IMF Working Paper

How Does U.S. Monetary Policy Influence Economic Conditions in Emerging Markets?

Vivek Arora and Martin Cerisola

INTERNATIONAL MONETARY FUND

IMF Working Paper

Western Hemisphere Department

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Prepared by Vivek Arora and Martin Cerisola[1]

Authorized for distribution by Steven Dunaway

August 2000

Abstract

This paper quantifies the economic impact of changes in U.S. monetary policy on emerging market countries. We explore 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. In addition, we simulate the direct effects of a tightening in U.S. monetary policy on economic conditions in developing countries. 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 and fostering economic growth in developing countries.

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I. INTRODUCTION

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 primarily been induced 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 et al. (1993) have emphasized the role of economic conditions—particularly interest rates—in industrial countries,[2] 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 (e.g., in 1994) or even precipitated changes in U.S. monetary policy (e.g., 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 and economic growth in several developing countries in Latin America, Asia, and Eastern Europe. In particular, we aim at empirically examining 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. In addition, we present the results from simulations using Multimod, the IMF's multi-country model, on how changes in U.S. interest rates affect economic conditions in developing countries.

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[2] 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..."

II. WHAT DRIVES SOVEREIGN SPREADS IN EMERGING MARKETS?

The existing empirical literature is not conclusive on how U.S. monetary policy affects emerging market sovereign spreads. 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.

Figure 1: Emerging Market Sovereign Spreads and U.S. Interest Rates
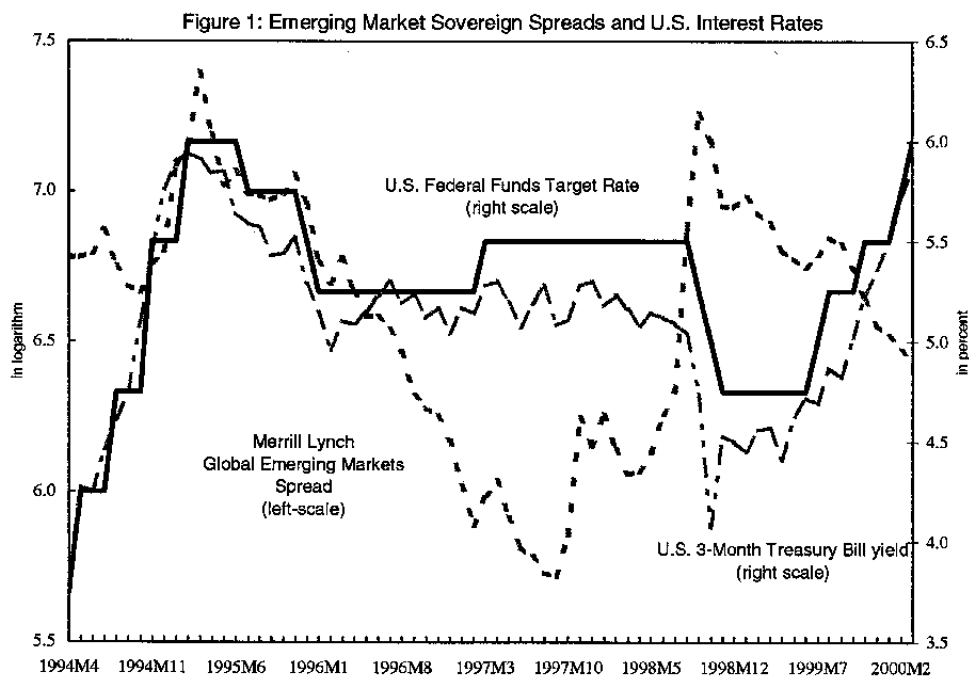
In contrast to much of the existing literature, we proxy the stance of U.S. monetary policy by the level of the U.S. federal funds target rate, which is a more direct measure than the yield on U.S. Treasury securities.

From a theoretical perspective, a rise in U.S. policy interest rates could lead to an increase in emerging market spreads for several reasons.[3] 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

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

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

$$(1+r) = p.(1+i) + (1-p).0.$$

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:

$$S = (1+r)(1-p)/p,$$

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:

$$dS/dr = [(1-p)/p] - [(1+r)p'/p^2],$$

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).

Notwithstanding the clear theoretical prediction and ample anecdotal evidence, the empirical literature on how U.S. monetary policy has affected emerging market spreads is less conclusive. Eichengreen and Mody (1998) found, for a sample of Latin American and East Asian countries during 1991–95, 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.[4] Their results might reflect the fact that the analysis focused on spreads for new bond issues of developing countries rather than on spreads for bonds actively traded in secondary markets. Their analysis covers a subperiod (1991–93) when the market for sovereign bonds was

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[4] 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.

developing, and another one (1994–95) when shocks seriously restricted access to the market for lower quality issuers. Cline and Barnes (1997) found a positive but statistically insignificant effect of U.S. Treasury yields on sovereign spreads in selected emerging markets during the mid-1990s, a finding shared by Kamin and Kleist (1999).

A related question, which we do not address directly in this paper, is whether the response of developing countries' interest rates to changes in U.S. rates depends on the exchange rate regime. A priori it is not clear whether the interest rate response would be larger in a fixed or in a floating exchange rate regime. On the one hand, in a floating exchange rate regime, the exchange rate can absorb some of the adjustment, and the interest rate might not have to change by as much as it would in a fixed rate regime. On the other hand, to the extent that countries with floating exchange rates may sometimes be regarded as more risky than those with credible pegs, a change in the risk premium may justify a larger interest rate increase. The question in the end is an empirical one. For a large sample of countries during 1970–99, Frankel, Schmukler, and Serven (2000) found that the response of domestic interest rates to a rise in U.S. interest rates was larger under fixed than under floating exchange rates. They found that, during the 1990s, interest rates in developing countries with fixed exchange rates tended to rise one for one with U.S. rates. Although Frankel et al. did not explicitly examine the behavior of interest rate spreads, the implication is that, during the 1990s, increases in U.S. interest rates did not lead to a significant change in spreads in developing countries with fixed exchange rates and led to a reduction in spreads in developing countries with floating rates.

