IMF Staff Papers
Vol. 48, No. 3

How Does U.S. Monetary Policy Influence Sovereign Spreads in Emerging Markets?

VIVEK ARORA and MARTIN CERISOLA*

This paper quantifies the impact of changes in U.S. monetary policy on sovereign bond spreads in emerging market countries. Specifically, the paper explores empirically how country risk, as proxied by sovereign bond spreads, is influenced by U.S. monetary policy, country-specific fundamentals, and conditions in global capital markets. While country-specific fundamentals are important in explaining fluctuations in country risk, the stance and predictability of U.S. monetary policy are also important for stabilizing capital flows and capital market conditions in emerging markets. [JEL E43, F36, G15]

The increased globalization of the world economy over the past decade has been reflected in the increased dependence of emerging markets on developments in the U.S. economy. While the dramatic rise in capital flows to emerging markets has been induced primarily by the implementation of sound macroeconomic policies and wide structural reforms in these countries, it has also been driven by changing conditions in industrial countries that have encouraged investors to diversify their portfolios into developing country assets. In particular, Calvo, Leiderman, and Reinhart (1993) have emphasized the role of economic conditions—particularly interest rates—in industrial

*Vivek Arora is a senior economist in the IMF's Western Hemisphere Department. Martin Cerisola is a Senior Economist in the Asia and Pacific Department of the IMF and was in the Western Hemisphere Department when this paper was written. They would like to thank, without implicating, Steven Dunaway, David Goldsbrough, Robert Flood, Charles Kramer, participants in an informal departmental seminar, and an anonymous referee for helpful comments and suggestions. They would also like to thank Tulio Vera, of Merrill Lynch, for providing the country data on sovereign spreads; IMF desk economists for other country-specific data; and Victor Culiuc for his research assistance. Any errors are the authors' responsibility.

countries,[1] while others have also pointed to structural changes in institutional portfolios in industrial countries, which led to a permanent increase in their exposure to developing countries.

The resumption of capital flows to developing countries during the 1990s was accompanied by a dramatic decline in interest rate spreads but increased countries' vulnerability to sudden reversals in investors' confidence and increased turbulence. Some past episodes of market turbulence occurred at the same time that the stance of U.S. monetary policy was being changed considerably (for example, in 1994) or even precipitated changes in U.S. monetary policy (for example, during the second half of 1998). Given the integration of global capital markets, changes in U.S. monetary policy have been felt by developing countries through effects on the cost and availability of funds, and on their creditworthiness.

In addition to the direct impact of changes in U.S. interest rates on rates in developing countries, interest rate spreads (the differences between yields on sovereign bonds of developing countries and U.S. treasury securities of comparable maturities), which are a proxy for country risk, have tended to move in the same direction as the changes in U.S. interest rates. This effect on developing country spreads was seen clearly in 1994 when a tightening of U.S. monetary policy was reflected in a substantial widening of spreads, and in 1998, when an easing of U.S. monetary policy in response to the flight to quality and the concerns about a U.S. credit crunch associated with the Russian default and the near demise of Long-Term Capital Management (LTCM) helped to restore global liquidity conditions and to reduce sovereign spreads somewhat.

This paper presents empirical evidence on how changes in U.S. monetary policy influence country risk in several developing countries in Latin America, Asia, and Eastern Europe. In particular, we examine empirically how country risk, as proxied by sovereign bond spreads, is influenced by U.S. monetary policy, country-specific fundamentals, and by conditions in world capital markets.

I. What Drives Sovereign Spreads in Emerging Markets?

From a theoretical perspective, a rise in U.S. policy interest rates could lead to an increase in emerging market spreads for several reasons.[2] To the extent that emerging market bonds are risky (there is a probability of default), the yield on emerging market bonds would have to rise by more than any rise in the risk-free rate. To illustrate, if r and i represent the interest rate on the risk-free asset and

[1]Calvo, Leiderman, and Reinhart (1993) note that flows to Latin America, and developing countries in general, during the early 1990s were triggered by "...falling interest rates, a continuing recession, and balance of payments developments in the United States...."

[2]See Kamin and von Kleist (1999) for further discussion.

the risky asset, respectively, and p is the probability of repayment on the risky asset, then the equilibrium condition is:

$$(1+r) = p \bullet (1+i) + (1-p) \bullet 0. \tag{1}$$

The interest rate spread, S, defined as the difference between the rate on the risky asset and on the risk-free asset, in equilibrium is then:

$$S = (1+r)(1-p)/p, \tag{2}$$

and its derivative with respect to r is $(1 - p) / p$, which is positive as long as $p < 1$. This says that as long as there is some risk of default, the rate on the risky asset will have to rise by more than any rise in the risk-free rate in order to compensate investors for the risk.

A rise in U.S. rates could also raise emerging market spreads through its effects on the ability of debtor countries to repay loans. A rise in U.S. rates would tend to increase debt-service burdens in borrowing countries, which would reduce their ability to repay loans. In addition, as noted by Kamin and Kleist (1999), a rise in U.S. rates could reduce investors' appetite for risk, leading them to reduce their exposure in risky markets, in turn reducing available financial resources in borrowing countries. In terms of the above illustration, if the probability of repayment is a negative function of the risk-free rate ($p = p(r)$, with $p' < 0$), then the first derivative of S with respect to r is:

$$dS / dr = \left[(1-p)/p\right] - \left[(1+r)p'/p^2\right], \tag{3}$$

which is positive (since $p < 1$ and $p' < 0$). This says that a rise in the risk-free rate raises the spread both because of the risk of default (the first term) and because that risk rises as the risk-free rate goes up (the second term).

A number of relatively recent papers have explored the question of how emerging market spreads are determined, including the role of macroeconomic fundamentals and changes in market sentiment. Notwithstanding the straightforward theoretical prediction and ample anecdotal evidence, the empirical literature on how U.S. monetary policy has affected emerging market spreads is less conclusive. Most of these analyses have tended to explore the role of global liquidity conditions, as proxied by a specific yield on a U.S. treasury security, on sovereign bond spreads. For example, in a study of 11 emerging market countries, Cline and Barnes (1997) found a positive but statistically insignificant effect of U.S. treasury yields on sovereign spreads during the mid-1990s. Kamin and von Kleist (1999) found no

statistically significant relationship between U.S. treasury rates and spreads for selected emerging market countries, with the correlation being negative in some cases. Eichengreen and Mody (1998a and 1998b) took these analyses further by explicitly analyzing demand and supply factors in the market for emerging market bonds. They found, for a sample of Latin American and East Asian countries during the early 1990s, that a rise in U.S. treasury interest rates tended to *reduce* spreads, and at the same time reduce the probability of a bond issue. The interpretation was that a rise in U.S. rates deterred emerging country issuers from coming to the market; with fewer issuers (who were likely to be of higher quality), prices rose and spreads fell.[3] These results, however, may be sensitive to the nature of the underlying data used in the analyses. These studies focused on sovereign spreads for *new bond* issues (so-called launch spreads) rather than on spreads for bonds actively traded in secondary markets. Also, some of the analyses cover a subperiod (1991–93) when the market for sovereign bonds was developing, and another one (1994–95) when shocks seriously restricted access to the market for lower quality issuers.

