (for example, the authors of the IMF's *International Capital Markets Report* and World Bank's *Global Development Finance*) emphasize the volume of borrowing and lending, since this has immediate implications for the financing gap and the sustainability of exchange rates and the current account. Compared to these

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<sup>2</sup>Goldstein (1998), Eichengreen and Rose (1999), and Pritsker (1999) are three efforts to get at this question.

<sup>3</sup>Representative of this genre is the paper by de Gregorio and Valdes (1999) prepared for this conference.

<sup>4</sup>See for example Eichengreen (1998) and Corsetti and Srinivasan (1999) for reviews of the literature.

aspects of market access, less attention has been paid to the maturity structure of borrowing, although those concerned with the risks associated with heavy reliance on short-term debt have pointed to the shortening of maturities as another channel through which instability can spread.<sup>5</sup>

Theory does not offer strong predictions about the margins on which the market will adjust or what types of borrowers will be affected. Models of complete information suggest that spillovers will affect mainly the *cost* of external finance. If lenders become more reluctant to lend, launch spreads will rise, and borrowers with the least attractive investment projects will withdraw from the market. In contrast, models of asymmetric information suggest that spillovers will have a pronounced impact on the *volume* of lending and that both high- and low-quality borrowers will be affected, since it is difficult for investors to tell them apart.<sup>6</sup> Models of the term structure of debt obligations offer reasons why a period of heightened financial turbulence will shorten the *maturity* of new loans for both more and less creditworthy borrowers, the latter because they are regarded as too risky to be extended long-term obligations, the former because they wish to avoid locking in high interest rates.<sup>7</sup>

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<sup>5</sup>See for example Rodrik and Velasco (1999).

<sup>6</sup>In other words, since higher interest rates cause borrowers with less risky projects to drop out of the market, upward pressure on interest rates will not equilibrate supply and demand, and credit rationing will result. Moral hazard (the tendency for higher interest rates to encourage borrowers faced by higher interest rates to opt for riskier projects) works in the same direction as this adverse-selection effect.

<sup>7</sup>See Diamond (1997). These alternative interpretations have very different policy implications: if the shortening of maturities mainly affects high-quality borrowers, it can be regarded as relatively benign, but if it affects mainly low-quality borrowers, then there is additional reason to be concerned about rollover risk.

There is some evidence consistent with each of these observations. The collapse in the volume of new issues in the wake of each of the crises of the 1990s is evident in Figure 1. After the Mexican crisis in December 1994, however, the decline lasted about one quarter and then was followed by a period of recovery and rapid growth until the Asian crisis in mid-1997. More than two years after the Asian crisis, in contrast, the volume of issues has still not recovered to the levels of early 1997.

Figure 1 also documents the tendency for spreads to widen during the financial turbulence that followed each of the three crises (whose timing is indicated in the figure by the three vertical lines). The sustained rise in spreads after the first half of 1997, like the sustained drop in volumes, attests to the widespread nature of the Asian crisis. The modest change in spreads following the Mexican crisis, like the relatively modest change in volumes, provides another indication that the Tequila was more limited than the repercussions of the Asian and Russian crises.

The impact on maturities is less clear. While there are modest signs of falling maturities following the three crises, the overall movement is up.<sup>8</sup>

This kind of “eye-conometrics” does not tell us anything systematic about how different borrowers were affected. It does not tell us whether changes in the price, availability and maturity of external finance reflect mainly changes in borrower creditworthiness superimposed on a stable

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<sup>8</sup>Figure 1 also shows that the variance of maturities and spreads fell sharply after each crisis. In Eichengreen and Mody (1998a), we showed borrowers with relatively poor credit tend to be rationed out of the market following a crisis; this explains why the variance of spreads would fall. Figure 1 suggests that the same mechanism may operate on maturities.

financial structure, or changes in the way the markets perceive and price a given set of borrower characteristics in the wake of a crisis (the so-called “flight to quality”).

In this paper we develop systematic evidence on how the Mexican crisis, the Asian crisis, and the Russian crisis affected the price, volume, and maturity of loans extended through the bond market in the 1990s. Our data set is essentially the universe of emerging-market bonds issued in the course of the decade; this allows us to mount a comprehensive analysis how different types of borrowers were affected. We estimate an integrated model of the borrowing and lending, pricing, and maturity decisions, something that does not seem to have been done before. This permits us to distinguish different margins along which emerging markets were affected.