A. 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, Kamin and Kleist (1999), Eichengreen and Mody (1998), and Cantor and Packer (1996)). 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. Goldfajn and Baig (1999) 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, Kaminsky and Reinhart (1999), and more recently Valdez (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. Valdez argued that contagion results primarily from the interaction of investors who face liquidity constraints and who have invested in emerging market assets which 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.[5] 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 which 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 and Theodossiou, 1998) 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 autoregressive conditional heteroskedasticity (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 importantly, changes in the spread between the three-month Treasury Bill yield and the U.S. federal funds target rate may capture heightened uncertainty about the expected stance of U.S. monetary policy, like in the first half of 1994.[6]

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[5] See International Capital Markets Report (1995–96) and Private Market Financing for Developing Countries Report (1995) for a more detailed analysis and account of events.

[6] 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. Kamin and Kleist (1999) and Cline

Figure 2: Alternative Proxies for Market Volatility
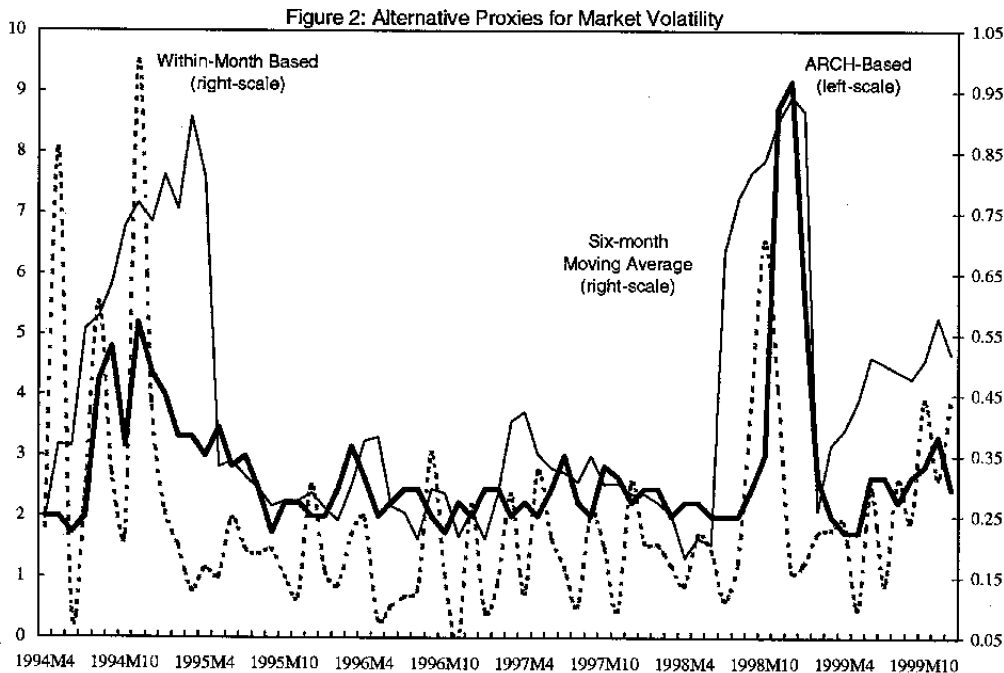
All the different proxies for market volatility tend to show increased market turbulence during 1994 and in the second half of 1998 (Figure 2). A scatter plot shows that a proxy based on a six-month moving average of standard deviations for the spread between the three-month yield on the Treasury bill and the federal funds target rate was highly statistically significant in explaining fluctuations in sovereign spreads across countries (Figure 3). However, the validity of this proxy for volatility 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. In fact, the R^2 is quite high, close to 30 percent.[7]

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and Barnes (1997) use short-term interest rates as a proxy for global liquidity conditions. Eichengreen and Mody (1998) use the yield on the ten-year U.S. Treasury as a proxy for global economic conditions.

[7] The alternative proxy suggested by Hardouvelis and Theodossiou, 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.

Figure 3: Sovereign Spreads and Moving-Average-Based Market Volatility
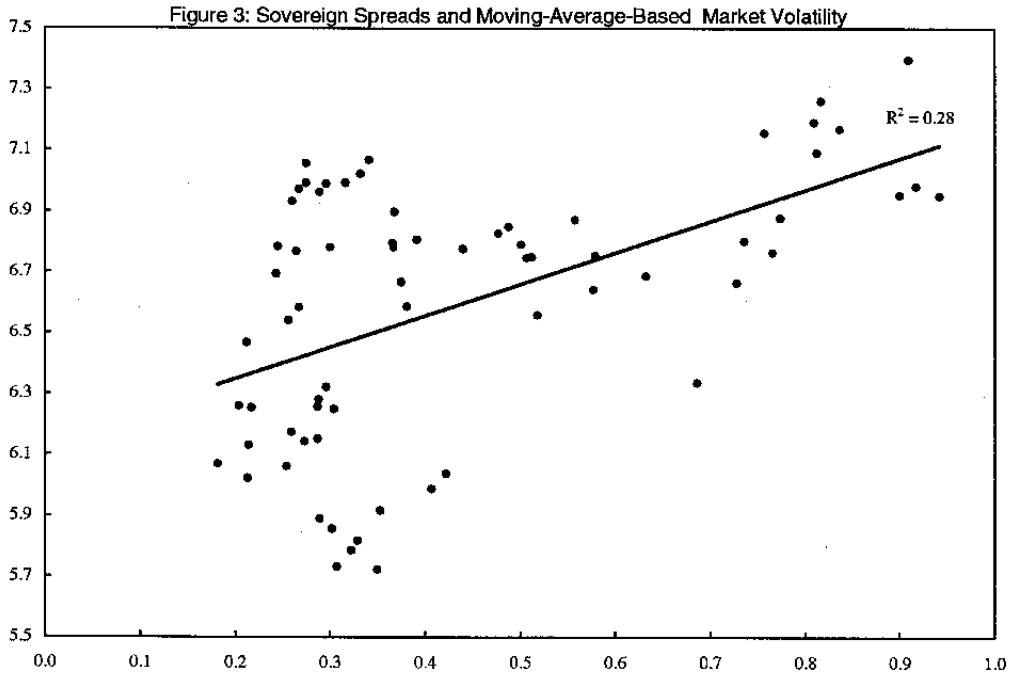
In fact, these observations are far from independent, and the high positive correlation between sovereign spreads and the proxy for market volatility is primarily the result of the way the proxy was constructed.[8] Nevertheless, in our empirical estimates, we used these proxies for market volatility in estimating the model, and the results are clearly sensitive to the chosen proxy.[9] However, given the constraints and limitations of the first two proxies for market turbulence noted above, 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 you allow for a proxy which aims at minimizing data overlapping and serial correlation. In fact, there is less of a positive correlation between the variables, as the R^2 declines from almost 30 percent to only 8 percent.