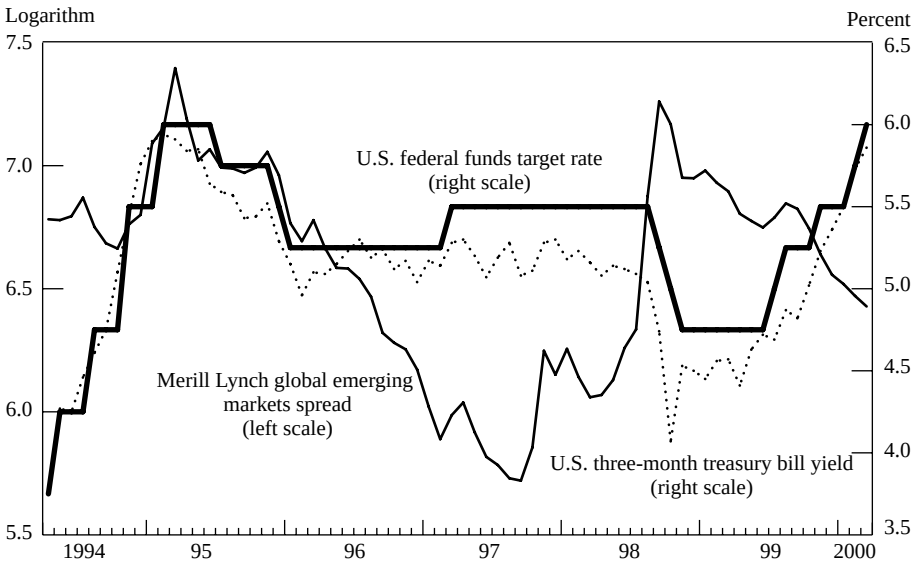
This paper adds to the existing literature in three dimensions. First, rather than examining spreads on new issues, we examine secondary market sovereign spreads, which is the concept that is most common in public discussion and which, as Eichengreen and Mody (1998a) note, can behave differently than launch spreads, as they tend to be actively traded based on current and expected developments.[4] Second, we isolate the impact of U.S. monetary policy by explicitly incorporating the U.S. federal funds target rate as an explanatory variable instead of the yield on a U.S. treasury security. Most of the specifications adopted so far have been somewhat simplistic, proxying U.S. monetary policy by the yield on U.S. treasury securities. However, shocks to U.S. treasury yields are not necessarily the result of changes in U.S. monetary policy. As seen in Figure 1, while the yield on the three-month U.S. treasury bill has in general fluctuated in tandem with the U.S. federal funds target rate, there have been many instances when these two rates have departed from each other. A recent instance was the so-called flight to quality during the Asian crisis, when U.S. treasury bill yields fluctuated dramatically even in the absence of changes in U.S. monetary policy. The level of the U.S. federal funds target rate is thus a more direct measure than the yield on U.S. treasury securities. Third, as discussed below, we explicitly analyze the role of market volatility, including uncertainty about U.S. monetary policy actions. In doing so, we present an autoregressive conditional heteroskedasticity (ARCH)–based measure of volatility that escapes criticisms that apply to more commonly used measures.

Clearly, from a theoretical and empirical point of view, changes in U.S. interest rates, or likewise in global liquidity conditions, would be expected to influence positively country risk and sovereign spreads in developing countries.

[3]Cline and Barnes (1997) pointed out in addition that falling U.S. interest rates are generally associated with an abundance of capital in international markets, which tends to drive down yields.

[4]Earlier analyses based on secondary market developments include Dooley, Fernandez-Arias, and Kletzer (1996) and Calvo, Leiderman, and Reinhart (1996). These papers found a significant negative impact of industrial-country interest rates on secondary market prices of emerging market debt.

Figure 1. Emerging Market Sovereign Spreads and U.S. Interest Rates



While Eichengreen and Mody (1998a and 1998b) found that a tightening of global liquidity conditions (as proxied by the 10-year U.S. treasury bond yield) tended to reduce sovereign spreads in emerging markets, as noted earlier, their result may be largely explained by the nature of the underlying data used in their analyses and by the sample period (1991–95), which covers the 1991–93 subperiod when the market for sovereign bonds was at a very early stage of development and when shocks seriously restricted access to the market for lower quality issuers.

We started by replicating the methodology of earlier studies, but using secondary market data. We estimated the following model individually for a group of emerging markets. The model was estimated for Argentina, Brazil, Bulgaria, Colombia, Indonesia, Korea, Mexico, Panama, the Philippines, Poland, and Thailand for the period 1994–99 (with a few exceptions due to data limitations). We adopted the following standard linear relationship:

$$\log(spread)_t = \alpha \log(ustnote_t) + \eta Z_t + \omega_t, \tag{4}$$

which aims at explaining fluctuations in the logarithm of sovereign spreads as a function of the log of the level of the yield on the 10-year U.S. treasury bond (*ustnote*) and country-specific macroeconomic variables (Z), where α and η are parameters to be estimated and ω is the error term. As for country-specific fundamentals, we selected a set of macroeconomic variables that have traditionally been used in the literature exploring fluctuations in sovereign spreads. In particular, the variables chosen were the fiscal balance, the net foreign asset position of the

banking system, central government external debt, and total external debt (all expressed as a ratio to GDP), the debt-service ratio, and the ratio of gross international reserves to imports. However, more recent studies, such as Kaminsky, Lizondo, and Reinhart (1997) and Kaminsky and Reinhart (1998), have emphasized the need to identify key macroeconomic and financial variables that may provide some early warning signals of banking and currency crises, and the role of other fundamental factors in driving banking and currency crises. Kaminsky, Lizondo, and Reinhart (1997) propose a set of variables that track more effectively the emergence of a crisis, such as deviations of the real exchange rate from trend, equity prices, and the ratio of broad money to gross international reserves. These additional variables, which are not part of our estimation, are worth exploring in future research.

The results, presented in Table 1, confirm that there is a positive relationship between sovereign spreads in secondary markets and the yield on U.S. treasury securities.[5] Evidently, the main difference from Eichengreen and Mody's study seems to be related to the use of secondary rather than primary sovereign bond spreads. In addition, the results show that the level of the 10-year U.S. treasury note yield has a significant positive effect on sovereign spreads, with a mean group elasticity estimated at 0.78 and a mean standard error of 0.36.

While the above analysis suggests that the U.S. 10-year treasury note yield—a proxy for global liquidity conditions—tends to influence positively secondary market sovereign bond spreads, more direct measures of U.S. monetary policy—such as the U.S. federal funds rate—and a model-driven proxy for market volatility may help to explain better fluctuations in sovereign bond spreads.

What Is Market Turbulence and How Do We Proxy It?

Several authors have emphasized that, in addition to country-specific fundamentals, changes in market sentiment have been important in driving fluctuations in emerging market sovereign spreads (see, for example, Cantor and Packer (1996), Eichengreen and Mody (1998a and 1998b), and Kamin and von Kleist (1999)). These changes in market sentiment have often been sudden and abrupt, and have led many authors to argue that these changes in sentiment have been manifested by some form of market turbulence or "contagion" of shocks from one country to another, which has driven down sovereign debt prices or widened spreads. Baig and Goldfajn (2001) have analyzed the contagion from Russia to Brazil during 1998, while Edwards and Susmel (2000) have explored how changes in financial volatility, particularly interest rate volatility, have affected countries that supposedly have experienced market turbulence or contagion.

While some authors have argued that these episodes of market turbulence have to some extent reflected evidence of "irrational investor behavior," others have tried to explain these episodes primarily as "liquidity events." In particular, Valdés

[5]These regressions are based on the 10-year U.S. treasury note yield, as used by Eichengreen and Mody. Similar results were obtained when using the yield on the three-month U.S. treasury bill.

Table 1. Determinants of Sovereign Bond Spreads for Selected Emerging Markets

Period	Argentina 94:4–99:12	Brazil 94:4–99:12	Mexico 94:4–99:12	Panama 96:8–99:12	Colombia 97:4–99:12	Poland 94:11–99:12	Bulgaria 95:06–99:12	Philippines 94:4–99:12	Thailand 97:11–99:12	Korea 98:7–99:12	Indonesia 97:4–99:12
U.S. 10-year treasury yield	0.51 (.000)	0.96 (.000)	0.84 (.000)	0.21 (.208)	0.54 (.000)	1.01 (.000)	1.08 (.000)	0.54 (.000)	0.54 (.002)	1.54 (.000)	0.83 (.000)
Net foreign assets (in percent of GDP)	–0.05 (.000)	. . .	. . .	–0.09 (.000)	–0.47 (.001)	–0.32 (.000)	0.00 (.493)	. . .	–0.01 (.000)	–0.08 (.000)	. . .
Fiscal balance (in percent of GDP)	. . .	–0.01 (.395)	. . .	–0.09 (.000)	. . .	. . .	. . .	. . .	. . .	. . .	–1.01 (.000)
Gross reserves to imports	. . .	. . .	–0.39 (.708)	. . .	. . .	–2.25 (.050)	. . .	–3.71 (.002)	. . .	. . .	. . .
Debt-service ratio	. . .	. . .	. . .	. . .	. . .	. . .	0.02 (.011)	0.01 (0.117)	0.11 (.036)	. . .	. . .
Central government debt (in percent of GDP)	0.14 (.000)	0.10[1] (.000)	0.06 (.000)	. . .	0.21 (.000)	. . .	. . .	0.08 (.000)	. . .	. . .	. . .
Total external debt (in percent of GDP)	. . .	. . .	. . .	0.09 (.000)	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Dummy[2]	. . .	. . .	. . .	. . .	. . .	. . .	–0.53 (.000)	. . .	. . .	. . .	. . .
Adjusted *R*-squared	0.53	0.31	0.24	0.60	0.76	0.50	0.57	0.29	0.77	0.75	0.71

Source: IMF staff estimates.