Not surprisingly, we find roles for changes in both fundamentals and market sentiment following each of the three crises of the 1990s. But we find that the impact of changes in market sentiment is largely limited to the region in which the crisis originates. There is evidence of persistent unfavorable market sentiment in the behavior of primary-market spreads in Latin America but not East Asia after the end of 1994, and in East Asia but not Latin America after the first half of 1997. While the volume of new issues by East Asian borrowers was depressed by unfavorable market sentiment in 1995, and the volume of new issues by Latin American borrowers was similarly depressed by unfavorable market sentiment in the second half of 1997, inter-regional spillovers operating through this channel died out quickly, unlike the within-region impact, which persisted. This is consistent with the findings of authors like Glick and Rose (1998) who have emphasized the regional character of contagion, although our interpretation of the phenomenon is different.

In addition, we find that changes in market sentiment affecting Latin America appear to have been felt more through their impact on prices and less on quantities, compared to other regions. An interpretation is that when market sentiment deteriorates and spreads begin to rise, East Asian countries withdraw from the market, preferring to delay borrowing until another day, which they are able to do given their relatively high degree of real-side flexibility and pliable current accounts. Latin American countries, which historically have enjoyed less current account flexibility, continue to approach the market despite the less attractive terms.

Finally, while changes in market sentiment affect the price and quantity of new issues, we find less evidence of an impact on maturity. Why lenders and borrowers are so reluctant to respond to changing credit-market conditions by adjusting the maturity of new issues thus emerges as an important topic for future research.

Given that this paper was prepared for a project on contagion, it is worth asking how it fits into the larger literature on this subject. Research on contagion is dominated by two approaches. One focuses on changes in the likelihood of a devaluation or currency crisis in a country when similar events occur in neighboring countries in the current or immediately preceding periods.<sup>9</sup> The other looks for changes in the correlation of stock, bond and exchange-market returns across countries in periods of financial turbulence.<sup>10</sup> Both of these approaches analyze macroeconomic aggregates. Both focus on the behavior of asset prices, be these exchange rates or stock prices. And both are vulnerable to the “common-unobservable-shocks” critique — namely, that observed

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<sup>9</sup>Here the relevant neighborhood can be defined as economic and financial (Eichengreen and Rose 1999) as well as in purely geographic terms (Glick and Rose 1998).

<sup>10</sup>See the articles surveyed in Forbes and Rigobon (this volume).

co-movements across countries could reflect common, period-specific shocks that are not readily observed by the econometrician rather than contagion per se. While our approach is not free of these limitations, it is an attempt to move beyond them. Rather than relying exclusively on macroeconomic data, we also utilize microeconomic data (on individual bonds). Rather than focusing exclusively on the behavior of prices, we consider also quantities and maturities. And rather than attempting to model contagion per se, we develop the distinction between fundamentals and market sentiment.

## 2. Specification and Estimation

The typical model employed in studies of emerging-market spreads is a linear relationship of the form:

$$\log(S) = bX + u_1 \tag{1}$$

where  $S$  is the spread,  $X$  is a vector of issue, issuer, and period characteristics, and  $u_1$  is a stochastic error term.

Such models are commonly estimated by ordinary-least squares. But OLS will be biased if not all potential issuers are in the sample. The spread and the maturity of the bond (and their relationship to issue and issuer characteristics) will be observed only when positive decisions to borrow and lend are made. Assume that these variables are only observed when a latent variable  $B$  crosses a threshold  $B'$  defined by:

$$B' = gX' + u_2 \tag{2}$$

where  $X'$  is the vector of variables that determines the desire of borrowers to borrow and the willingness of lenders to lend, and  $u_2$  is a second error term. If the error terms in equations (1) and (2) are bivariate normal with standard deviations  $s_1$  and  $s_2$  and covariance  $s_{12}^2/s_1s_2$ , this is a standard sample selection model, a la Heckman (1979).

Our model differs from the standard formulation in that  $S$  is a vector rather than a single variable. In our case, we are interested in the impact of borrower characteristics and global credit conditions on the maturity as well as the price of emerging market issues. The maturity as well as the spread will only be observed when positive decisions to borrow and lend are made.

Estimating the spread, maturity and decision-to-borrow equations as a fully-simultaneous system creates some econometric complications. Following previous work on the maturity structure of corporate bonds (e.g. Strohs and Mauer 1996), we assume that while maturity affects spread, spread does not affect maturity. This assumption allows us to first estimate the probit and maturity equations jointly using maximum likelihood, to substitute predicted for observed maturity in the spreads equation, and then to estimate the latter jointly with the probit, again by maximum likelihood.<sup>11</sup> The standard errors of the coefficients in the spread equation are

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<sup>11</sup>To establish the robustness of our results, we relaxed this assumption and estimated the spread and maturity equations by two-stage least squares (having first estimated the probit and constructed the Inverse Mills Ratio for inclusion in the other two equations). The point estimates on the vast majority of the coefficients (and all those we discuss in the text) differ little under the two approaches.

corrected using the estimated variance from the Heckman maximum likelihood estimates of the spread on the observed (not predicted) value of maturity as an approximation of the appropriate variance.