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

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

Figure 4: Sovereign Spreads and ARCH-Based Market Volatility

$R^2 = 0.08$
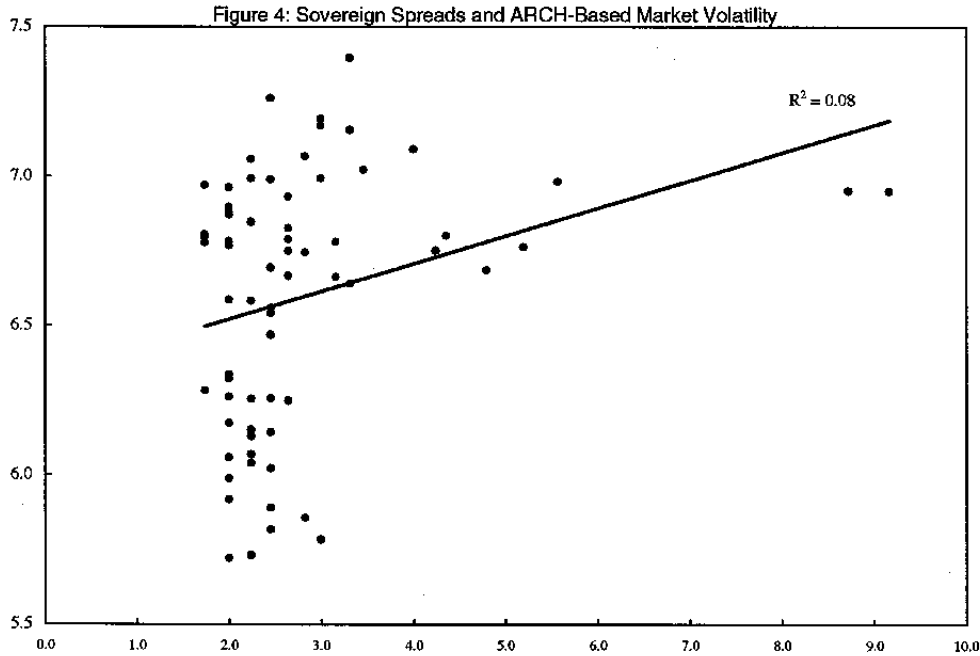
B. Econometric Evidence

An econometric model for sovereign bond spreads was estimated individually for a group of emerging market countries. The model was estimated for Argentina, Brazil, Bulgaria, Colombia, Indonesia, Korea, Mexico, Panama, the Philippines, Poland, and Thailand. We adopted the following standard linear relationship:[10]

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

which 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.[11] As explained before, the

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[10] 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 was available starting only in 1997.

[11] 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

(continued...)

proxy for market volatility is 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 choosing country-specific fundamentals, we selected a set of macroeconomic variables which 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 to banking and currency crises, and the role of other fundamental factors in driving banking and currency crises. Kaminsky et al. propose a set of variables which 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 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 roughly ¾ (Table 1).[12] 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 macro-economic performance and low indebtedness.[13]

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

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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.

[12] 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.

[13] 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.

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, Panama), the Philippines, and to some extent Poland, all countries that underwent comprehensive debt reschedulings in the past.

The model presented in Table 1 explains fluctuations in emerging market sovereign spreads relatively well for most countries (Figure 1, Appendix). In particular, the model explains roughly between half and three-quarters of the fluctuations in spreads for most countries. 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 and the proxy for market volatility in eight out of eleven 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 (Figure 2, 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 *narrow rather than widen* sovereign spreads for a group of developing countries during this period.

C. Global Liquidity Conditions and Other Factors at Work

Following the Mexican crisis of 1994–95, there was a large compression of emerging market sovereign spreads, which declined from a peak close to 1600 basis points in March 1995 to about 325 basis points in July 1997 (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.[14] 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 mark and yen. In fact, Argentina, Brazil, and Mexico became very active in issuing yen-denominated bonds in

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[14] See International Capital Markets Report, September 1996, p.16.

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 non-investment 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.

Figure 5: Sovereign Bond Issues in Yen-Denominated Debt
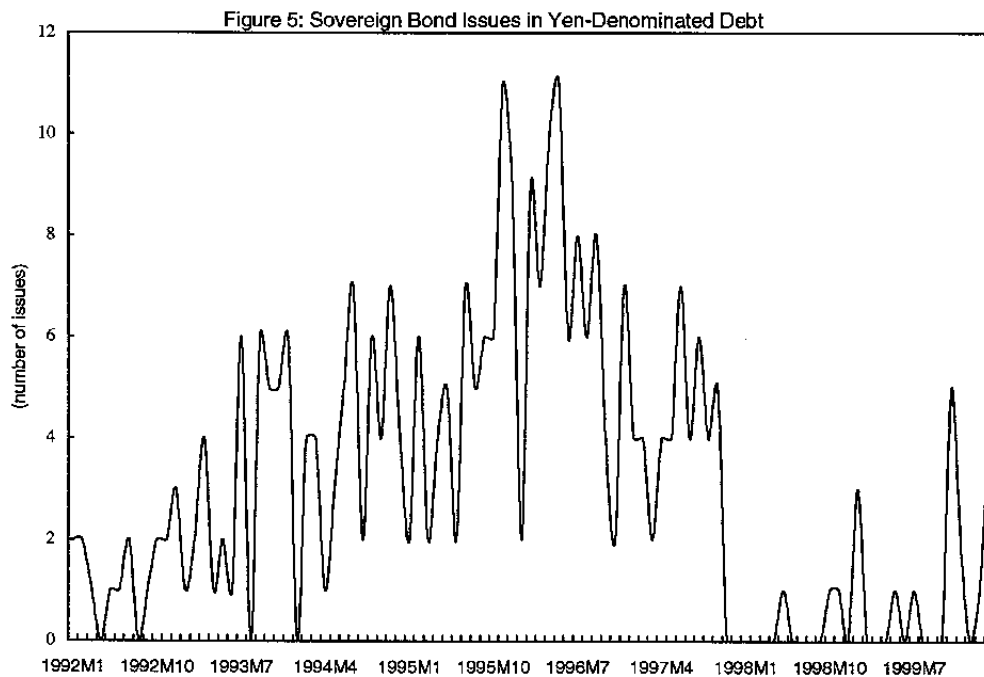
It is difficult to assess whether the failure of our model to fully account for the sharp compression in spreads in Argentina, Brazil, Mexico, Bulgaria, Poland, and the Philippines, particularly between mid-1996 and mid-1997, reflects the omission or inadequate account of country-specific fundamentals rather than the inability to capture global changes (including global liquidity conditions, portfolio shifts, or momentum strategies by institutional investors). Nevertheless, we 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 which have usually been treated by institutional investors as one group