Note: Probability values, for the null hypothesis of a coefficient equal to zero, are reported in parentheses. Standard errors have been adjusted following the Newey-West procedure.

[1]Refers to net debt.

[2]A dummy was included to allow for the effects associated with the introduction of a currency board in Bulgaria.

(1997) and Kaminsky and Reinhart (2000) have emphasized the financial aspects of contagion. Kaminsky and Reinhart noted the role of international bank lending and cross-market hedging as sources of contagion based on fundamentals. Valdés argued that contagion results primarily from the interaction of investors who face liquidity constraints and who have invested in emerging market assets that are potentially highly illiquid. When facing liquidity needs in one particular class of asset or country, such investors would tend to withdraw liquidity from some other class or country.

In the same vein, others have emphasized the importance of liquidity effects on capital flows and asset prices in emerging markets, which on certain occasions may have been associated with sudden and unexpected changes in U.S. monetary policy.[6] For example, during the first half of 1994, the U.S. Federal Reserve raised the federal funds rate by 125 basis points, which precipitated a sharp unwinding of highly leveraged positions by hedge funds, proprietary traders, and institutional investors, which had been financing purchases of long-term treasury securities with short-term borrowing. This unwinding of positions contributed to and exacerbated a steep correction in emerging sovereign bond markets. In sum, what these authors suggest is that a need for liquidity, precipitated by a rise in U.S. interest rates or other exogenous shock, becomes one of the main transmission vehicles of financial turmoil across assets and countries.

In terms of how to model turbulence or volatility, several approaches have been tested in the literature. Most approaches have used statistical measures based on standard errors for a certain variable that was considered as relevant in capturing the market turbulence or contagion. For example, the work of Hardouvelis (1989) in exploring the link between the level of margin requirements and stock market volatility in the United States was based on a moving average representation for volatility of real stock returns. More recent studies (Hardouvelis, Pericli, and Theodossiou, 1997) have proxied market volatility by computing the standard deviation of daily returns during a month. This volatility measure, which is based on daily data, is constructed in a way that tends to avoid data overlapping, and its associated problems, by being sampled every month. Other more advanced techniques have aimed at estimating conditional volatility and have been based on Schwert's (1989) procedure and on the ARCH model developed by Engle (1982). With these methods in mind, we proxied market volatility by computing different statistical and econometric measures on the spread between the yield on the three-month U.S. treasury bill and the U.S. federal funds target rate. In principle, the yield on the three-month U.S. treasury bill can be considered a key short-term risk-free rate that usually serves as a benchmark for pricing other high-yield assets in world capital markets, and that would most likely reflect changes in global liquidity and economic conditions. More important, changes in the spread between the three-month treasury bill yield and the

[6]See IMF (1995a, 1995b, and 1996) for a more detailed analysis and account of events.

U.S. federal funds target rate may capture heightened uncertainty about the expected stance of U.S. monetary policy, as in the first half of 1994.[7]

All the different proxies for market volatility tend to show increased market turbulence during 1994 and in the second half of 1998 (Figure 2). A scatter plot shows that a proxy based on a six-month moving average of standard deviations for the spread between the three-month yield on the U.S. treasury bill and the federal funds target rate was highly statistically significant in explaining fluctuations in sovereign spreads across countries (Figure 3). The validity of this proxy for volatility, however, has been questioned in the empirical literature by Hsieh and Miller (1990), who argue that it induces a spurious correlation between variables due to its high serial correlation. The construction of this proxy using moving averages leads to strong autocorrelation, which leads to highly problematic statistical inference. Therefore, regressing a highly autocorrelated series, such as the proxy for market turbulence, on other variables can produce a significant coefficient, even when no true relationship exists. The clustering of observations in Figure 3 would suggest that, *were these observations independent*, a strong direct relationship would be found between sovereign spreads and the proxy for volatility. The R^2 is quite high, at close to 30 percent.[8] In fact, these observations are far from independent, and the high positive correlation between sovereign spreads and the proxy for market volatility is primarily the result of the way the proxy was constructed.[9] Nevertheless, in our empirical estimates, we used these proxies for market volatility in estimating the model, and the results are clearly sensitive to the chosen proxy.[10] Given the constraints and limitations of the first two proxies for market turbulence noted above, however, we decided to use the fitted values for the conditional standard error from an ARCH model for the spread between the three-month yield on the U.S. treasury bill and the federal funds target rate. As is well established in the literature, ARCH models are useful in analyzing financial data because they capture the persistence in volatility that is observed in many financial time series. In particular, large shocks tend to be followed by large shocks of unpredictable sign, suggesting that there is persistence in market volatility and that it tends to vary over time. As seen in Figure 4, the positive relationship between spreads and market volatility looks significantly different from the one presented in Figure 3 once one allows for a proxy that minimizes data overlapping and serial correlation. In fact, there is less of a positive correlation between the variables, as the R^2 declines to only 8 percent.

[7]It is also evident, however, that changes in this spread may not necessarily *fully* reflect expected changes in the stance of U.S. monetary policy, as was demonstrated during the Asian crisis and, to some extent, during the events associated with the default by Russia and the near demise of LTCM during the second half of 1998. Cline and Barnes (1997) and Kamin and von Kleist (1999) use short-term interest rates as a proxy for global liquidity conditions. Eichengreen and Mody (1998a and 1998b) use the yield on the 10-year U.S. treasury bond as a proxy for global economic conditions.

[8]The alternative proxy suggested by Hardouvelis, Pericli, and Theodossiou (1997), the standard deviation of the daily spread within a month, is not presented in the paper because it was not statistically significant in most equations, except in those for Argentina, Bulgaria, and Indonesia.

[9]Notwithstanding these shortcomings, the autocorrelation coefficient is not highly persistent, as it declines to almost zero at the fourth lag.

[10]When using the six-month moving average proxy for market volatility, the econometric estimates show that this variable is highly significant across countries.

