III

International Financial Contagion

The forced devaluation of the Brazilian real in mid-January was the latest in a series of financial crises that have engulfed emerging market economies in recent years. A prominent feature of these crises—the Mexican crisis of 1994–95, the Asian crises of 1997–98, and the Russian crisis of 1998, as well as of the earlier ERM crises of 1992–93 directly involving European industrial countries—was the spread of difficulties from one economy to others in the same region and, in some cases, beyond, in a process that has come to be referred to as "contagion."

A remarkable feature of the Asian crisis was the degree to which it spread from Thailand to other countries in the region in the span of a few months. But the impact was not confined to Asia. Currencies in Latin America, central and eastern Europe, Russia, and South Africa came under pressure as a number of countries experienced capital outflows in late 1997. The international spillovers from the Russian crisis were even greater. Yield premia for emerging market bonds rose sharply, currency pressures intensified in many emerging market countries, and equity prices fell precipitously in both emerging and mature markets. The widespread flight to quality and the rush for liquidity led to a severe tightening of credit conditions not only for emerging market borrowers but also for nonprime corporate borrowers in some mature markets.

The frequency and intensity of crises in emerging market countries in the second half of the 1990s is of growing concern to policymakers. Questions increasingly are raised about the nature of these crises, the factors responsible for their spread, and the policies needed both to prevent crises from erupting in the first place and, once a crisis has erupted, to limit its severity and stem its spillover to other countries.

Analysis of contagion is particularly timely, for two main reasons. One is the continued risk of financial market spillovers, which could have an immediate bearing on the near-term economic prospects for many individual countries and for the world economy. The other is the need to draw broader lessons from the emerging market financial crises in the past several years, which have highlighted the potentially disruptive role of international capital markets. Capital flows can be volatile and subject to "herding" effects. Contagious crises, or crises characterized by the sudden widespread withdrawal of funds from emerging markets, may therefore increasingly become intrinsic features of globalized capital markets. This raises the question (not directly addressed in this chapter) of how the functioning of the international financial system should be reformed so as to limit the occurrence of such crises while continuing to benefit from the progressive integration of world capital markets. In this respect, too, a fuller understanding of international financial contagion would be helpful.

Previous issues of the *World Economic Outlook* have analyzed various aspects of financial crises. In particular, the May 1998 issue focused on indicators of currency and banking crises in both emerging market economies and industrial countries in the post–Bretton Woods period. Subsequent work in the IMF's Research Department further explored the use of early warning systems in predicting balance of payments crises and their possible role in IMF surveillance. The focus of that analysis was to identify economic and financial variables that can be used to predict the likelihood that a country will face a currency or balance of payments crisis over a given time horizon or, less ambitiously, that provide early indication of vulnerability to such a crisis.[1] This issue of the *World Economic Outlook* extends earlier work by looking at factors that render a country vulnerable to contagion and thus enhance the risk that a currency crisis in one country will spill over to others. Characteristics of crisis and noncrisis countries are analyzed to examine how the countries that experienced currency pressures in the six-month period following the outbreak of the ERM, Mexican, Asian, and Russian crises differed ex ante from countries that did not. The role of external and internal imbalances, trade and financial linkages, and reserve adequacy are examined both individually and simultaneously, with particular attention paid to measures of vulnerability to contagion.

The Changing Nature of Currency Crises

Financial crises in emerging market economies in the 1990s, as in earlier decades, have been char-

[1]See Andrew Berg and Catherine Pattillo, "Are Currency Crises Predictable? A Test," Working Paper 98/154 (Washington: IMF, November 1998), and Gian Maria Milesi-Ferretti and Assaf Razin, "Current Account Reversals and Currency Crises: Empirical Regularities," Working Paper 98/89 (Washington: IMF, June 1998).

acterized by the sudden collapse of pegged exchange rate regimes. The underlying cause of the crises has been the buildup of unsustainable economic imbalances and misalignments in exchange rates, often in a context of financial sector distortions and weaknesses. But while these imbalances and weaknesses have been at the root of the crises in the countries that spawned recent major emerging market crises—Mexico, Thailand, and Russia—the associated difficulties that have subsequently arisen in other economies with apparently limited trade or financial links with the original crisis economy, and in the absence of a change in their macroeconomic fundamentals, are unusual in the absence of a large common shock. This has led to a rethinking of the causes (and models) of balance of payments crises.

Explanations of currency crises distinguish between crises caused by a deterioration in fundamentals and those that result from self-fulfilling speculative attacks. Up until the time of the ERM and Mexican crises, explanations and models of currency crises stressed the role of macroeconomic fundamentals. In these "first-generation" models, a speculative attack on a fixed exchange rate stems from inconsistent government policies, such as the monetization of persistently large fiscal deficits and the maintenance of a pegged exchange rate. Such inconsistencies may well last a while and be overlooked by markets, as long as the monetary authority's stock of foreign exchange reserves is thought to be large enough to defend the peg until policies are corrected. But with international reserves being steadily eroded by excessive domestic credit expansion, the situation is not sustainable indefinitely. When international reserves reach some critically low level, there is a sudden speculative attack on the currency, with investors rushing to draw from the diminishing stock of foreign exchange so as to avoid capital losses when the peg collapses. Even though in practice the timing of the crisis cannot be predicted precisely, a crisis is the predictable outcome of policy inconsistencies. Although this explanation of currency crises applies in many cases, and offers useful insights, including that an attack need not be a result of a large shock, it has one major drawback: the assumption that a government's commitment to a fixed exchange rate is independent of the state of the economy.

The currency crises of the 1990s, particularly the ERM crises, challenged the view that foreign exchange market crises stem largely from undisciplined fiscal and monetary policies. Indeed, many of the countries caught up in these crises had not had overly expansionary policies. Furthermore, the decisions to abandon the exchange rate pegs were not so much due to the exhaustion of international reserves as to the reluctance of governments to maintain high interest rates long enough to fend off repeated speculative attacks. The costs of defending the peg were judged to exceed the benefits.