in an asset class.[15] 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.[16]

Figure 6: Short-Term Interest Rates in Industrial Countries
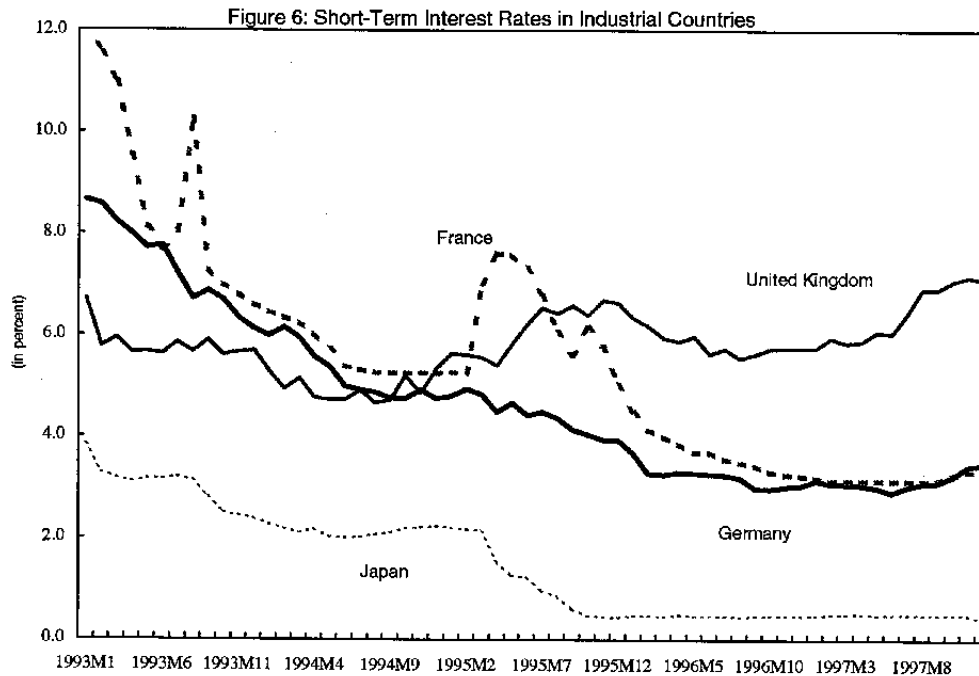
III. MACROECONOMIC EFFECTS OF U.S. MONETARY POLICY ON DEVELOPING COUNTRIES

The macroeconomic effects on developing countries of a tightening in U.S. monetary policy were explored using the IMF's multi-country model (Multimod).[17] A tightening of U.S.

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[15] 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.

[16] The results are available upon request.

[17] See Laxton et al. (1998) for a discussion of Multimod, and Laxton and Prasad (2000) for a Multimod-based analysis of the effects of macroeconomic shocks in the United States on major industrial countries.

monetary policy would in general be expected to reduce the availability of, and raise the interest rate on, credit for developing countries.[18] In Multimod, the reduction in credit to developing countries is modeled by a tightening of the financing constraint faced by debtor countries. The financing constraint depends inversely on the ratio of expected debt service to exports, so that an increase in U.S. interest rates, by raising the debt-service ratio, reduces the availability of financing. The spread (risk premium) on developing country credit is not explicitly modeled in Multimod.

A scenario that examined the macroeconomic impact on developing countries of an increase in the U.S. federal funds rate of 100 basis points relative to the baseline was simulated over a ten-year period starting in 2000 (Table 2).[19] The baseline was represented by the central forecast in the May 2000 World Economic Outlook exercise. In order to focus on the effects of a U.S. monetary policy tightening, the interest rate increase was assumed to be exogenous (rather than, for example, a response to rapid U.S. demand growth).

The simulation suggested that for developing countries as a whole the rise in U.S. interest rates would lead to a reduction in real GNP and domestic demand relative to the baseline of nearly ½ percent annually over the medium term.[20] Among developing countries, there is a substantial difference between the macroeconomic impact on debtor and on creditor countries, with debtor countries experiencing a much larger negative impact.

Debtor countries would face a rise in debt-service costs (of nearly 2 percentage points in the first few years) and a tightening in their financing constraint, and the rise in debt service would require a rise in their net exports.[21] Higher debt-service payments, together with the

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[18] Goldfajn and Baig (1999), for example, find for selected countries that rises in U.S. interest rates tended to reduce capital flows. They interpret this as evidence that "push" rather than "pull" factors determine capital flows.

[19] The ten-year period was chosen so as to allow an assessment of the medium-term effects. The size of the rate increase (100 basis points) is sufficiently representative because Multimod does not have significant nonlinearities regarding the effects of U.S. interest rate increases on developing countries. Alternative simulations with interest rate increases of 200 and 300 basis points suggest that the effects on macroeconomic variables in developing countries are roughly two and three times as large, respectively, as in the 100 basis point case (Table 3).

[20] Because interest rates are assumed in Multimod to affect real activity and debt service with a lag, the effects of higher interest rates are larger over the medium term than immediately upon impact.