Figure 2. Alternative Proxies for Market Volatility

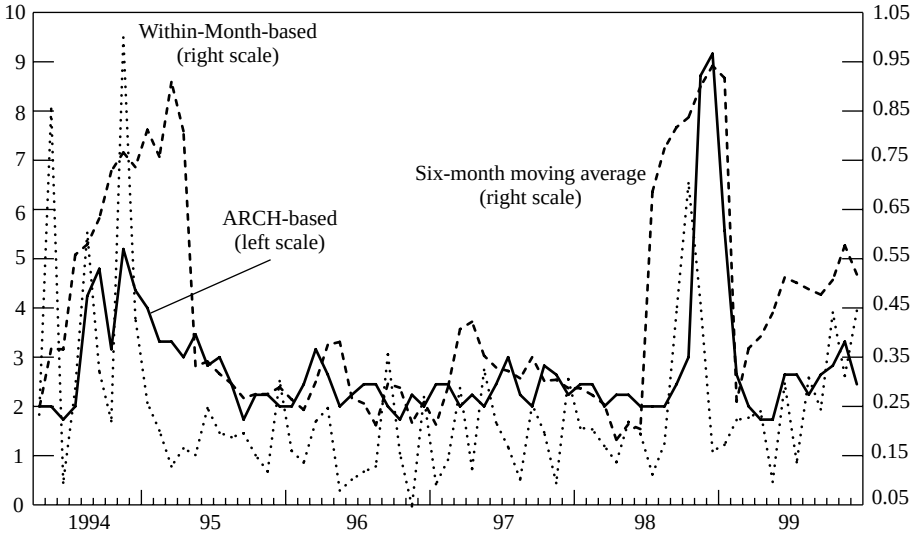


Figure 3. Sovereign Spreads and Moving-Average-Based Market Volatility

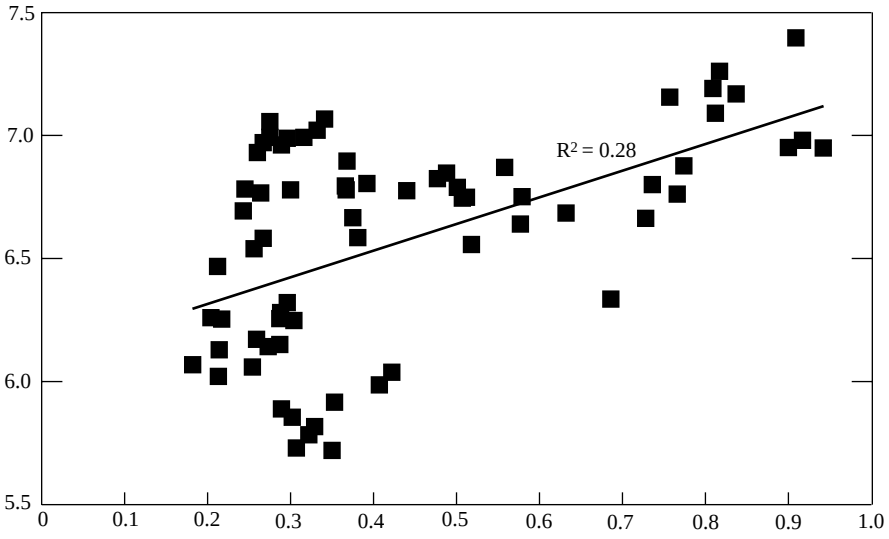
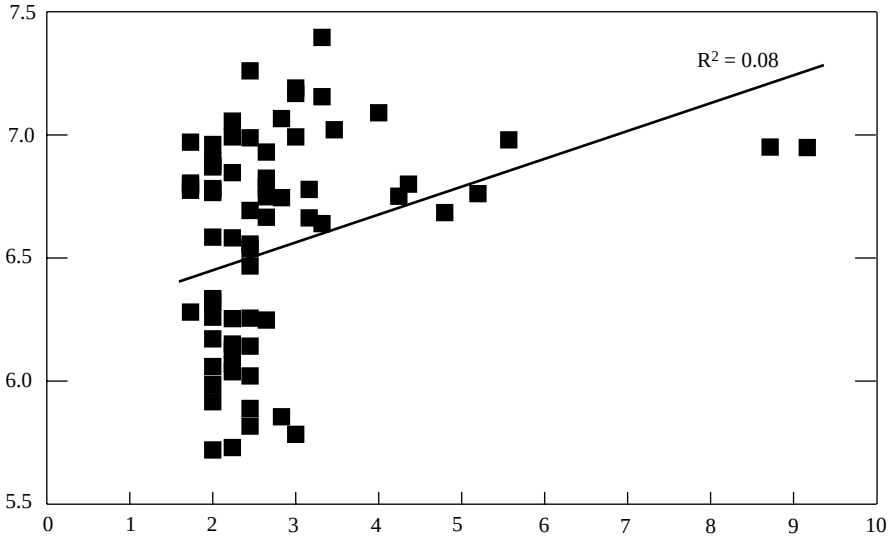


Figure 4. Sovereign Spreads and ARCH-Based Market Volatility



Econometric Evidence

The econometric model for sovereign bond spreads presented in the previous section was modified by explicitly including the U.S. federal funds target rate and a proxy for market volatility. The model, which was estimated individually for the same group of countries, is as follows:[11]

$$\log(spread)_t = \rho \log(ffr_t) + \lambda mktvol_t + \theta Z_t + e_t. \quad (5)$$

The model aims at explaining fluctuations in the logarithm of sovereign spreads as a function of the level of the U.S. federal funds target rate (*ffr*), the proxy for market volatility (*mktvol*) derived from an ARCH model, and country-specific macroeconomic variables (*Z*), where ρ, λ, and θ are parameters to be estimated, and *e* is the error term.[12] As explained before, the proxy for market volatility is

[11]We did not believe panel data estimation would have been more efficient than the chosen procedure. As the results show, homogeneity in the estimated parameters is highly rejected, as parameters differ significantly across countries and even within regions. With a relatively small number of countries and a large number of observations, it is more efficient to estimate the model for each country separately rather than impose some form of homogeneity through panel data estimation. In addition, panel data estimation would have severely restricted the sample period, given that data for most Asian countries were available starting only in 1997.

[12]An alternative proxy for U.S. monetary policy is the federal funds futures rate. In using the target (spot) rate, we thought that market expectations of the federal funds rate would be reflected in the spot yield on the three-month treasury bill, and as a result our proxy for market volatility would indirectly capture expectations about U.S. monetary policy.

intended to capture changes in investor sentiment which may be related to expected changes in U.S. monetary policy. It may also pick up the effects of other market-related events, such as the flight to quality effects during the Asian crisis.

In line with the previous model, the results show that the level of the U.S. federal funds target rate has significant positive effects on emerging market spreads, with the mean group elasticity estimated at 0.82 (Table 2).[13] The estimated elasticities vary considerably across countries (the standard error for the mean group estimate is 0.35): the estimates for Argentina, Colombia, Panama, and the Philippines are smaller than the average; the estimates for Brazil, Mexico, and Bulgaria are close to 1; and those for Korea and Poland appear to be very high given their past macroeconomic performance and low indebtedness.[14] Nevertheless, the results suggest that the estimated impact of changes in the U.S. federal funds rate on sovereign spreads is slightly higher (but economically not significant) than the one estimated for the yield on the 10-year U.S. treasury bond.

The model also supports the view that increased market volatility, which may be related to heightened uncertainty about the expected path of U.S. monetary policy, has significant positive effects on spreads across countries and regions. However, a significant proportion of fluctuations in emerging market spreads is driven by country-specific fundamentals. In particular, the results suggest that improved macroeconomic fundamentals, such as higher net foreign assets (in terms of GDP or imports), lower fiscal deficits, and lower ratios of debt service to exports and debt to GDP, help to lower sovereign spreads. For example, a higher net foreign asset position contributed to lower spreads in many Latin American and Asian countries—particularly those that had in place fixed exchange rate regimes and where lender-of-last-resort considerations seemed particularly important—such as Argentina, Panama, Thailand, and Korea. Foreign indebtedness appears to contribute positively to sovereign spreads, especially in Latin America (particularly Argentina, Mexico, Brazil, and Panama), the Philippines, and to some extent Poland, all countries that underwent comprehensive debt reschedulings in the past.

The model presented in Table 2 explains fluctuations in emerging market sovereign spreads relatively well for most countries (see Figure A1 in the appendix). In particular, the model explains roughly between half and three-quarters of the fluctuations in spreads for most countries, and for most countries (9 out of 11) the adjusted R^2 increases significantly. In addition, using the Phillips-Perron (1988) test, we do not reject the hypothesis that sovereign spreads are cointegrated with the chosen country-specific fundamentals, the U.S. federal funds rate, and the

[13]Needless to say, the rise in the level of emerging market interest rates will not necessarily be as large as the sum of the rise in spreads and the rise in the U.S. federal funds rate. In the United States, the yield curve tends to flatten as monetary policy is tightened, so that a rise in short-term interest rates is usually not fully passed through to longer-term rates.

[14]The results for Korea, Thailand, and Indonesia, especially the size of the U.S. interest rate elasticity, should be interpreted with some caution due to the relatively small sample size and the fact that the estimation mainly covers the period of an IMF arrangement. In the case of Poland, the model did not include any measure of indebtedness due to the lack of a time series from 1994, and as a result, may be biasing upwards the coefficient of the U.S. federal funds rate.

Table 2. Determinants of Sovereign Bond Spreads for Selected Emerging Markets

Period	Argentina 94:4–99:12	Brazil 94:4–99:12	Mexico 94:4–99:12	Panama 96:8–99:12	Colombia 97:4–99:12	Poland 94:11–99:12	Bulgaria 95:06–99:12	Philippines 94:4–99:12	Thailand 97:11–99:12	Korea 98:7–99:12	Indonesia 97:4–99:12
U.S. federal funds rate	0.54 (.000)	0.95 (.000)	0.93 (.000)	0.26 (.052)	0.54 (.000)	1.26 (.000)	1.09 (.000)	0.57 (.000)	0.63 (.001)	1.45 (.000)	0.78 (.000)
Market volatility[1]	0.08 (.003)	0.05 (.000)	0.07 (.013)	–0.01 (.411)	0.05 (.000)	0.05 (.001)	0.03 (.150)	0.04 (.093)	0.02 (.022)	–0.01 (.576)	0.16 (.000)
Net foreign assets (in percent of GDP)	–0.05 (.000)	. . .	. . .	–0.09 (.000)	–0.38 (.000)	–0.29 (.036)	–0.01 (.056)	. . .	–0.01 (.000)	–0.07 (.000)	. . .
Fiscal balance (in percent of GDP)	. . .	–0.01 (.010)	. . .	–0.08 (.000)	. . .	. . .	. . .	. . .	. . .	. . .	–0.91 (.000)
Gross reserves to imports	. . .	. . .	–2.04 (.041)	. . .	. . .	–2.68 (.001)	. . .	–3.00 (.014)	. . .	. . .	. . .
Debt-service ratio	. . .	. . .	. . .	. . .	. . .	. . .	0.01 (.027)	0.02 (0.024)	0.08 z(.160)	. . .	. . .