The explicit consideration of the costs and benefits of a fixed exchange rate policy—with the government's cost-benefit calculus influenced by market expectations about the viability of the fixed exchange rate—is at the heart of "second-generation" explanations of speculative attacks.[2] The existence of multiple government objectives implies a trade-off between a fixed exchange rate policy and other objectives. For instance, in addition to wanting to maintain a fixed exchange rate, a government may also wish to limit its debt-service obligations, lower the rate of unemployment, or safeguard a fragile banking system. The problem that this poses is that, if market sentiment coalesces around the belief that a currency might be devalued and the devaluation expectations are built into (higher) nominal interest rates, then the prospects for a lower debt burden, reduced unemployment, or a less fragile banking system are worsened, and the costs of maintaining the peg are increased. Recognizing that the government's commitment to a fixed exchange rate is constrained by other objectives, market participants might attack the currency. In contrast, if market sentiment is dominated by the belief that the currency will not be devalued, then the costs of maintaining the fixed exchange rate are reduced, and the peg can be more easily maintained.

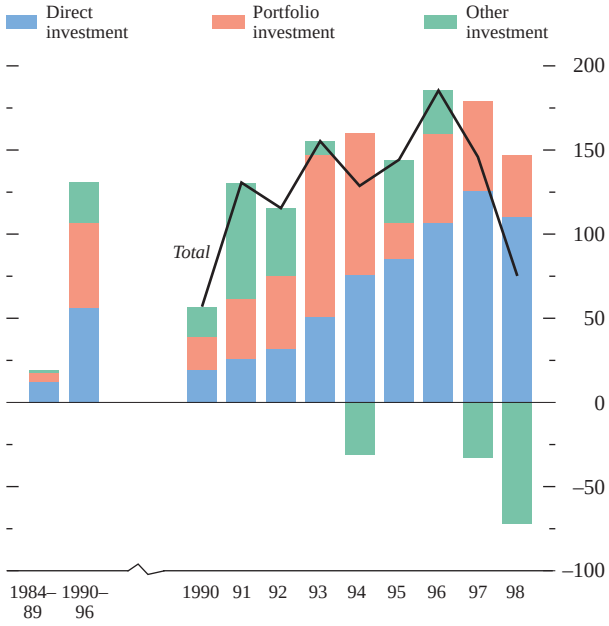
A currency crisis, therefore, is not necessarily the outcome of an underlying policy inconsistency before a speculative attack: a currency can be attacked even when policies are consistent with the maintenance of a pegged exchange rate. Rather, a speculative attack can be triggered by a sudden and unpredictable shift in market expectations about the viability of a fixed exchange rate. If the attack then raises the cost of maintaining the peg so high as to cause the authorities to abandon it, the crisis becomes self-fulfilling: the devaluation validates the market's expectations.

This does not mean that currency crises are unrelated to economic fundamentals. Market expectations are not formed in a vacuum. Expectations of a government's commitment not to devalue are influ-

[2]The "first-generation," "second-generation" terminology used to distinguish between alternative approaches to modeling speculative attacks on fixed exchange rate regimes was coined by Barry Eichengreen, Andrew Rose, and Charles Wyplosz, "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Special Reference to the European Monetary System," in Matthew Canzoneri, Wilfred Ethier, and Vittorio Grilli, eds., *The New Transatlantic Economy* (Cambridge and New York: Cambridge University Press, 1996). For an examination of how models of speculative attacks help in understanding the causes of currency crises, see Robert P. Flood and Nancy P. Marion, "Perspectives on the Recent Currency Crisis Literature," Working Paper 98/130 (Washington: IMF, September 1998).

Figure 3.1. Net Capital Flows to Developing Countries, by Component
(Billions of U.S. dollars; period average)

Net private capital flows to developing countries rose steeply in the first half of the 1990s.



enced not only by the stock of international reserves available to defend the currency, but also by the perceived willingness of the authorities to sacrifice other objectives, which, in turn, depends on the state of the economy. For example, it is more difficult to keep interest rates high for an extended period if the banking system is not very sound or if unemployment is high. The economy's fundamentals, therefore, must usually be weak along some dimensions before a shift in market sentiment can push the economy into a crisis.

The Mexican and, especially, the Asian crises have extended the focus of analysis from the role of traditional economic fundamentals in currency crises to that of financial sector weaknesses and the globalization of financial markets in increasing an economy's vulnerability to sudden capital outflows. The increased integration of many developing countries with the global financial system can be seen in various ways, but it is perhaps most clearly illustrated by the growth of net private capital flows to these economies. These flows averaged about $130 billion a year during 1990–96, a sevenfold increase from the average annual inflow over 1984–89 (Figure 3.1). In 1996 they peaked at $186 billion, corresponding to 3.6 percent of developing country GDP. The largest capital flows in the 1990s have been in equity and portfolio investments, unlike in previous years when most inflows represented bank lending. They have also been highly concentrated, with just ten countries receiving about 80 percent of total net private capital flows to developing countries.

Naturally, therefore, the question has arisen whether the globalization of financial markets has increased the frequency of crises or has in some important way altered the nature of them. While the incidence of currency crises in emerging market countries was double that in industrial countries during the past two decades, the frequency of crises in emerging markets shows no marked trend, as documented in the May 1998 *World Economic Outlook*. The nature of crises, however, appears to have changed.

The increased globalization of financial markets has meant that crises involve the capital account more than in the past. A change in expectations or investor sentiment can induce a sudden, sharp reversal in capital flows, precipitating a currency crisis. With larger capital flows, a crisis can occur more rapidly than in the past. Crises have also tended to become more severe and even less predictable and to come in waves, since the risks of spillover and contagion are greater. They have also tended to be regional.

One reason for the increased volatility of private capital flows is that globalization of financial markets can reduce the incentives for information gathering and thereby strengthen herd behavior when, as is often the case, expectations are formed in a context of imperfect and asymmetric informa-

tion.[3] The herd behavior and fads occasionally observed in mature markets have gained in scope with the increased international integration of financial markets.