### 3. Data

We estimated the model using data for primary spreads for developing-country bonds issued from 1991-I through 1999-II. From *Capital Bondware* we gathered data on the spread, maturity, and amount of each issue, whether it was privately placed, whether the issuer was a private or governmental entity, whether the issue was denominated in dollars, yen or deutsche marks, the industry of origin, whether the issuer was a sovereign, (other) public entity, or private-sector issuer, and whether the interest rate was fixed or floating. Building on earlier work on the bond market, we included the following variables as measures of credit worthiness: external debt relative to GNP, debt service relative to exports, whether a debt restructuring agreement (with either private or official creditors) had been concluded within the previous year, the growth rate of real GDP, the variance of the export growth rate, the ratio of reserves to short-term debt, and the ratio of domestic private credit to GDP. For the analysis of maturity, we also included the inflation rate.<sup>12</sup>

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<sup>12</sup>These are the variables we employed as measures of credit worthiness in Eichengreen and Mody (2000); our earlier analysis (Eichengreen and Mody 1998a) used a more limited set of country characteristics. Details on the definition, construction and sources of these variables are provided in Appendix A.

We also utilized a subjective measure of country credit worthiness provided by *Institutional Investor*.<sup>13</sup> Since *Institutional Investor's* country credit rating is correlated with other issuer characteristics, including it in the spreads equation, where many of these other issuer characteristics also appear, complicates interpretation. We therefore substituted the residual from a first-stage regression in which the credit rating was regressed on the ratio of debt to GNP, the debt rescheduling dummy, the ratio of reserves to GNP, the rate of GDP growth, and the variance of export growth. In addition to entering these variables in levels, we interacted them with a dummy for Latin America. We estimated this equation separately for each sub-period. We interpret the residuals from these regression of credit ratings on observable economic characteristics as a measure of political risk.

Details on the procedure and the results are in Appendix B. It turns out that in contrast to our results for issuance, spreads and maturities, the signs of the coefficients in the credit-rating equations remain the same across periods.<sup>14</sup>

To proxy for international credit conditions, we used the yield on ten-year U.S. treasury bonds. Ten-year rates are appropriate insofar the term to maturity of the underlying asset is

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<sup>13</sup>The advantage of the *Institutional Investor* data over the Moody's/S&P ratings used by most previous authors is more complete country coverage and regular publication. The data are biannual.

<sup>14</sup>In other words, changes in procedures and indicators used by the rating agencies do not appear to have been a channel for contagion, insofar as it is valid to generalize from the *Institutional Investor* scores.

broadly similar to that on the bonds in our sample. We also employ a measure of the yield curve, the log of the difference between the ten-year and one-year U.S. treasury rates.<sup>15</sup>

Estimating an equation for market access (whether or not borrowing is observed) requires information on those who did not issue bonds. For each country we considered three categories of issuers: sovereign, (other) public, and private. For each quarter and country where one of these issuers did not come to the market, we recorded a zero, and where they did we recorded a one.

Tabulations of the variables for the period up to the Mexican crisis, from the Mexican crisis to the Asian crisis, from the Asian crisis to Russia's default, and since August 1998 appear in Table 1. The table highlights the expansion of the market up to the Asian crisis and its relative quiescence thereafter. The number of new bond issues rises through the Asian crisis before falling back in the two recent subperiods. Launch spreads similarly narrow up to the Asian crisis and widen subsequently. Together these facts point to demand shifts by investors as a factor in changing market conditions. A number of other variables display interesting -- sometimes surprising -- changes across columns. The share of sovereigns in borrowers is higher in each period than the period that came before—surprisingly given the emphasis in contemporary commentary on growing private sector access to the market. Similarly, the share of privately placed bonds, having held steady up to the summer of 1997, rises after the Asian crisis and again after Russia's default, contrary to the perception of steadily growing reliance on public issuance.

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<sup>15</sup>Average maturity was 5 to 8 years, depending on which of the samples used below is considered. The ten-year note was also used by previous authors such as Cline and Barnes (1997), which therefore enhances comparability. The use of the yield curve also brings into play the role of short-term interest rates.

#### 4. Determinants of Issuance, Maturities, and Spreads

We are interested in whether the crises of the 1990s show up in reduced issuance, shorter maturities, or higher spreads. To this end, we estimated a probit for the determinants of issuance, an equation to explain the maturity of new issues (corrected for selectivity bias), and a spreads equation (corrected for selectivity bias and also for the impact of maturities on spreads). We analyze shifts in these relationships following the Mexican crisis, the Asian crisis, and the Russian crisis.