Table 2. *(concluded)*

Period	Argentina 94:4–99:12	Brazil 94:4–99:12	Mexico 94:4–99:12	Panama 96:8–99:12	Colombia 97:4–99:12	Poland 94:11–99:12	Bulgaria 95:06–99:12	Philippines 94:4–99:12	Thailand 97:11–99:12	Korea 98:7–99:12	Indonesia 97:4–99:12
Central government debt (in percent of GDP)	0.13 (.000)	0.10[2] (.000)	0.05 (.000)	. . .	0.19 (.000)	. . .	. . .	0.07 (.001)	. . .	. . .	. . .
Total external debt (in percent of GDP)	. . .	. . .	. . .	0.09 (.000)	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Dummy[3]	. . .	. . .	. . .	. . .	. . .	. . .	–0.40 (.000)	. . .	. . .	. . .	. . .
Adjusted *R*-squared	0.51	0.55	0.45	0.62	0.81	0.54	0.60	0.37	0.78	0.81	0.82
Phillips-Perron test for Cointegration[4]	–3.77**	–2.50	–2.75*	–3.25**	–3.67**	–2.09	–4.52**	–2.22	–6.59**	–3.80**	–3.73**

Source: IMF staff estimates.

Notes: Probability values, for the null hypothesis of a coefficient equal to zero, are reported in parentheses. One and two asterisks imply rejection of the null hypothesis of no cointegration at the 90 and 95 percent level of significance. Standard errors have been adjusted following the Newey-West procedure.

[1]Based on the fitted conditional standard error from an ARCH model for the spread between the three-month treasury bill and the federal funds rate.

[2]Refers to net debt.

[3]A dummy was included to allow for the effects associated with the introduction of a currency board in Bulgaria.

[4]Based on critical values estimated for a regression without a constant term as in MacKinnon (1991). See Hamilton (1994).

proxy for market volatility in 8 out of 11 countries, with the models for Brazil, Poland, and the Philippines rejecting the hypothesis of cointegration. This may be partly related to the finding that the model is subject to a structural break in late 1995 in several countries (see Figure A2 in the appendix). Specifically, in the cases of Argentina, Brazil, Bulgaria, Mexico, the Philippines, and Poland, the model fails to fully account for the sharp narrowing of spreads that took place during the period leading up to the Asian crisis. The narrowing of sovereign spreads between the first half of 1996 and mid-1997 was particularly pronounced in these countries, and may have been associated more with changes in market access and with global portfolio shifts by institutional investors than with country-specific fundamentals. These results seem to suggest that some form of "contagion" may have also contributed to *narrowing rather than widening* sovereign spreads for a group of developing countries during this period.

Global Liquidity Conditions and Other Factors at Work

Following the Mexican financial crisis of 1994–95, there was a large compression of emerging market sovereign spreads, which declined from a peak close to 1,600 basis points in March 1995 to about 325 basis points in July 1997 (see Figure 1). In fact, as noted by some analysts, the international bond market experienced, between end-1994 and early 1996, one of the greatest rallies in its recent history.[15] Such a compression in sovereign spreads for U.S. dollar-denominated bonds was driven by supply as well as demand factors. On the supply side, Andrews and Ishii (1995) noted that developing countries shifted the currency denomination of bond issues away from the U.S. dollar to issues denominated in deutsche marks and Japanese yen. In fact, Argentina, Brazil, and Mexico became very active in issuing yen-denominated bonds in the Euro-yen and Japanese markets (Figure 5). Access by developing countries to the alternative currency issues was eased by the deregulation of the yen-denominated market, which eliminated restrictions on the sale of sovereign yen-denominated Eurobond issues to Japanese investors in 1994, and reduced the minimum credit rating requirement in 1996, from investment to noninvestment grade for any sovereign issuer of Samurai bonds. On the demand side, interest rates in industrial countries declined markedly and were at extremely low levels in Japan, Germany, and France for a considerable period of time (Figure 6), while several of the Latin American countries, particularly Mexico, faced a rapid recovery in macroeconomic fundamentals. All these factors may have contributed to restoring investors' confidence rapidly, boosting global liquidity, and renewing the demand for new bond issues by developing countries

It is difficult to assess whether the failure of our model to fully account for the sharp compression in spreads in Argentina, Brazil, Mexico, Bulgaria, Poland, and the Philippines, particularly between mid-1996 and mid-1997, reflects the omission or inadequate account of country-specific fundamentals rather than the inability to capture global changes (including global liquidity conditions, portfolio shifts, or momentum strategies by institutional investors). Nevertheless, we

[15]See IMF (1996), p. 16.

Figure 5. Sovereign Bond Issues in Yen-Denominated Debt
(number of issues)

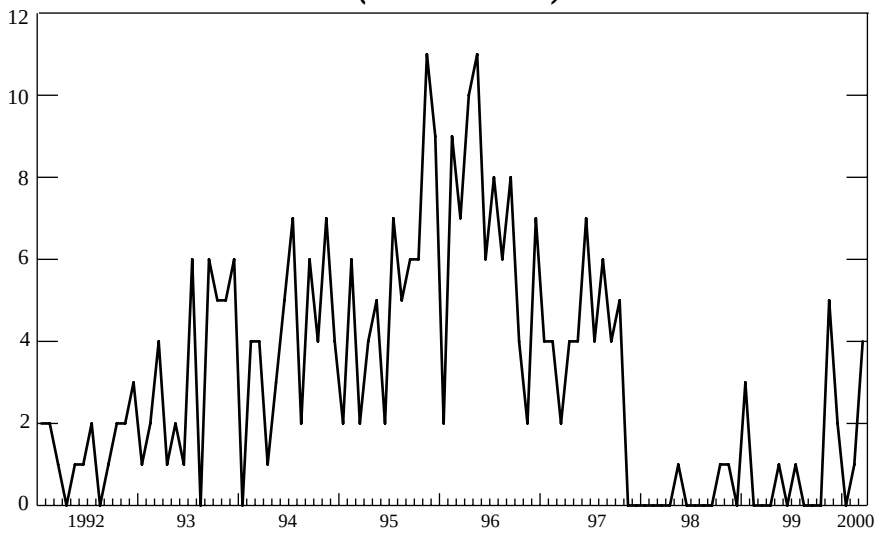
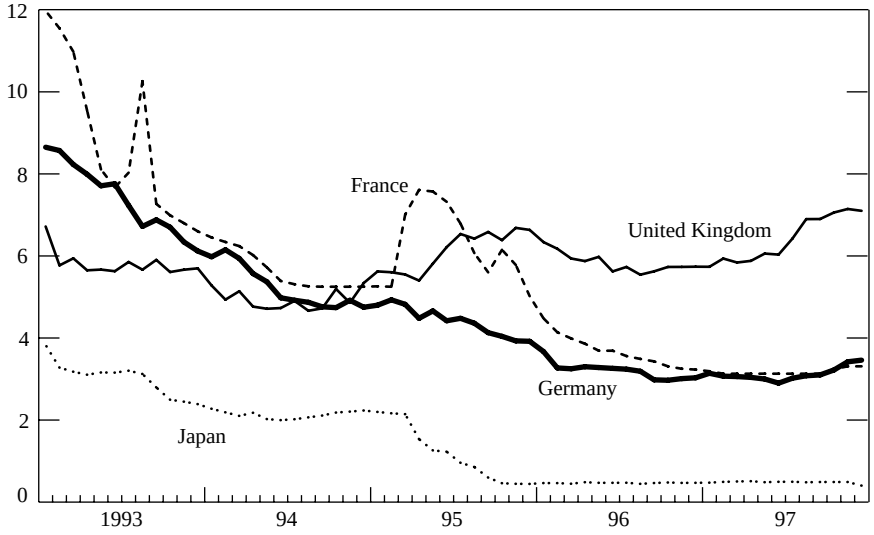


Figure 6. Short-Term Interest Rates in Industrial Countries
(in percent)



suspect that global liquidity factors may have been at work given that the failure to predict such narrowing of spreads is primarily confined to a group of developing countries that have usually been treated by institutional investors as one group in

an asset class.[16] To capture some of these effects, particularly the structural changes associated with the liberalization of the yen-denominated bond market, we extended the model by including the Hodrick-Prescott cyclical component of the number of yen-denominated sovereign bond issues by emerging-market countries during this period. A significant (but very small) negative effect was found for some of those countries, particularly Argentina and Mexico, while the rest of the results remained largely unchanged.[17]

II. Conclusions

This paper presented empirical evidence on how U.S. monetary policy has influenced country risk in several developing countries in Latin America, Asia, and Eastern Europe. In contrast to previous results in the literature, but consistent with what we might anticipate from theory, our results suggest that the level of U.S. interest rates has direct positive effects on sovereign bond spreads. In addition, the econometric evidence supports the view that, while country-specific fundamentals are extremely important in determining country risk, so is the stance and predictability of U.S. monetary policy.