Herd behavior by investors is one reason why financial crises in emerging markets might come in waves. More generally, the factors that help to explain why currency crises tend to be clustered fall into several categories.[4]

- *Common shocks,* such as a steep rise in world interest rates, a sharp slowdown in world aggregate demand, a decline in commodity prices, or large changes in exchange rates between major currencies, can play a major role in inducing pressures on the currencies of several countries simultaneously. In this case, the simultaneous occurrence of crises stems from the interaction of a common shock and domestic fundamentals.
- When a country experiences a financial crisis marked by a significant depreciation of its currency, other countries may suffer from *trade spillovers,* owing to the improved price competitiveness of the crisis country. If the exchange rate crash is accompanied, as is typically the case, by a downturn in economic activity and a compression of imports in the crisis country, the associated income effect would further depress the exports of trade partners. The price and income effects operate not only through direct bilateral trade linkages, but also through price competition and income repercussions in third markets. Furthermore, in view of the critical role played by expectations in financial markets, it is important to consider trade spillovers not only from countries that have already experienced an exchange rate crash, but also from those that might be subject to contagion effects.
- *Financial linkages* can be another channel for spillover and contagion effects. The occurrence of a crisis in one or more countries might induce investors to rebalance their portfolios for risk management, liquidity, or other reasons. For instance, when a crisis breaks out in one country, investors who have positions in that country will usually want to reduce their now increased risk exposure and will sell assets whose returns are highly variable and positively correlated with those of the assets in the crisis country. Investors may also be induced to sell liquid assets for other reasons, such as when the reduced value of the assets of a crisis country gives rise to an immediate need to raise cash to meet margin calls.[5] In addition, investors may sell assets that are highly represented in their portfolios simply because of their greater availability. Some countries, therefore, may experience capital outflows independently of their macroeconomic fundamentals, simply because their assets are viewed as relatively more risky (in the wake of a crisis elsewhere or because they are positively correlated with those of a crisis country), more liquid, or highly represented in the portfolio of creditors to the crisis country.
- *Shifts in investor sentiment* might also play a role in the spread of crises. A crisis in one country can serve as a "wake-up call," inducing financial markets to reassess other countries' fundamentals.[6] Countries with mediocre fundamentals or financial vulnerabilities may then be subject to contagion effects from a shift in market sentiment or increased risk aversion. If a currency crisis in one country generates fears of speculative attacks elsewhere, investors may expect to profit from speculating against currencies that they think other investors will sell too. The most promising targets are likely to be currencies that seem likely to be defended by official exchange market intervention or increases in interest rates, but that seem most likely eventually to collapse and yield speculative gains. The risk of a crisis precipitated by a sudden change in expectations is likely to be greater, the larger is the country's share of short-term obligations and the larger is the maturity mismatch between assets and liabilities, because the economy will then be more vulnerable to a run by a fairly modest share of lenders. Low levels of international reserves in relation to the stock of short-term external debt or the domestic banking sector's liabilities may therefore signal financial vulnerability. Countries with weak domestic banking systems may also be at risk because financial market participants may see this as a constraint on the monetary authorities' ability (and

[3]For instance, herd behavior can occur because, as the number of markets grow and the share of a country's assets in the investor's portfolio declines, the payoff to gathering country-specific information is reduced; or if investment fund managers are evaluated on their performance relative to that of other managers, they may find it optimal to "follow the herd." These explanations are part of a broad class of models in which expectation formation in the context of imperfect and asymmetric information can explain rational herd behavior by investors—see, for instance, Guillermo A. Calvo and Enrique G. Mendoza, "Contagion, Globalization, and the Volatility of Capital Flows" (unpublished; College Park, Maryland: Center for International Economics, University of Maryland, January 1998).

[4]For a taxonomy of the linkages explaining contagion, see Paul Masson, "Contagion: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria," Working Paper 98/142 (Washington: IMF, September 1998).

[5]On the role of liquidity in contagion, see Ilan Goldfajn and Rodrigo Valdes, "Capital Flows and the Twin Crises: The Role of Liquidity," Working Paper 97/87 (Washington: IMF, July 1997).

[6]See Morris Goldstein, *The Asian Financial Crisis: Causes, Cures, and Systemic Implications,* Policy Analyses in International Economics No. 55 (Washington: Institute for International Economics, 1998).

willingness) to raise interest rates in defense of the currency.

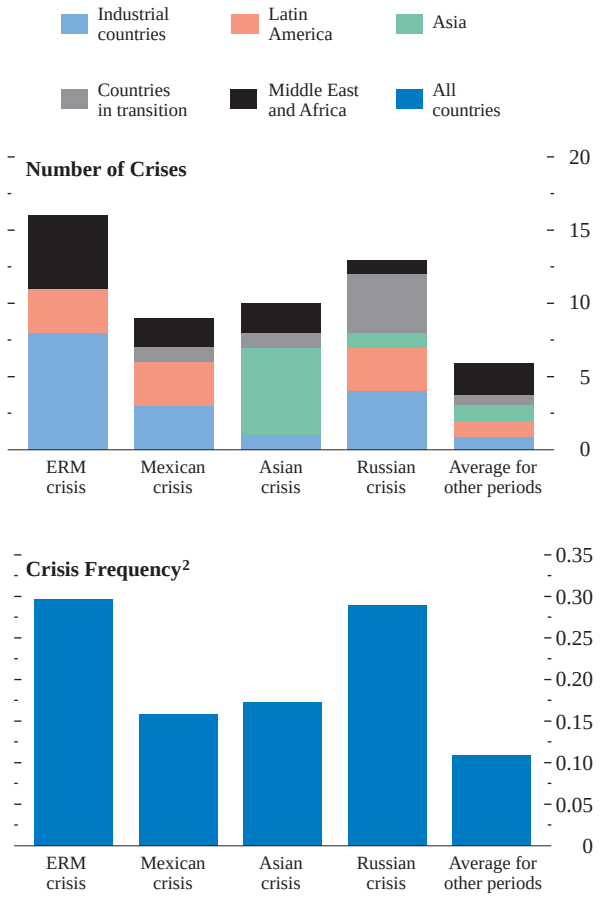
Assessing the Role of Fundamentals and Contagion in Recent Crisis Episodes

To assess the characteristics of the countries that have been affected during the major financial crises in the 1990s, an operational definition of financial market pressure is required to determine which countries suffered most during these periods of financial instability. The definition could be confined to "currency crises" (that is, episodes of intense foreign exchange market pressure), or it could be broadened to include pressures in other financial markets (such as movements in stock prices or bond yields) or evidence of large-scale capital flight. In this chapter, only currency crises are considered.