**Issuance.** Table 2 reports the results for the issue decision. (Throughout, coefficients in bold face differ significantly from zero at the five per cent confidence level, while coefficients that are only shaded differ from zero at the ten per cent confidence level.) For the full sample (through the second quarter of 1999), the results are similar to those we reported in Eichengreen and Mody (1998a, 1998b).<sup>16</sup> A lower debt/GDP ratio, a higher credit rating residual (i.e. less political risk), higher growth rates, and a lower variance of export growth -- all factors that improve country creditworthiness -- plausibly increase the probability of issuance. Since these factors are also associated with lower spreads (as our earlier analysis shows and results reported in this paper confirm), we interpret them as mainly shifting investors' appetite for emerging market bonds. In contrast, a lower ratio of reserves to short-term debt is associated with not just a higher probability of issuance but also higher spreads. We interpret these variables as shifting outward the supply of new issues by emerging-market borrowers.

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<sup>16</sup>The coefficients are normalized to the partial derivative of the probability distribution function with respect to a small change in the independent variable evaluated at average values of the independent variables to facilitate interpretation.

Some differences are evident across periods. Prior to the Mexican crisis, U.S. interest rates were negatively correlated with bond issuance. Some years ago, Calvo, Leiderman, and Reinhart (1996), focusing on Latin America, also argued that higher U.S. interest rates tend to be associated with smaller capital flows to emerging markets. For emerging markets as whole, however, that effect seems to have waned between the Mexican and Asian crises. And after the Asian crisis, the sign on the U.S. interest rate turns positive, though it is smaller for Latin America than for other regions. For the decade as a whole, we get a negative effect of U.S. interest rates for Latin America (again, from the sign and significance of the sum of the coefficients), consistent with the early observations of Calvo et al., but not for other regions.

The GDP growth rate is the other country-specific factor that importantly alters credit market access between periods. The coefficient on growth rates, although also positive initially, increased after the Mexican crisis and increased further after the Asian crisis. Thus, between the Mexican and Asian crisis, when countries in East Asia and Latin America enjoyed respectable rates of growth, small increases in growth rates were accompanied by large increases in issuance. In contrast, following the Asian crisis, when growth rates fell and turned negative in several Asian and Latin American countries, these countries suffered both because of their poor growth prospects and also because the higher coefficient on the growth rate variable implied that poor growth was penalized more in the post-Asian crisis period. Thus, the positive relationship between growth and issuance, holding other factors constant, indicates that bond flows are procyclical. A key channel through which collateral damage is transmitted following a crisis

would appear to be the deterioration of growth, which in addition to its direct effect curtails the demand for emerging market bonds.

A third trend associated with the Mexican and Asian crises was the decline in non-sovereign issuance. Issuance by government agencies other than the sovereign and private issuance, which were higher than sovereign issues before the Tequila, fell sharply following the Mexican and Asian crises. Sovereign issuers are, with rare exceptions, the most creditworthy borrowers. Hence, with the flight to quality following the Asian crisis, non-sovereign borrowers were disproportionately rationed out of the market. This is evident in the decline in the size of the coefficients for public (non-sovereign) borrowers and private borrowers following the Asian crisis and the decline in their interactions with the dummy variable for Latin America already following the Mexican crisis.

These three factors -- changes in the level and effect of U.S. interest rates, growth prospects, and the relative attractiveness of non-sovereign credits -- more than explain the decline in East Asian bond issuance following the 1997 crisis.<sup>17</sup> In other words, after accounting for changes in the level and effect of these three variables, which were common to all emerging markets, issuance by Indonesia, Malaysia, Korea and Thailand was actually greater than predicted. (Presumably it was positively influenced by other perceived attributes of these four economies, possibly the view that growth prospects were still positive in the long run.) Similarly, although the raw data show that the probability of bond issuance fell sharply after the Russian crisis, the

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<sup>17</sup>Thus, the Gang-of-Four dummy (which equals unity for Indonesia, Malaysia, the Republic of Korea, and Thailand) enters with a positive and statistically significant sign in the equation for the period following the Asian crisis.

post-Russia dummy has a *positive* and significant sign, implying that the factors identified above *more than explain* the fall in the emerging-market bond issuance.

**Maturity.** Of the three dimensions of market access, maturity appears to have held up best in the face of successive crises. Although it declined slightly after the Mexican crisis (as shown in Figure 1), it returned to its prior upward trend subsequently. Following the Asian crisis, while rate of bond issuance fell and spreads rose, average maturity remained relatively stable, although the length of new issues slumped temporarily in the second quarter of 1998.