An approach to U.S. monetary policy that provides financial markets with clear indications of policymakers' views about the balance of inflationary risks and intentions is likely to reduce the negative impact of a rise in U.S. interest rates on country risk in developing countries. More important, policymakers in developing countries still enjoy a significant degree of freedom to influence country risk and economic growth. Country-specific macroeconomic fundamentals, such as a sound and sustainable fiscal policy and low indebtedness, are extremely important in reducing country risk and domestic interest rates, factors that are highly conducive to fostering sustainable economic growth.

The search for the best proxies for U.S. monetary policy, market volatility, and country-specific fundamentals is a complicated task and we do not claim to have found the true underlying model. Evidently, several different options are available to model any of the fundamental factors determining country risk. In particular, future research could explore the role of the U.S. federal funds futures, rather than the target level, as a proxy for U.S. monetary policy, while some of the early warning indicators of currency crises can be included in the set of country-specific fundamentals.

[16]See Aitken (1998), and Borensztein and Gelos (2000) for empirical evidence on the role played by shifts in institutional investors' sentiment in determining asset prices in developing countries.

[17]The results are available upon request.

APPENDIX

Data Description

Data on sovereign bond spreads for each country were obtained from Merrill Lynch and are based on its IGOV Index. The U.S. target federal funds rate and the three-month U.S. treasury bill rate were obtained from the U.S. Federal Reserve system.

Country-specific data were based on information provided by national authorities. Several data series were available on a monthly basis, but some (including GDP) were available only on a quarterly basis, and a few only on an annual basis. Quarterly and annual data were converted to a monthly basis using a cubic spline interpolation.

Data definitions are as follows:

Net foreign assets (NFA)	NFA of the banking system, in percent of GDP.
Fiscal balance	Budget balance of the central or federal government, defined in percent of GDP.
Gross reserves to imports	Gross international reserves as a percent of imports of goods and nonfactor services.
Debt-service ratio	External debt service as a percent of exports of goods and nonfactor services.
Central government debt	External debt of the central or federal government, in percent of GDP.
Total external debt	External debt of the private and public sectors, in percent of GDP.

Details on the estimation period and data availability for individual countries are as follows:

Argentina

Estimation period: April 1994–December 1999. NFA: monthly. Central government debt: quarterly starting in the fourth quarter of 1996 and annually for earlier periods.

Brazil

Estimation period: April 1994–December 1999. Fiscal balance: quarterly. Central government debt: quarterly.

Bulgaria

Estimation period: June 1995–December 1999. NFA: monthly. Debt-service ratio: quarterly starting in the fourth quarter of 1996 and annually for earlier periods.

Colombia

Estimation period: April 1997–December 1999. NFA: quarterly. Data refer to the NFA of the financial sector. Central government data: annual.

Indonesia

Estimation period: May 1997–December 1999. Fiscal balance: quarterly.

Korea

Estimation period: July 1998–December 1999. NFA: monthly.

Mexico

Estimation period: April 1994–December 1999. Gross reserves/imports: monthly. Central government debt: quarterly.

Panama

Estimation period: August 1996–December 1999. NFA: quarterly. Fiscal balance: quarterly. Total external debt: quarterly.

Philippines

Estimation period: April 1994–December 1999. Gross reserves/imports: quarterly. Debt-service ratio: quarterly. Central government debt: quarterly.

Poland

Estimation period: November 1994–December 1999. NFA: monthly. Gross reserves/imports: monthly.

Thailand

Estimation period: November 1997–December 1999. NFA: monthly. Debt-service ratio: annual.

Figure A1. Sovereign Spreads in Selected Emerging Markets, Actual versus Fitted Values
(in logarithm)