A currency crisis can be defined simply as an episode in which a country experiences a substantial nominal devaluation or depreciation. This criterion, however, would exclude instances where a currency came under severe pressure but the authorities successfully defended it—by intervening heavily in the foreign exchange market, by raising interest rates sharply, or by both. Many such instances would justifiably be regarded as crises. An alternative approach, therefore, would be to construct an index of speculative market pressures that takes into account not only movements in the exchange rate, but also movements in international reserves or interest rates that absorb pressure and thus moderate the exchange rate changes.[7] For the analysis in this chapter, an index of speculative market pressure was constructed as a weighted average of (detrended) monthly exchange rate changes and reserve changes. Occasions when the value of the index exceeded a specific threshold were classified as crises.[8] Countries that ex-

Figure 3.2. Incidence of Currency Crises During the 1990s[1]

The incidence of crises during the ERM, Mexican, Asian, and Russian crisis episodes was significantly higher than during other periods.



[1]The crisis index is described in the text. The ERM crisis occurred during September 1992 through February 1993; the Mexican crisis, December 1994 through May 1995; the Asian crisis, July through December 1997; and the Russian crisis, August through November 1998.

[2]Defined as the number of crises per country, adjusted for data availability and excluding periods of high inflation.

[7]The approach follows procedures adopted in the economic literature and reflects the constraints imposed by the availability of data for any large set of countries. See Chapter IV, "Financial Crises: Characteristics and Indicators of Vulnerability," in the May 1998 *World Economic Outlook*, pp. 74–97, for a fuller discussion of operational definitions of currency crises.

[8]The weights were chosen so that the conditional variance of the two components of the index was equal. Exchange rates were relative to the U.S. dollar, except for those of the European countries other than Russia, which were relative to the deutsche mark. Trends were country-specific. Periods in which the 12-month inflation rate exceeded 100 percent were excluded. The threshold, which was set to 1.645 times the pooled standard deviation of the calculated index plus the pooled mean of the index, was chosen so that 5 percent of the monthly index values would exceed that threshold if the values were distributed normally. Relative to that threshold, about 12 percent of the countries experienced currency crises in the average six-month period. The frequency of crises is similar to that found in previous studies. Interest rates were excluded from the index because of the lack of comparable, market-determined interest rate data for many of the emerging market economies for the full sample period.

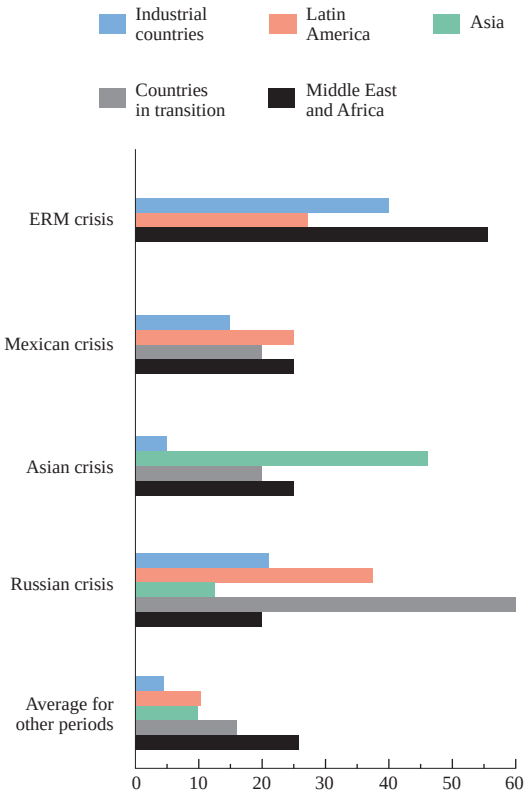
perienced crises during the ERM, Mexican, Asian, and Russian episodes were identified as all those suffering foreign exchange market pressures exceeding this threshold within six months of the beginning of these episodes.[9]

This approach, while capturing the more serious currency crises and speculative attacks in exchange markets, inevitably also picks up episodes associated with significant but less-than-critical exchange market pressures. This is helpful to identify instances of spillover and contagion. However, the approach may miss periods of financial instability that are not directly or substantially reflected in the foreign exchange market. This should be borne in mind in interpreting the results and drawing inferences of general applicability.

On this basis, currency crises were identified for a group of over 60 industrial and emerging market economies for the period 1990–98.[10] Sixteen economies were found to have experienced substantial currency pressures during (or within six months of) the ERM episode, 9 during the Mexican episode, 10 during the Asian episode, and 13 during the Russian episode (Figure 3.2). The incidence of crises during these periods was much higher than during other six-month windows in the 1990s, when on average under six countries (or about 10 percent of the sample, adjusting for availability of data and excluding high-inflation countries) suffered significant currency market pressures. During the ERM and Russian crises about 30 percent of the countries in the sample experienced currency pressures, while in the Mexican and Asian crises 15–20 percent were affected. In geographic distribution, the ERM crisis primarily affected European industrial countries and emerging market economies in the Middle East and Africa; the Mexican crisis, mainly Latin American countries but also other emerging market economies outside Asia; the Asian crisis, mostly Asian economies; and the Russian crisis, mainly the eastern European transition economies but

Figure 3.3. Frequency of Crises, by Country Group[1]
(Percent of countries in country groups experiencing crisis)

Currency crises in the 1990s have tended to be regional.