One variable that seems to have mattered for maturity, but in different ways in different periods, is the U.S. yield curve. Before Mexican crisis (as shown in the second column of Table 3), a steeper yield curve resulted in lower maturity, as if international lenders were reluctant to lend long-term when interest rates were expected to rise. Subsequent to the Tequila, in contrast (columns 3 and 4), the coefficient on the yield curve has been positive and significant, which is consistent with the perspective of an emerging market borrower wishing to borrow to lock in favorable interest rates. It follows that in the period following the Asian crisis, when interest rates were low, that subset of borrowers which was still able to access the market chose to lock in favorable rates, offsetting any tendency for investors to opt for shorter maturities.<sup>18</sup>

Among the country-specific determinants of maturity we consider are the inflation rate and the credit rating, with the squared term on these variables included to test for nonlinear effects. A

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<sup>18</sup>Notice also, that the Inverse Mills Ratio has been especially large since Asian crisis. The positive sign on this coefficient implies that issuers have unobserved characteristics that lead simultaneously to a higher probability of market issuance and longer maturities.

moderate rate of inflation appears to have reduced maturity sharply in the period between the Mexican and Asian crises but not otherwise. Before Mexico, only relatively high inflation rates made it difficult to borrow long term, as reflected in the negative and statistically significant sign on inflation squared. Following the Asian crisis, this effect appears to have disappeared, presumably because inflation became less of a concern as deflation became more of a risk.

Maturity first rises with credit quality and then declines. This pattern comes through strongly in each of the three subperiods. In the domestic corporate bond context, Flannery (1980) suggests that in an environment characterized by asymmetric information, relatively good borrowers will want to issue short-term debt, since their estimate of their own credit worthiness will be even higher than that of outside investors; once their performance reveals them to be of high quality, they will be able to refinance at lower cost, leading to a reluctance to issue long-term debt that locks them into high interest rates. Our results suggest that an analogous effect operates in international markets.

The subperiod estimates reveal steady changes in the coefficients on the credit rating and dummy variable for whether a bond carries a guarantee. The coefficient on the dummy variable for a guarantee is positive and significant before the Asian crisis but negative and significant thereafter. The obvious explanation is that the presence of a guarantee reduced the perceived risk of long-term lending before the Asian crisis, but that the need for a guarantee was taken as a signal of the poor quality of the issuer thereafter. The rating at which maturity reaches its maximum similarly ratches upward from 56 before Mexico, to 58 between the Mexican and Asian crises, and to 64 following the Asian crisis.

**Spreads.** Since our analysis shows that maturity bears a non-linear relationship to creditworthiness and that spreads are influenced by maturity, we present the results on the determinants of spreads separately for low-rated and high-rated issuers (those with ratings above and below 55 on the *Institutional Investor* scale).<sup>19</sup> These results are in Tables 4 and 5.

Prior to the Asian crisis, U.S. interest rates do not appear to have had much effect on the spreads paid by low-rated borrowers. This is in contrast to the significant influence of U.S. rates on *issuance*, as noted above and by Calvo, Leiderman, and Reinhart (1996). However, since the Asian crisis, the U.S. interest rate and the slope of the yield curve have both had a significant impact on spreads. The negative sign on the U.S. interest rate coefficient implies rising spreads in this period of falling interest rates, as does the positive sign on the slope of the yield curve. Recall, that these two factors -- U.S. interest rates and the slope of the yield curve -- were also associated with reduced issuance. In combination, then, the reduction in issuance and widening of spreads implies a reduced demand for bonds from lower rated issuers.

For high-rated issuers, the effect of U.S. interest rates and the yield curve is the opposite of that for low-rated issuers in the period after the Asian crisis. High-rated borrowers appear to have voluntarily reduced their participation in the market (i.e., as rates declined, there were fewer issues and lower spreads).

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<sup>19</sup>The same basic results obtain whether we split the sample at this or slightly different credit-rating thresholds. We chose 55 in order to obtain clean coefficients on the maturity variable, as explained in Appendix C.

Country characteristics influence spreads in predictable ways.<sup>20</sup> The credit rating residual is negative for both high- and low-rated countries (less credit risk implies lower spreads) and does not vary much between periods. In contrast, the coefficient on the debt/GDP ratio falls over time for both high and low-rated countries, as if heavily indebted countries are penalized less over time in terms of the spreads they pay.

Notice the changes over time in the effect of the growth rate. Prior to the Mexican crisis, higher growth was penalized for less credit-worthy borrowers, as if those fast growth rates were viewed as unsustainable. After the Asian crisis, the coefficient reverses sign, as if borrowers from low-rated countries that were best able to sustain growth were rewarded with lower spreads.