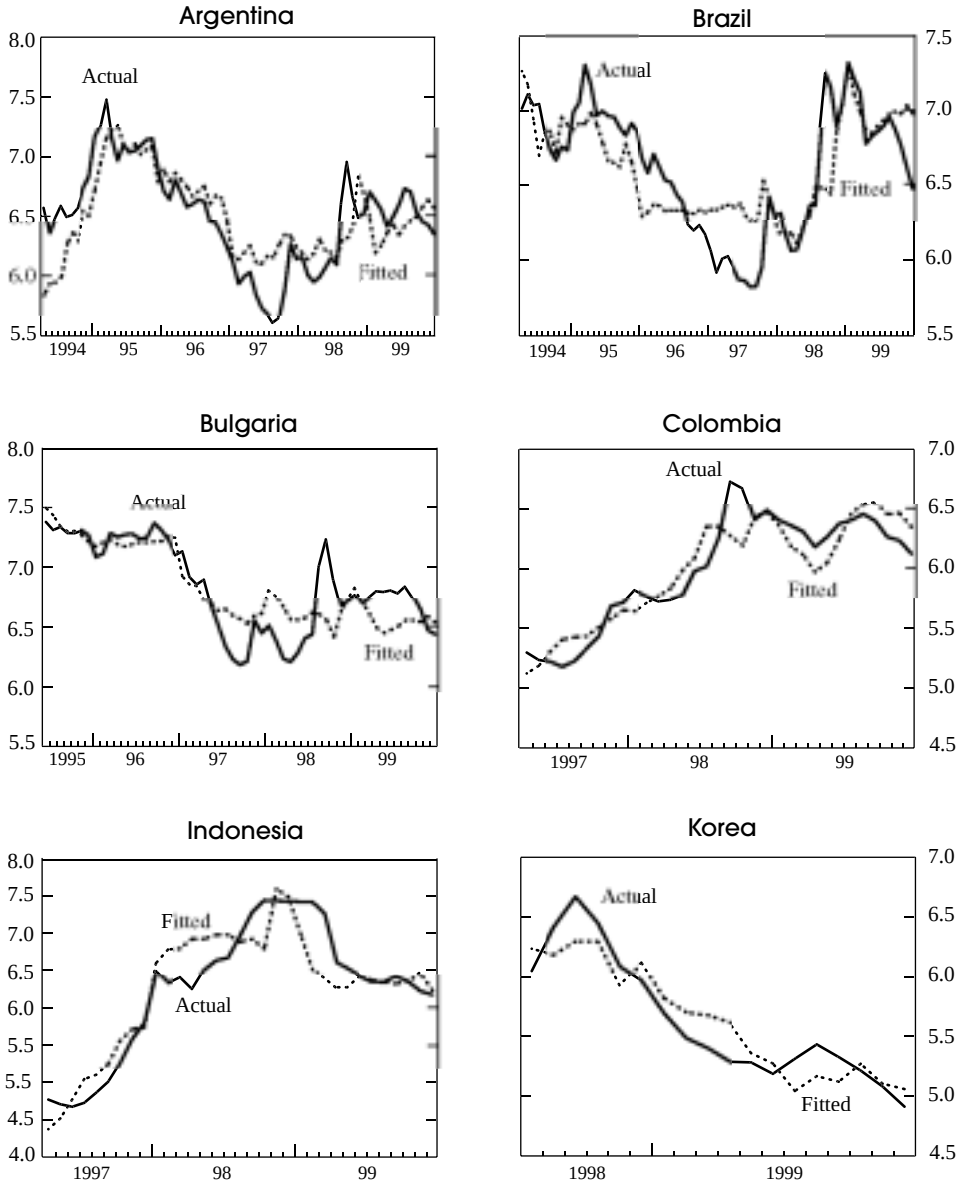
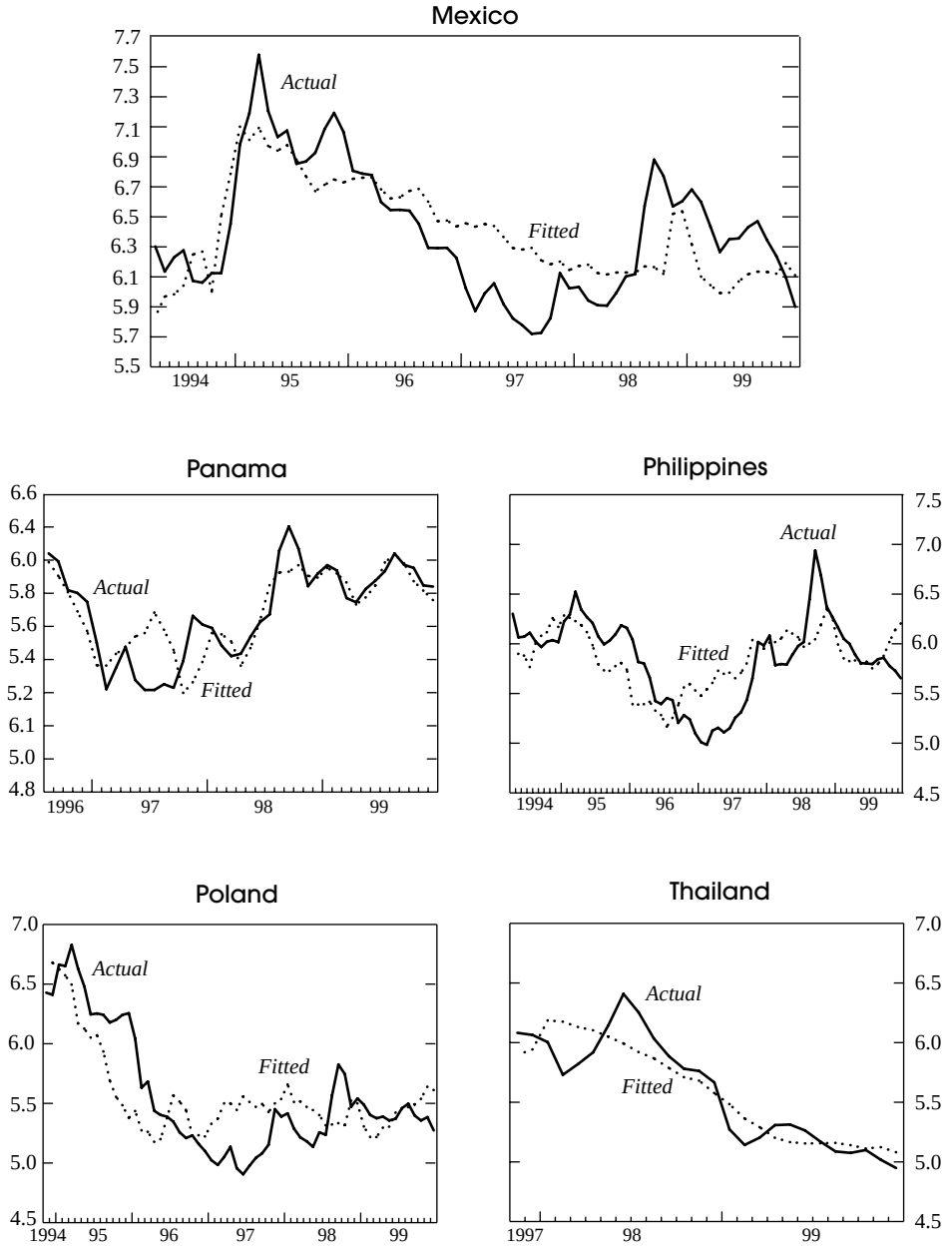


Figure A1. (*concluded*)



Sources: Merrill Lynch; and authors' estimates.

Figure A2. Stability Tests[1]

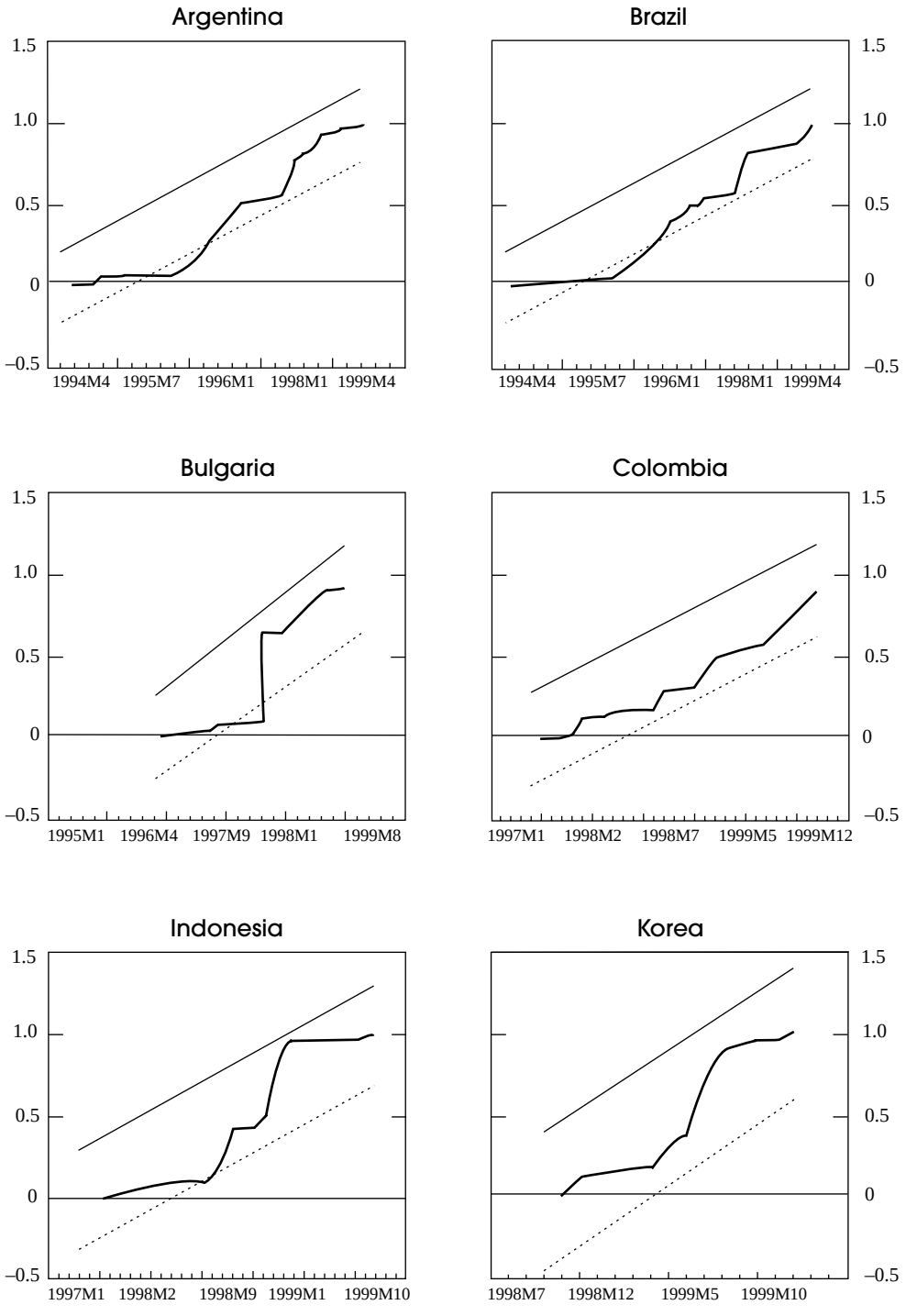
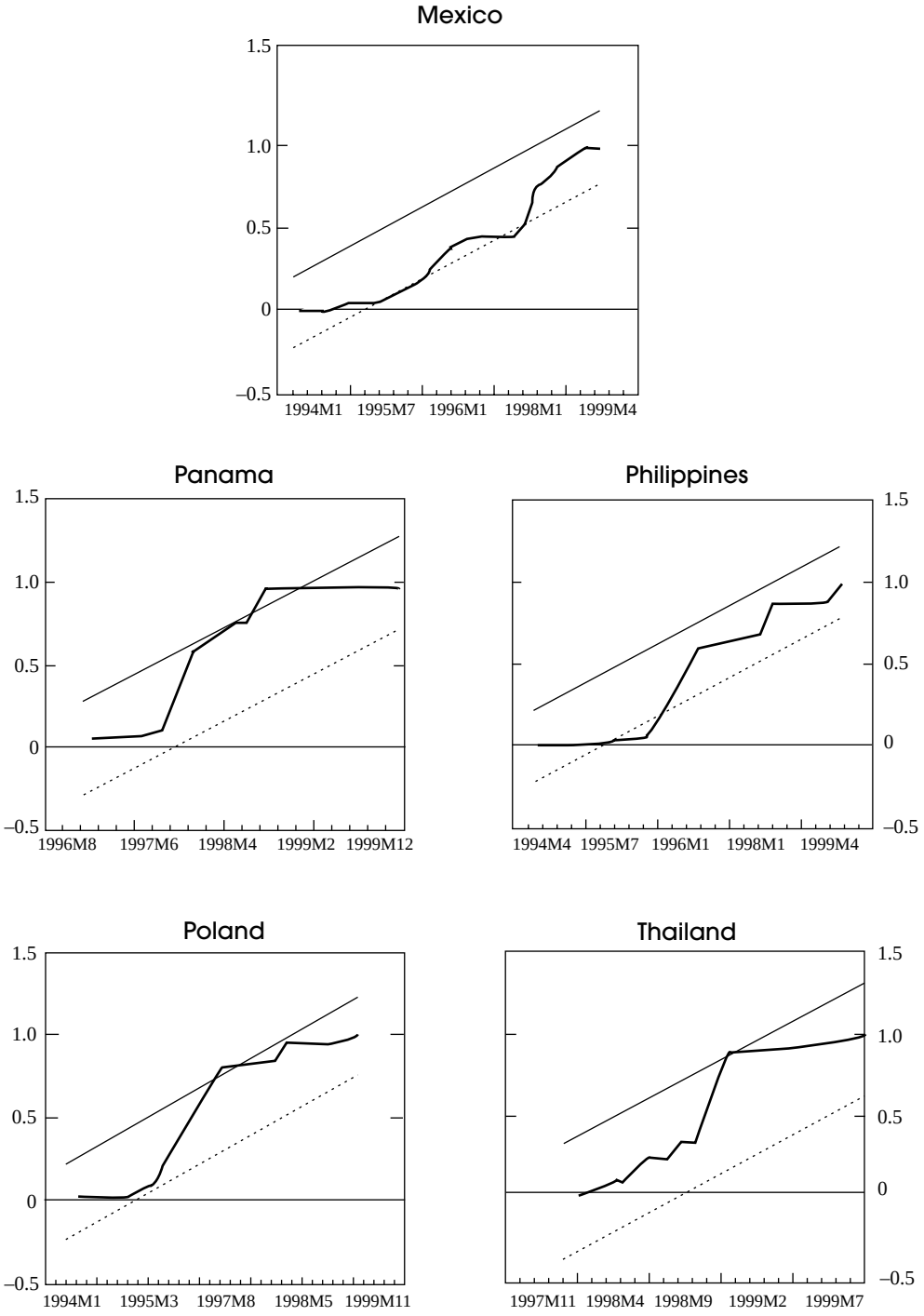