[21] The increase in the trade balance for these countries relative to the baseline would be offset by higher interest payments, leaving the current account balance roughly unchanged.

tightening of the financing constraint, would in turn contribute to a sharp reduction in domestic demand, with both consumption and investment falling relative to the baseline. The overall impact would be to reduce GNP and domestic demand by ½ percent annually. This is roughly the same as the total impact on developing countries because debtor countries account for an overwhelming proportion (around 90 percent) of the GNP of developing countries.

Creditor countries, in contrast, would experience a positive wealth effect arising from higher returns on their net foreign assets. The higher returns would allow domestic demand and GNP to rise relative to the baseline by ¼ percent and ½ percent, respectively, annually over the medium term. A reduction in the trade balance of these countries would be partly offset by higher interest receipts, allowing the current account balance to improve slightly over the medium term.

IV. 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, and examined how changes in U.S. monetary policy may affect economic conditions in developing countries as a group. 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 an U.S. interest rate rise on country risk and economic growth in developing countries. Our Multimod simulations suggest that the effects of higher U.S. interest rates on economic growth in developing countries are far from trivial. Nevertheless, to the extent that U.S. monetary policy actions can be anticipated by participants in global capital markets, market turbulence and contagion would likely be reduced. More importantly, 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 which are highly conducive to fostering sustainable economic growth.

The search for finding the best proxies for U.S. monetary policy, market volatility, and country-specific fundamentals is a very 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.

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 percentage points of GDP.
Fiscal balance	Budget balance of the central/federal government, defined in percentage points 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/federal government, in percentage points of GDP.
Total external debt	External debt of the private and public sectors, in percentage points of GDP.

Details on the estimation period and data availability for indiviual 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.

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

Period	Argentina 1994:4–99:12	Brazil 1994:4–99:12	Mexico 1994:4–99:12	Panama 1996:8–99:12	Colombia 1997:4–99:12	Poland 1994:11–99:12	Bulgaria 1995:06–99:12	Philippines 1994:4–99:12	Thailand 1997:11–99:12	Korea 1998:7–99:12	Indonesia 1997:5–99:12
U.S. federal funds rate	0.54	0.95	0.93	0.26	0.54	1.26	1.09	0.57	0.63	1.45	0.78
	(.000)	(.000)	(.000)	(.052)	(.000)	(.000)	(.000)	(.000)	(.001)	(.000)	(.000)
Market volatility 1/	0.08	0.05	0.07	-0.01	0.05	0.05	0.03	0.04	0.02	-0.01	0.16
	(.003)	(.000)	(.013)	(.411)	(.000)	(.001)	(.150)	(.093)	(.022)	(.576)	(.000)
Net foreign assets (in percent of GDP)	-0.05	...	...	-0.09	-0.38	-0.29	-0.01	...	-0.01	-0.07	...
	(.000)			(.000)	(.000)	(.036)	(.056)		(.000)	(.000)	
Fiscal balance (in percent of GDP)	...	-0.01	...	-0.08	...	...	...	...	...	...	-0.91
		(.010)		(.000)							(.000)
Gross reserves to imports	...	...	-2.04	...	...	-2.68	...	-3.00	...	...	...
			(.041)			(.001)		(.014)			
Debt service ratio	...	...	...	...	...	...	0.01	0.02	0.08	...	...
							(.027)	(.024)	(.160)		
Central government external debt (in percent of GDP)	0.13	0.10 2/	0.05	...	0.19	...	...	0.07	...	...	...
	(.000)	(.000)	(.000)		(.000)			(.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: Staff estimates.
Probability values, for the null hypothesis of a coefficient equal to zero, are reported in parentheses. Standard errors have
been adjusted following Newey West procedure.

1/ Based on the fitted conditional standard error from an ARCH model for the spread between the three-month T-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/ Hamilton (1994) reports critical values at the 90 and 95 percent confidence level of about -2.59 and -2.912 for a sample size of 50–100 observations, respectively.
One and two asterisks imply rejection of the null hypothesis of no cointegration at the 90 and 95 percent level of significance.

Table 2. Developing Countries: Macroeconomic Effects of a 100 Basis Point
Increase in the U.S. Federal Funds Interest Rate

(Deviation from baseline, in percent unless otherwise noted)

	2000	2001	2002	2003	2004
Developing countries					
Real GNP	-0.2	-0.4	-0.5	-0.4	-0.4
Domestic demand	-0.3	-0.6	-0.6	-0.5	-0.3
Net debtor countries					
Real GNP	-0.2	-0.5	-0.6	-0.6	-0.6
Domestic demand	-0.4	-0.7	-0.6	-0.5	-0.4
Current account/GNP 1/	0.1	0.1	0.0	0.0	-0.1
Trade balance/GNP 1/	0.2	0.3	0.3	0.2	0.1
Net debt (billions of dollars)	-11.4	-22.1	-30.4	-35.8	-38.1
Debt service/exports 1/	0.7	1.8	1.8	1.8	1.5
Net creditor countries					
Real GNP	-0.1	0.3	0.5	0.7	0.7
Domestic demand	0.1	0.2	0.3	0.4	0.4
Current account/GNP 1/	-0.3	0.0	0.1	0.2	0.2
Trade balance/GNP 1/	-0.3	-0.5	-0.6	-0.5	-0.4
Net foreign assets/GNP 1/	0.3	0.6	1.1	1.6	2.3

Source: Staff calculations, based on WEO projections and Multimod.

1/ Deviation from baseline in percentage points.

Table 3. Developing Countries: Macroeconomic Effects of a Tightening in
U.S. Monetary Policy (Deviation from Baseline, in percent)

	2000	2001	2002	2003	2004
I. Increase of 100 Basis Points in U.S. Federal Funds Rate					
Real GNP	-0.2	-0.4	-0.5	-0.4	-0.4
Domestic demand	-0.3	-0.6	-0.6	-0.5	-0.3
II. Increase of 200 Basis Points in U.S. Federal Funds Rate					
Real GNP	-0.4	-0.9	-0.9	-0.9	-0.8
Domestic demand	-0.7	-1.2	-1.2	-1.0	-0.7
III. Increase of 300 Basis Points in U.S. Federal Funds Rate					
Real GNP	-0.6	-1.3	-1.5	-1.5	-1.3
Domestic demand	-1.2	-1.5	-2.2	-1.9	-1.4

Source: Staff calculations, based on WEO projections and MULTIMOD.