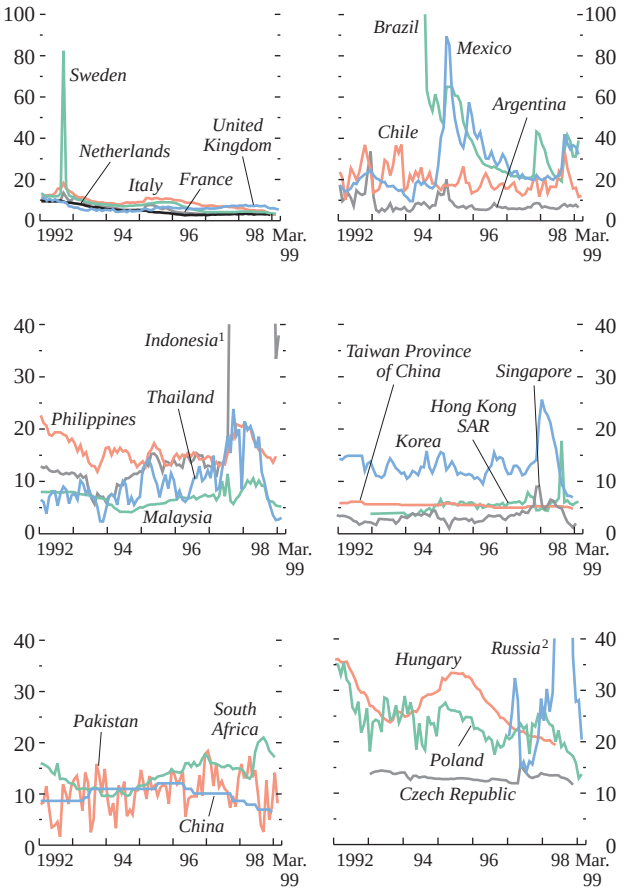
[1]The number of crises per country in country groups, adjusted for data availability and excluding periods of high inflation. The crisis index is described in the text. The ERM crisis occurred during September 1992 through February 1993; the Mexican crisis, December 1994 through May 1995; the Asian crisis, July through December 1997; and the Russian crisis, August through November 1998.

[9]The beginnings of the four crises were dated as September 1992 for the ERM crisis, December 1994 for the Mexican crisis, July 1997 for the Asian crisis, and August 1998 for the Russian crisis. In each of these months, at least one economy suffered a substantial currency depreciation (a currency "crash"). For the Russian crisis, the crisis period is only four months because the data sample ends in November 1998. The economies that experienced foreign exchange market pressures during these crises did not (all) necessarily do so because of contagion effects; the pressures could have arisen independently of developments in other countries. This point is discussed further below.

[10]The group included 20 industrial countries and 41 emerging market economies, consisting of 13 Asian economies, 12 Latin American economies, 7 transition (eastern European) economies, and 9 economies in Africa and the Middle East. Germany and the United States served as the reference countries for the European (other than Russia) and the non-European economies, respectively, and were therefore not included in the sample.

Figure 3.4. Selected Countries: Short-Term Interest Rates
(Percent a year)

Interest rates have been a frequently used means of defending a currency under pressure.



Source: IMF, *International Financial Statistics*. Short-term money market rate or, if unavailable, comparable lending rate.

[1]The Indonesian short-term rate peaked at 81 percent in August 1998.

[2]The Russian three-month interbank rate reached 140 percent in September 1998.

also some Latin American countries, especially Brazil (Figure 3.3, on preceding page).[11]

As mentioned above, in addition to movements in the exchange rate and international reserves, other indicators of financial crisis and contagion might include sharply rising short-term interest rates, falling stock market prices, and widening bond yield spreads. During the major financial crises of the 1990s, these financial variables moved significantly in many of the affected countries. These indicators, therefore, might identify other countries affected by contagion that were not identified by the index of foreign exchange market pressure.

Increases in interest rates are, of course, a frequently used means of defending a currency under pressure.[12] During the ERM crisis, for example, interest rates in Sweden were raised to over 80 percent (on average) during September 1992 (Figure 3.4). For some other countries that experienced substantial currency pressures during the ERM crisis, such as Italy and Denmark, interest rates rose sharply as well. Rising interest rates in France, Norway, and Portugal indicate that these countries, which were not identified by the exchange market pressure index as crisis countries, also suffered currency market pressure. For emerging market economies where comparable, market-determined interest rate data are available, rising short-term interest rates also suggest exchange market pressure. In many of the crisis economies during the Mexican, Asian, and Russian crises, interest rates did rise substantially, although sometimes with a lag. In a few economies identified as noncrisis countries, interest rates also rose steeply, indicating that these countries were likely affected by contagion as well.

Stock market prices fell sharply at the beginning of the ERM crisis in most of the European industrial countries that suffered currency market pressure during that crisis (Figure 3.5). In Italy and Sweden, stock prices, measured in local currency, plummeted about 10 percent during September 1992, and they also fell in most of the other crisis industrial countries. In the United Kingdom, however, where stock prices had fallen in previous months, the stock market rose after sterling was allowed to float and, at the same time, interest rates allowed to decline. In most of the non-

[11]The Middle East and Africa region has experienced a larger incidence of crises (as identified by the index used) than other regions because several of the countries in this region have relatively volatile international reserves. As a result, the incidence of crises for these economies may be biased somewhat upward.

[12]Short-term interest rates, in fact, have been included in exchange market pressure indices constructed to study currency crises and contagion in industrial countries. (See, for example, Barry Eichengreen, Andrew K. Rose, and Charles Wyplosz, "Contagious Currency Crises: First Tests," *Scandinavian Journal of Economics*, Vol. 98 (No. 4, 1996), pp. 463–84.) In studies that include emerging market economies, however, the lack of comparable, market-determined interest rates for a broad sample of countries has made use of these rates impractical.

crisis industrial countries, such as France, the Netherlands, and Switzerland, stock markets rose during the crisis. Falling stock prices in Greece, Norway, and Portugal, however, corroborate other indicators and suggest that these countries also suffered from financial contagion.