## **5. Out-of-Sample Predictions**

We now use the model for each subperiod to predict volumes, spreads and maturities in the succeeding period. In other words, the coefficients from the period prior to the Tequila, in conjunction with the actual values of the independent variables in the period between Mexico and Asia, are used to predict values in the interlude between the Mexican and Asian crises. Similarly, the coefficients estimated on data for the period between the Mexican and Asian crises, in conjunction with the actual values of the independent variables in the period following the Asian crisis, are used to generate predicted values for the period after the summer of 1997. We follow

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<sup>20</sup>The rescheduling variable appears in Table 4 for low-rated issuers but not in Table 5 for high-rated issuers because there are no highly-rated countries with recent histories of rescheduling in the sample, not surprisingly given the way the rating agencies operate.

the same procedure for the period following the Russian crisis.<sup>21</sup> The prediction errors tell us whether changes in issuer, country and global credit conditions can explain observed changes in volumes, spreads and maturities, or whether there was in addition a role played by shifts in market sentiment (the flight to quality).

**Issuance.** Table 6 shows that following the Mexican crisis and before the Asian crisis, issuance was lower than predicted, except -- surprisingly -- in Latin America. The results for these other regions suggest, intuitively, that the flight to quality led to a sharp drop in the volume of borrowing. In Latin America, in contrast, actual rates of issuance exceeded predicted levels, especially in 1996-7. There the effect of shifts in market sentiment showed up mainly in the behavior of spreads.

Following the Asian crisis, the probability of bond issuance again fell below the levels predicted by the model estimated on data for the previous period, especially in the first half of 1998, reflecting the flight to quality (except in Eastern Europe, where issuance remained buoyant). The volume of issuance recovered fastest in Latin America (the crisis there being milder than in Asia), with actual volumes exceeding predicted levels in 1998. After the Russian crisis, issuance remained below predicted levels in all regions. Not surprisingly, Eastern and Central Europe were disproportionately affected. But, again, Latin America recovered relatively

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<sup>21</sup>Thus, while the results in the final columns of Tables 2-5 include data through 1999-II (given the difficulty of estimating the full model on the relatively small number of observations for the subperiod following the Russian crisis), the out-of-sample forecast errors in the final column of Tables 6-8 are based on a model estimated through 1998-II. For Table 9, we use a model estimated on data through 1999-II and an in-sample forecast due to what would otherwise be an insufficient number of observations.

quickly, with the volume of issues again exceeding predicted levels in the first quarters of 1999.

Our interpretation is that investor nervousness affecting the volume of bond issuance by Latin American borrowers died out more quickly than that affecting borrowers in other regions following each of the crises of the 1990s. This pattern is not surprising following the Asian and Russian crises, whose effects were presumably more serious in other parts of the world than in the Western Hemisphere. But it is striking that the same effect is also evident following the Tequila of 1994 and early 1995, suggesting that it may reflect deeper aspects of capital market access by Latin American countries.

**Maturities.** Maturities (Table 7) behave similarly to volumes following the Mexican crisis. Maturities tend to be shorter than predicted in 1995 but exceed the out-of-sample forecasts in 1996 and early 1997. Note that while the maturity of new Latin American bond issues was nearly two years shorter than predicted in 1995, it recovers subsequently and is four years longer than predicted by the first half of 1997. Following the Asian crisis, in contrast, actual maturities remain above the out-of-sample forecasts based on the estimated model for the Mexico-Asia period. This attests to the stability of the maturity variable: despite the crisis, borrowers who did come to the market were able to maintain and even lengthen the term to maturity. Maturities also appear to have held up surprisingly well following the Russian crisis, except in Latin America.

**Spreads.** Following the Mexican crisis, Latin American spreads were, as expected, higher than predicted by the out-of-sample forecasts, especially for issuers from lower-rated countries. This effect decayed over time until by the first half of 1997 the difference had reached negligible levels. The generally positive attitude of international investors toward East Asian borrowers in

this period of “spread compression” is reflected in the tendency for actual spreads to fall further and further below predicted levels as the Mexico-Asia interregnum progressed.<sup>22</sup>

After the Asian crisis, in contrast, the spreads paid by low-rated borrowers continue for the most part to be narrower than the out-of-sample forecasts. East Asia comes closest to constituting an exception; there, the forecast error is negligible at first and remains small (35 basis points) in the first half of 1998. It is striking that actual spreads remain below — even if only slightly below — the out-of-sample forecasts for the region, given the severity of its crisis and the behavior of spreads after Mexico. Contrary to much informal discussion, then, it would appear that high observed spreads in East Asia following its crisis reflected the deterioration in fundamentals more than any shift in market sentiment or flight to quality.<sup>23</sup> This is in contrast to issuance, where the effect of fundamentals is smaller, that of shifts in market sentiment larger.

The number of issuers in the high-credit-quality group is smaller; hence the differences in Table 9 are likely to be less robust. But a few results are worthy of note. In Latin America the fallout from the Tequila lingers longer: actual minus predicted spreads remain positive from 1995 through 1997, again as if adjustment in that region occurs more in more in terms of spreads than in terms of issuance. After the Asian crisis, Asian spreads are higher than the out-of-sample

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<sup>22</sup>For other regions, we similarly see actual spreads below predicted levels. It should be noted that some of the differences for these other regions are driven by a relatively small number of observations.