Figure 1. Sovereign Spreads in Selected Emerging Markets
Actual vs. Fitted Values (in logarithm)
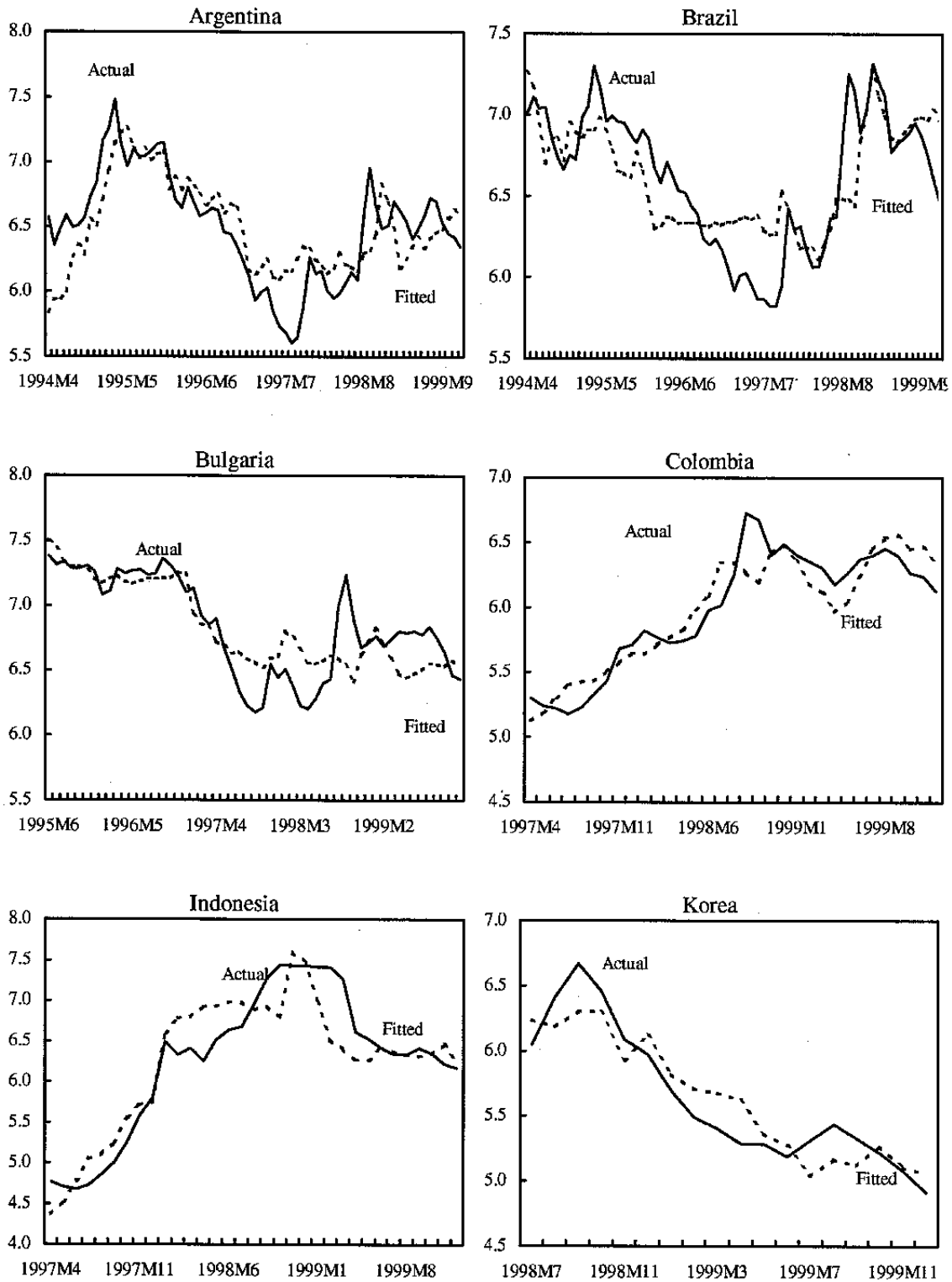
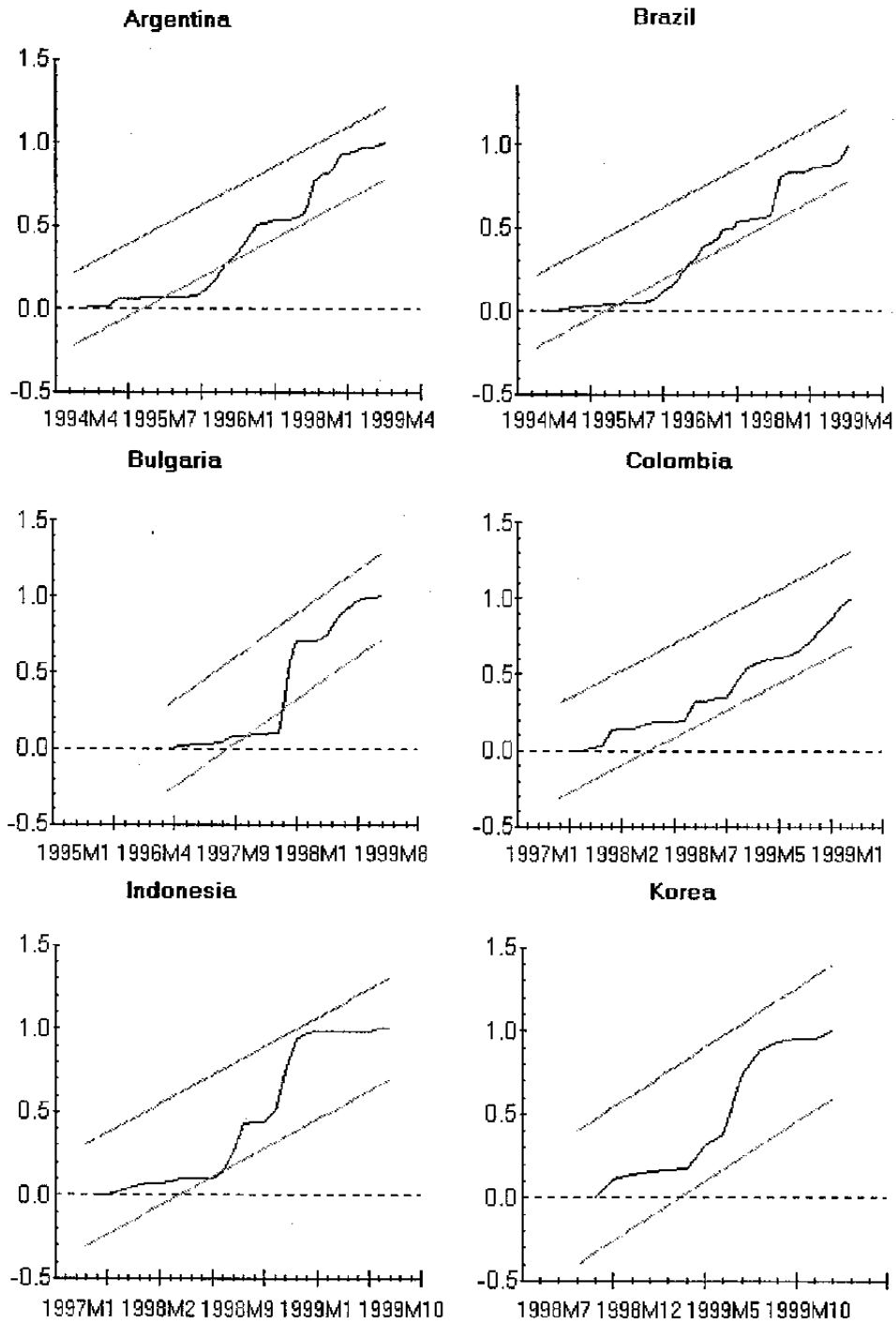Sources: Merrill Lynch; and staff estimates.