Similarly, during the Mexican, Asian, and Russian crises, falling stock prices point to the likelihood that several other countries suffered from financial contagion, in addition to those identified by the exchange market pressure index. In the Mexican crisis, Peruvian stock prices (measured in local currency) declined by over 30 percent in the months following the onset of the crisis, while in Hong Kong the stock market fell by about 20 percent. Other Asian stock markets, such as those in Indonesia, Korea, Malaysia, the Philippines, and Thailand, fell as well but by smaller amounts. In comparison, stock prices in Argentina, Brazil, and Mexico dropped at least 35 percent. During the Asian crisis, stock markets in Brazil and Hong Kong SAR declined by over 30 percent, and the Indian stock market dropped by about 17 percent. In contrast, Korean, Indonesian, Malaysian, and Thai stock prices plummeted by over 40 percent. Most recently, stock prices in all but six countries in the data sample fell by at least 10 percent in the aftermath of the Russian crisis, while stocks in Russia declined by over 30 percent in August 1998 but rallied (in ruble terms) thereafter.[13]

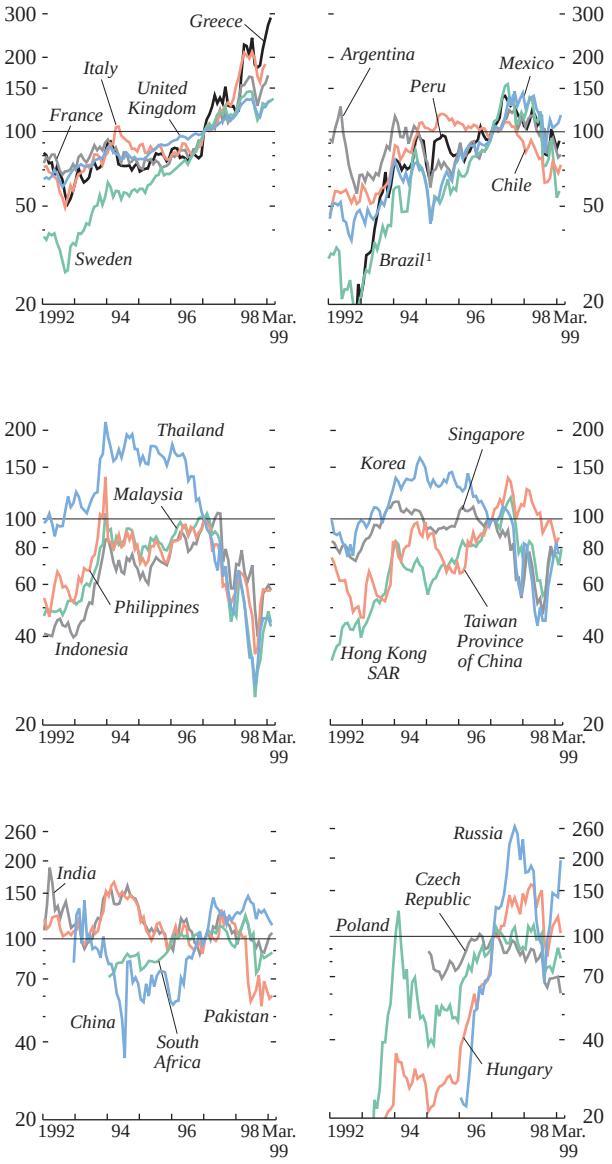
Emerging market sovereign bond yield spreads increased substantially, albeit temporarily, during each of the four major financial crises (Figure 3.6). Overall, spreads jumped by about 10 percentage points in the aftermath of the Mexican and Russian crises and by about 3 percentage points during the ERM and Asian crises. Data on these spreads for individual countries, particularly for the earlier part of the 1990s, are relatively limited. Indication of currency market pressure from widening country-specific spreads, when available, is often, but not always, consistent with the evidence suggested by the index of currency pressures discussed earlier. During the Mexican crisis, for example, spreads rose by over 10 percentage points in Mexico and by lesser amounts elsewhere, particularly in Latin America. After the floating of the baht, sovereign bond yield spreads rose by more than 5 percentage points during the second half of 1997 in some of the crisis-afflicted Asian economies. But these spreads also increased by lower amounts in countries not identified by the currency market pressure index, such as Argentina, Brazil, and Mexico, possibly indicating some financial contagion in these countries. Most recently, sovereign bond yield spreads rose significantly almost everywhere during the global flight to quality in the wake of the Russian debt moratorium.

[13]Stock price data were available for 50 of the 61 countries in the sample for 1998.

Figure 3.5. Selected Countries: Stock Prices

(Index in local currency; logarithmic scale; January 1997 = 100)

Declines in equity prices have tended to corroborate other indicators of financial contagion.

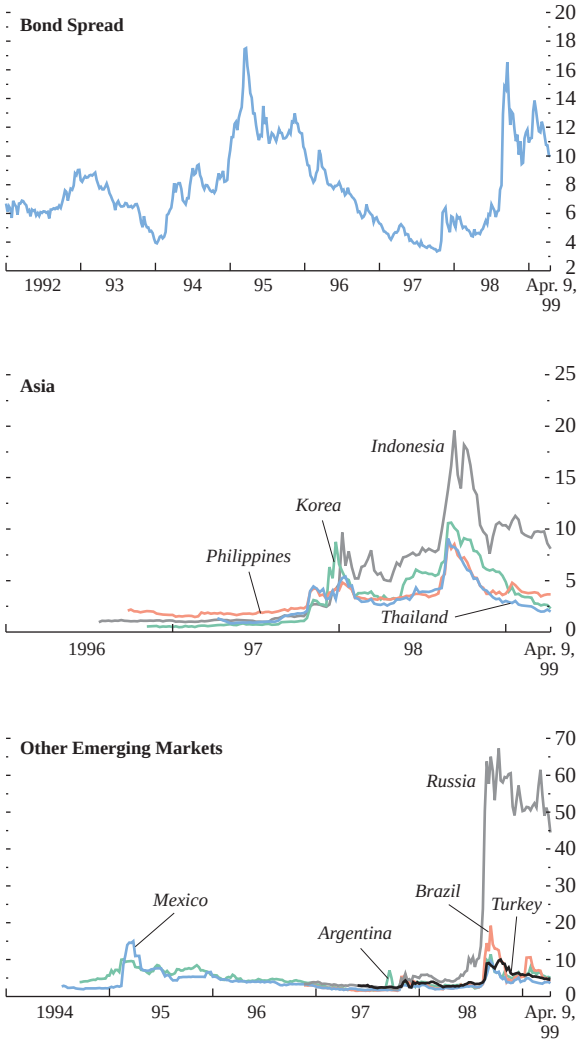


Sources: Bloomberg Financial Markets, LP; International Finance Corporation (IFC), Emerging Markets Database; IMF, *International Financial Statistics*; and WEFA, Inc.