<sup>23</sup>Specifically, the decline in growth rate and the rise in debt/GDP ratios had the effect of raising spreads, as would have been predicted. For example, for low-rated East Asian borrowers, debt/GDP rose from 49 percent in the Mexico-Asian crisis period to 75 percent following the Asian crisis and growth fell from over four percent to negative rates.

forecasts, not surprisingly, while Latin American spreads are lower than forecast. An interpretation is that high-quality East Asian borrowers voluntarily withdrew from the market in 1997-8, because the spreads demanded by the market exceeded those the borrowers regarded as reasonable. (To put it another way, the high-quality borrowers could afford to wait.) After the Russian crisis, Asian spreads fell below predicted values; we find this same result for high and low-rated Asian borrowers. Again, it is as if Asian borrowers, regardless of credit quality, were better able to delay borrowing so as to avoid paying exorbitant spreads.

Thus, while there is ample evidence of changes in market sentiment affecting spreads, the dominant effect is within the region in which the crisis originates. Following the Mexican crisis, Latin American spreads were persistently higher than predicted by the pre-crisis model, in contrast to other regions, where spreads returned quickly to predicted levels and even fell below them. Similarly, following the Asian crisis, the excess of actual over predicted spreads was larger in Asia than in other regions, and the gap was smallest in Asia in periods and market segments where actual values fell short of predictions. Other authors like Glick and Rose (1998) have similarly emphasized the regional character of contagion. While we make the same observation, our interpretation of it is different. We emphasize changes in investor sentiment toward the region as a whole, rather than the trade links highlighted by these previous authors, which in our framework should show up as changes in fundamentals.

## **6. Conclusions**

In this paper we have examined how negative shifts in market sentiment are felt in the

bond market and identify the country characteristics associated with the damage. To identify the impact on volumes, maturities and spreads, we estimated a model of these three dimensions of market access. Three key findings emerge from the paper.

- While there is ample evidence of adverse changes in market sentiment (the so-called “flight to quality”), the dominant effect is within the region in which the crisis originates. There is evidence of persistent unfavorable market sentiment in the behavior of primary-market spreads in Latin America but not East Asia after the end of 1994, and in East Asia but not Latin America after the first half of 1997. While the volume of new issues by East Asian borrowers was depressed by unfavorable market sentiment in 1995, and the volume of new issues by Latin American borrowers was similarly depressed by unfavorable market sentiment in the second half of 1997, inter-regional spillovers operating through this channel appear to have died out quickly, unlike the within-region impact, which persisted.
- In Latin America, changes in market sentiment appear to have been felt more through their impact on prices and less on quantities, compared to other regions. This might seem surprising given the decline in the volume of issues following the Mexican crisis. But even in the aftermath of the Tequila, when the rate of new issues slowed, that decline is all but entirely attributable to the observed deterioration in country credit worthiness (that is, less favorable values of the independent variables), leaving little to be explained by changes in market sentiment. This is not to say that shifts in market sentiment were unimportant for Latin America, only that their main impact was on spreads rather than issue volumes. We suspect that the contrast with East Asia reflects the relative flexibility of the economies in

the two regions and their derived demands for external funds. One conjecture is that when market sentiment deteriorates and spreads begin to widen, East Asia countries withdraw from the market, preferring to delay borrowing until another day, which they are able to do given their relatively high degree of real-side flexibility and pliable current accounts. In contrast, Latin American countries, which enjoy less flexibility, continue to come to the market irrespective of the level of spreads.

- While changes in market sentiment affect the price and quantity of new issues, there is less evidence of an impact on maturities. Maturities have risen steadily over the 1990s and remained largely immune to changes in market sentiment. While they declined modestly in the aftermath of each emerging market crisis, those declines have been mild, the subsequent recovery rapid. Moreover, observed changes in fundamentals more than fully account for these temporary declines in the term of lending; actual maturities exceed predictions based on the previous period's estimated model but the current period's independent variables for each of the intra-crisis intervals considered in this paper. The upward drift in the maturity of emerging market bond issues and its stability in the face of repeated crises contrast with the shortening maturity of bank lending in the first half of the 1990s, and with sharp drops in the term of bank loans in periods of turbulence, which became a source of policy concern as the period progressed. Why maturities remain so stable (equivalently, why lenders and borrowers seem so reluctant to respond to changing credit-market conditions by adjusting the maturity of new issues) is an important topic for future research.