Figure 1. Sovereign Spreads in Selected Emerging Markets
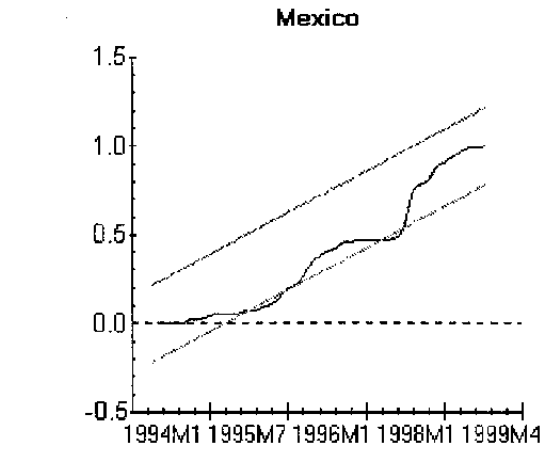Actual vs. Fitted Values (in logarithm) (concluded)
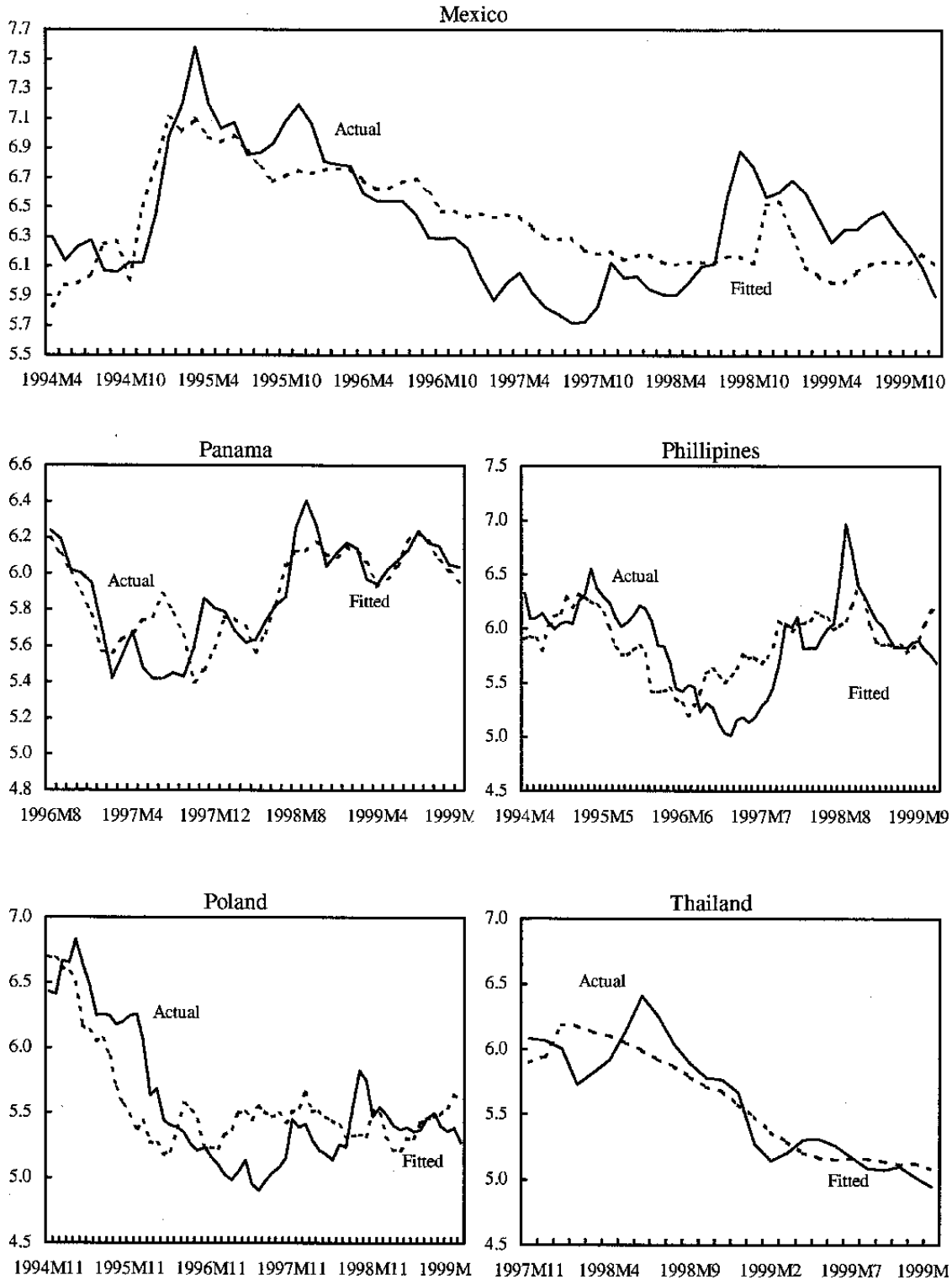
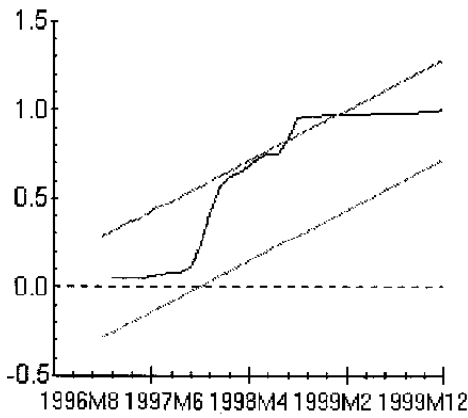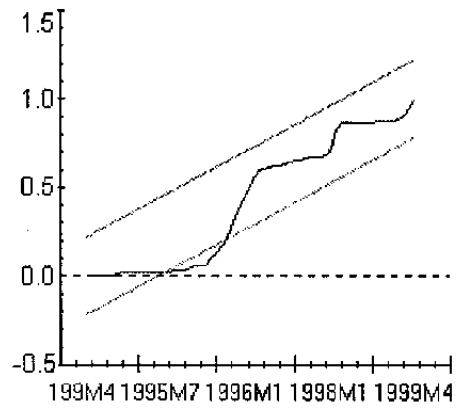Sources: Merrill Lynch; and staff estimates.