[1]Index in U.S. dollars because of hyperinflation in the early 1990s.

Figure 3.6. Emerging Market Yield Spreads[1]
(Percentage points)

Bond yield spreads increased substantially during the major crisis episodes.



Source: Bloomberg Financial Markets, LP.

[1]J.P. Morgan's Emerging Market Bond Index (EMBI) spread relative to the theoretical U.S. zero-coupon yield curve, and secondary market yield spreads on U.S. dollar-denominated Eurobonds.

Common Shocks

One reason for contemporaneous pressures on the currencies of several countries might be common shocks—such as a change in world interest rates. In part, the debt crises of the early 1980s in Latin America were triggered by the substantial rise in real interest rates in the United States. Other potential common shocks include a slowdown in world output growth, changes in the bilateral exchange rates between the major world economies (particularly when exchange rates are pegged to these major currencies), and trade price shocks.

Each of the major crises of the 1990s occurred subsequent to a substantial change in the world or regional environment.[14] Thus, in the two years prior to the ERM crisis, German interest rates had risen substantially in response to overheating pressures, and, in the aftermath of reunification, cyclical positions in Germany and other ERM countries differed substantially (Figure 3.7). These developments contributed to tensions in the ERM. The sharp rise of U.S. interest rates during 1994 may have contributed to the pressure on the Mexican peso during the latter part of that year. Although world interest rates were relatively flat before the devaluation of the Thai baht, the competitiveness of the Asian economies was adversely affected by the sharp depreciation of the yen relative to the U.S. dollar over the two years prior to the crisis because many of these economies had exchange rates effectively pegged to the dollar. Furthermore, the economic stagnation throughout the 1990s of Japan, a major trading partner for the afflicted Asian economies, adversely affected the regional economic environment. The sharp fall in oil and other commodity prices during 1997 and 1998 may have contributed to the pressure on the currencies of some of the commodity-exporting countries most affected by the Russian crisis.

Characteristics of Countries Vulnerable to Contagion

As explained earlier, contemporaneous pressures on the currencies of several countries can occur for other reasons than common shocks. The analysis that follows examines the characteristics of countries vulner-

[14]Extensive analysis of the ERM, Mexican, Asian, and Russian crises may be found in previous *World Economic Outlook* and *International Capital Markets* reports, in particular the January 1993 *Interim Assessment* and the October 1993 *World Economic Outlook*, and the April 1993 *International Capital Markets* report on the ERM crises; the May 1995 *World Economic Outlook* and the August 1995 *International Capital Markets* report on the Mexican crisis; the December 1997 *Interim Assessment* of the *World Economic Outlook* and the December 1997 *International Capital Markets* report on the Asian crisis; and the December 1998 *World Economic Outlook and International Capital Markets: Interim Assessment* on the Russian crisis.

able to contagion by comparing the average behavior of a variety of macroeconomic, trade, and financial market variables between economies that suffered currency market pressure during the four major financial crises of the 1990s and economies that did not. Because the sample of countries and crises are not homogeneous, the robustness of these results was also examined by comparing the differences in behavior between crisis and noncrisis economies for each of the four major crises individually, as well as for industrial and emerging market economies separately.[15]

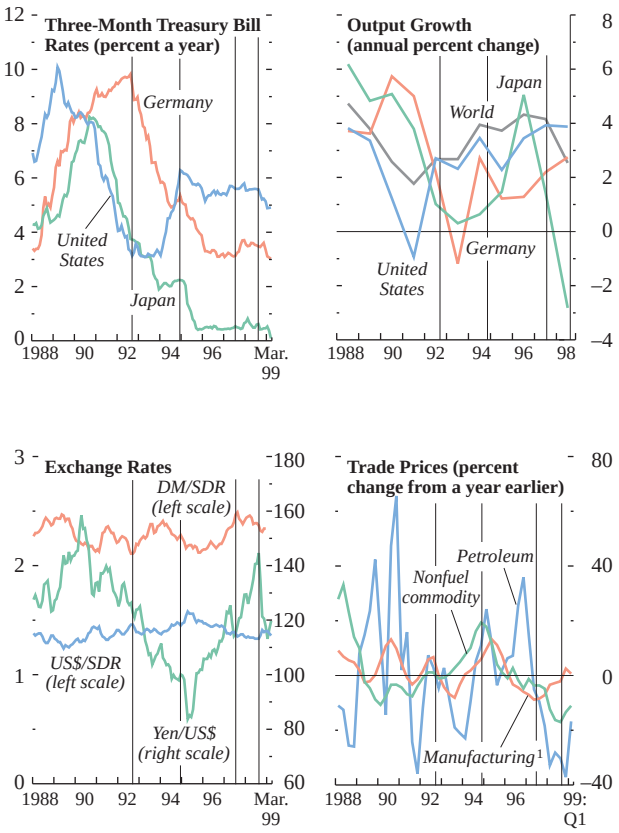
Observed differences between crisis and noncrisis economies for some variables indicate fundamental or macroeconomic imbalances, such as unsustainable monetary and fiscal policies or unsustainable current account deficits under pegged exchange rates, that may have caused a country to develop a crisis even without contagion. Differences in other variables, however, such as trade links and financial market links, may identify vulnerabilities only when other economies suffer crises. In addition, investors might reassess risk and adopt more demanding criteria for "good" fundamentals or, in fact, reevaluate fundamentals, even when these have remained objectively unchanged during a period of "global" crisis. Consequently, differences in the fundamental variables between crisis and noncrisis countries might indicate vulnerability to contagion even when those differences might not lead to a crisis in a noncontagious global environment. The differences in average behavior, described below, do not necessarily imply any causal link between these variables and the occurrence of contagious crises but may simply indicate a source of vulnerability to these crises. Furthermore, the results reflect the sample of countries and the criterion used to identify crises in terms of currency pressure. In particular, as mentioned above, the group of crisis countries may exclude several economies that suffered financial market pressures as reflected by sharply rising interest rates, falling equity prices, or widening sovereign bond yield spreads. An alternative criterion might include these countries if the relevant comparable data were available for a sufficiently large set of industrial and emerging market economies over the full sample period.