This last observation — the long term to maturity of bond debt and its stability in the face of shocks — has led some commentators to encourage countries to rely more on the bond market and less on bank debt, which is prone to run off in the event of a crisis. Our study highlights the other side of this coin, that access to the bond market tends to dry up just when it is needed. Our analysis suggests that this problem has been growing with time. In particular, the weight investors attached to growth when deciding whether to lend increased after the Mexican crisis. Between the Tequila and the outbreak of the Asian flu, many countries in East Asia and Latin America enjoyed rapid growth, large quantities of bond issuance, and strikingly narrow spreads. But with the outbreak of the Asian crisis, as growth fell and in important instances turned negative, the importance investors attached to growth rose still further, precipitating an especially sharp drop in the volume of bond issuance. This heightened dependence of issue volumes on growth precisely in periods when growth rates suffered suggests that while bond debt may not flee in a crisis to the same extent as short-term bank debt, market access for those in need of additional credit can be seriously impaired. While foreign bank credits have special risks, bond finance is no panacea.

## Appendix A. Data, Sources and Variables

Our data on international bonds, obtained from *Capital Bondware* and supplemented by the Emerging Markets Division of the International Monetary Fund, covers the period 1991-I through 1999-II. It includes: (a) launch spreads relative to risk-free rates (on government bonds of comparable maturities issued in the same currency as the bond under consideration), in basis points, where one basis point is one-hundredth of a percentage point; (b) amount of the issue (in millions of \$US); (c) maturity of the issue in years; (d) whether the borrower was a sovereign, other public-sector entity, or private debtor; (e) the currency of issue; (f) the borrower's sectoral affiliation: manufacturing, financial services, utility or infrastructure, other services, or government (where government refers to central banks and subsovereign entities that could not be classified in the other four industrial sectors); and (g) the country and region of the borrower.

This information was supplemented with country characteristics as described in Appendix Table A. Sources for this information included various issues of the International Monetary Fund's *World Economic Outlook (WEO)* and *International Financial Statistics (IFS)*, the World Bank's *World Debt Tables (WDT)* and *Global Development Finance (GDF)*, the Bank for International Settlements' *Maturity, Sectoral and National Distribution of International Bank Lending*, and *Institutional Investor's Country Credit Ratings*. Missing data for some countries were filled in using the U.S. State Department's annual country reports on *Economic Policy and Trade Practices* (available on the web at [http://www.state.gov/www/issues/economic/trade\\_reports/](http://www.state.gov/www/issues/economic/trade_reports/)).

## **Appendix B. The Credit Rating Residual**

In this appendix we report the equations used to construct the credit rating residual used as a measure of political risk. As explained in the text, we regress the credit rating on the ratio of debt to GNP, the debt rescheduling dummy, the ratio of reserves to GNP, the rate of GDP growth, and the variance of export growth. In addition to entering these variables in levels, we interacted them with a dummy variable for Latin America. We estimated the equation separately for each sub-period.

The results (shown in Appendix Table B) are of independent interest. When estimated on data for the full period, 11 of 12 independent variables enter with coefficients different from zero at the 95 per cent confidence level. (The one exception is the interaction term between the standard deviation of export growth and the Latin America dummy.) The signs of the coefficients are intuitively plausible. Larger reserves, less debt, faster growth and more stable export growth improve credit ratings, while a recent history of debt rescheduling worsens them. Large reserves and a heavy debt burden matter more for Latin America, whereas fast growth and a recent history of rescheduling matter less.

In contrast to our results for issuance, spreads and maturities, the signs of the coefficients in the credit-rating equations generally remain the same across periods. Two exceptions are the interaction between the debt/GDP ratio and the dummy for Latin America, which is positive for the period before the Asian crisis, and the interaction between growth rate and Latin America dummy, which is negative for most of the 1990s but turns positive after Asian crisis.

## Appendix C. The Spread-Maturity Relationship

Theoretical analyses suggest that maturity should first rise and then fall with credit quality. We expect maturity to rise with credit quality initially because lenders will be disinclined to purchase long-term bonds from the lowest-quality borrowers. For high-quality borrowers we expect maturity to decline with credit quality, since high-quality borrowers will prefer short-term debt in order to be able to refinance on more favorable terms in the future.

This implies that spreads should rise with maturity for high-quality borrowers, reflecting two factors working in the same direction. Spreads tend to increase with maturity, other things equal, because of the higher liquidity risk, but in addition longer maturity will be associated with lower credit quality in the high-quality subgroup, thus also leading to higher spreads. For low-quality borrowers, in contrast, the two factors work in opposite directions, since higher maturity is associated with better credit quality and therefore with lower spreads. If this second effect dominates we would expect the reverse relationship between maturity and spreads for low rating category borrowers, and the type of overall relationship between spreads and maturity indicated in Figure 2.

The data support this reasoning. We fit a quadratic in credit rating to maturity, obtaining coefficients of the expected sign and an inflection point at 55.3 on the *Institutional Investor* scale. The estimated equation is:



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