Figure 2. Stability Tests 1/

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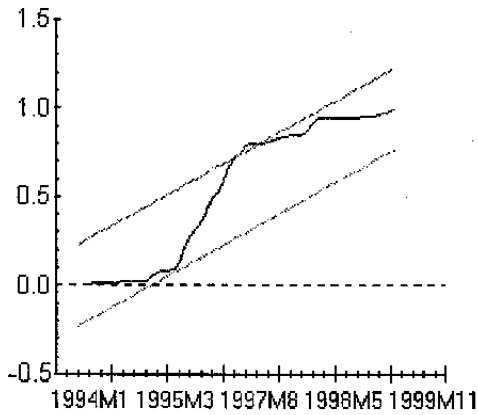
Mexico

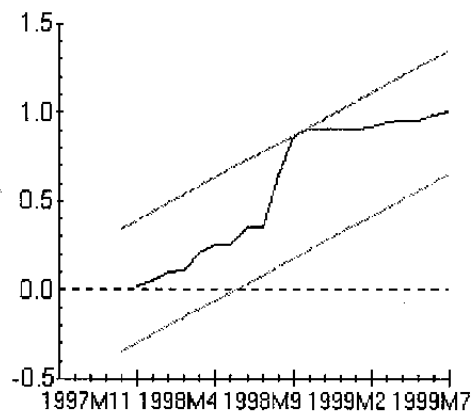Panama

Philippines

Poland

Thailand

References

Aitken, B., 1998, 'Have Institutional Investors Destabilized Emerging Markets?" *Contemporary Economic Policy*, 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, December.

Borensztein, E. and Gelos, G., 2000, "A Panic-Prone Pack? The Behavior of Emerging Market Mutual Funds." IMF Working Paper, forthcoming.

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

Cline, W. and Barnes K., 1997, "Spreads and Risk in Emerging Markets Lending," Institute of International Finance, Working Paper No. 97-1, December.

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

Eichengreen, B. and Mody A., 1998, "What Explains Changing Spreads on Emerging-Market Debt: Fundamentals or Market Sentiment?," National Bureau of Economic Research Working Paper No. 6408, February.

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

Frankel, J., Schmukler, S. and Serven, L., 2000, "What Happens in Other Countries When the Fed Tightens? Interest Rate Sensitivity and Currency Regime," unpublished draft, World Bank, June.

Goldfajn, I. and Baig, T., 1999, "The Russian Default and the Contagion to Brazil," unpublished draft.

Hamilton, J., 1994, *Time Series Analysis*, Princeton University Press.

Hardouvelis, G., 1989, "Margin Requirements, Volatility, and the Transitory Component of Stock Prices," Federal Reserve Bank of New York Research Paper No. 8909, May.

Hardouvelis, G. and Theodossiou, P., 1998, "The Asymmetric Relation between Initial Margin Requirements and Stock Market Volatility Across Bull and Bear Markets," unpublished draft.

Hsieh, D. and Miller, M., 1990, "Margin Regulation and Stock Market Volatility," *Journal of Finance*, vol. XLV, No.1, March.

International Monetary Fund, 1995 and 1996, "International Capital Markets Report."

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

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

Kaminsky, G. and Reinhart, C., 1998, "Financial Crises in Asia and Latin America: Then and Now", *American Economic Review*, Vol. 88, No. 2, May, pp.444–448.

Kaminsky, G. and Reinhart, C., 1999, "On Crises, Contagion, and Confusion," unpublished manuscript.

Laxton D., Isard P., Faruqee P., Prasad E., and Turtelboom B., 1998, "*MULTIMOD Mark III: The Core Dynamic and Steady State Models,*" International Monetary Fund, Occasional Paper No. 164, Washington, DC.

Laxton, D. and Prasad, E., 2000, "International Spillovers of Macroeconomic Shocks: A Quantitative Exploration," IMF Working Paper (forthcoming).

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

Private Market Financing for Developing Countries, International Monetary Fund, 1995.

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

Valdés, R., 2000, "Emerging Markets Contagion: Evidence and Theory", Documento de Trabajo del Banco Central de Chile, May.