Figure A2. (*concluded*)



[1]Based on the cumulative sum of squared residuals statistic. Confidence bands for a 95 percent level of significance.

REFERENCES

Aitken, B., 1998, "Have Institutional Investors Destabilized Emerging Markets?" *Contemporary Economic Policy*, Vol. 16, pp. 173–84.

Andrews, D., and Ishii, S., 1995, "The Mexican Financial Crisis: A Test of the Resilience of the Markets for Developing Country Securities," IMF Working Paper 95/132 (Washington: International Monetary Fund).

Baig, T., and I. Goldfajn, 2001, "The Russian Default and the Contagion to Brazil," in *International Financial Contagion*, ed. by S. Claessens and K. Forbes (Boston: Kluwer Academic Publishers).

Borensztein, E., and G. Gelos, 2000, "A Panic-Prone Pack? The Behavior of Emerging Market Mutual Funds," IMF Working Paper 00/198 (Washington: International Monetary Fund).

Calvo, G., L. Leiderman, and C. Reinhart, 1993, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *IMF Staff Papers*, Vol. 40, No. 1, pp. 108–51.

———, 1996, "Inflows of Capital to Developing Countries in the 1990s," *Journal of Economic Perspectives*, Vol. 10, No. 2, pp. 123–39.

Cantor, R., and F. Packer, 1996, "Determinants and Impact of Sovereign Credit Ratings," *Federal Reserve Bank of New York Economic Policy Review* (October), pp. 37–53.

Cline, W., and K. Barnes, 1997, "Spreads and Risk in Emerging Markets Lending," Working Paper 97-1 (Washington: Institute of International Finance).

Dooley, M., E. Fernandez-Arias, and K. Kletzer, 1996, "Is the Debt Crisis History? Recent Private Capital Inflows to Developing Countries," *World Bank Economic Review*, Vol. 10, pp. 27–50.

Edwards, S., and R. Susmel, 2000, "Interest Rate Volatility and Contagion in Emerging Markets: Evidence from the 1990s," NBER Working Paper 7813 (Cambridge, Massachusetts: National Bureau of Economic Research).

Eichengreen, B., and A. Mody, 1998a "Interest Rates in the North and Capital Flows to the South: Is There a Missing Link?", *International Finance*, Vol. 1, No. 1, pp. 35–57.

———, 1998b, "What Explains Changing Spreads on Emerging-Market Debt: Fundamentals or Market Sentiment?," NBER Working Paper 6408 (Cambridge, Massachusetts: National Bureau of Economic Research, February.

Engle, R., 1982, "Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, Vol. 50, pp. 987–1001.

Hamilton, J., 1994, *Time Series Analysis* (Princeton, New Jersey: Princeton University Press).

Hardouvelis, G., 1989, "Margin Requirements, Volatility, and the Transitory Component of Stock Prices," Federal Reserve Bank of New York Research Paper 8909.

———, A. Pericli, and P. Theodossiou, 1997, "The Asymmetric Relation Between Initial Margin Requirements and Stock Market Volatility Across Bull and Bear Markets," CEPR Discussion Paper Series No. 1746 (London: Centre for Economic Policy Research).

Hsieh, D., and Miller, M., 1990, "Margin Regulation and Stock Market Volatility," *Journal of Finance*, Vol. 45 (March), pp. 3–30.

International Monetary Fund, 1995a, *International Capital Markets* (Washington: International Monetary Fund).

———, 1995b, *Private Market Financing for Developing Countries* (Washington: International Monetary Fund).

———, 1996, *International Capital Markets* (Washington: International Monetary Fund).

Kamin, S., and K. von Kleist, 1999, "The Evolution and Determinants of Emerging Market Credit Spreads in the 1990s," Working Paper No. 68 (Basel: Bank for International Settlements).

Kaminsky, G., S. Lizondo, and C. Reinhart, 1997, "Leading Indicators of Currency Crises," Policy Research Working Paper 1852 (Washington: World Bank).

Kaminsky, G., and C. Reinhart, 1998, "Financial Crises in Asia and Latin America: Then and Now," *American Economic Review*, Vol. 88 (May), pp. 444–48.

———, 2000, "On Crises, Contagion, and Confusion," *Journal of International Economics*, Vol. 51, No. 1, pp. 145–68.

MacKinnon, J., 1991, "Critical Values for Cointegration Tests," in *Long-Run Economic Relationships: Readings in Cointegration*, ed. by R.J. Engle and C.W.J. Granger (New York: Oxford University Press).

Phillips, P.C.B., and P. Perron, 1988, "Testing for a Unit Root in Time Series Regression," *Biometrika*, Vol. 75, pp. 335–46.

Schwert, G., 1989, "Tests for Unit Roots: A Monte Carlo Investigation," *Journal of Business and Economic Statistics*, Vol. 7, pp. 147–59.

Valdés, R., 1997, "Emerging Market Contagion: Evidence and Theory," Working Paper Series No. 7 (Santiago: Central Bank of Chile).