Countries that suffered currency pressures during the major financial crises of the 1990s showed sev-

[15]For the industrial country averages, all four global crises were pooled together. For the emerging market country averages, the Mexican crisis, the Asian crisis, and the Russian crisis—the three global crises that most affected the emerging market economies—were pooled together. Averages including only the ERM crisis for the industrial countries were not substantially different in general from the industrial country averages, and averages pooling all global crises for the emerging market economies or pooling only the Mexican and Asian crises for the emerging market economies were not substantially different in general from the emerging market country averages.

Figure 3.7. Common Shocks: Interest Rates, Output Growth, Exchange Rates, and Trade Prices

A substantial change in the external environment preceded each of the major crisis episodes.



Sources: IMF, *International Financial Statistics*; and *World Economic Outlook* database.

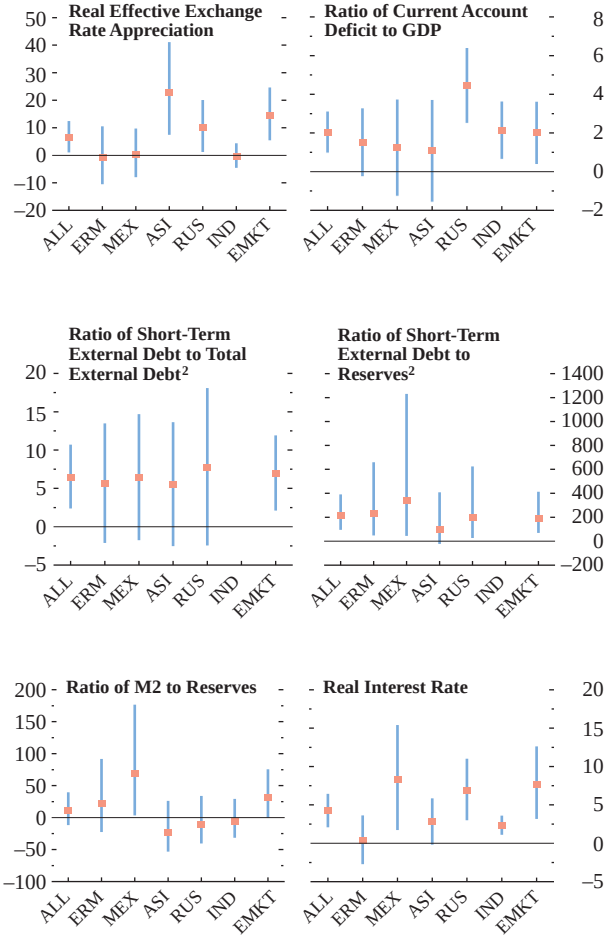
Note: The vertical lines represent the following (left to right): ERM crisis, which started September 1992; Mexican crisis, December 1994; Asian crisis, July 1997; and Russian crisis, August 1998.

[1]Export deflator for advanced economies.

Figure 3.8. Characteristics of Countries Vulnerable to Contagion[1]

(Percentage point differences between crisis and noncrisis countries, with standard error bands)

Crisis countries showed economic and financial characteristics significantly different from those of noncrisis countries.



eral indications of external and domestic imbalances (Figure 3.8).[16]

- On the *external side*, the appreciation of the real exchange rate during the three years prior to the onset of each of the major crises, a possible proxy for loss of international price competitiveness and exchange rate misalignment, was almost 15 percentage points larger on average for crisis than for noncrisis emerging market economies. For the industrial countries, the appreciation was not significantly different between crisis and noncrisis countries. The external current account deficit in the year before the crisis was also larger on average by over 2 percentage points of GDP in crisis than in noncrisis countries for both industrial and emerging market economies, which may further indicate poor trade competitiveness in the crisis countries. However, in many cases, particularly during the Asian crisis, there were no significant differences in precrisis external current account balances between economies that experienced currency crises and those that did not. In addition, short-term external debt in relation to total external debt before the crisis was 6 percentage points higher, while the ratio of short-term debt to reserves in the year before the crisis was almost 200 percentage points higher, in emerging market crisis economies compared with noncrisis economies. This indicates that these crisis economies were vulnerable to a change in investor sentiment in an unfriendly or illiquid external environment—a potential source of financial contagion.[17] Other external sector variables, such as changes in the terms of trade, the level of external debt, and the share of external debt denominated in foreign currency, were found to be insignificantly different between crisis and noncrisis countries during the period before the crisis episode erupted.
- Evidence of precrisis *domestic macroeconomic imbalances* that may have made a country vulnerable to financial market contagion in some instances included a high ratio of broad money (M2) to international reserves, high real interest rates, a banking crisis, slow GDP growth, and a high unemployment rate. The ratio of broad money to international reserves is the inverse of the extent to which liquid domestic liabilities of the banking system are backed by foreign exchange reserves and thus is a measure of the banking system's ability to withstand currency pressures. For emerging market crisis economies, this

[16]Univariate probit regressions of a crisis dummy variable on the variables discussed below yielded almost identical results, in terms of statistical significance, to those obtained from differences between averages of variables of crisis and noncrisis countries.

[17]Data on short-term and total external debt were not available for industrial countries.

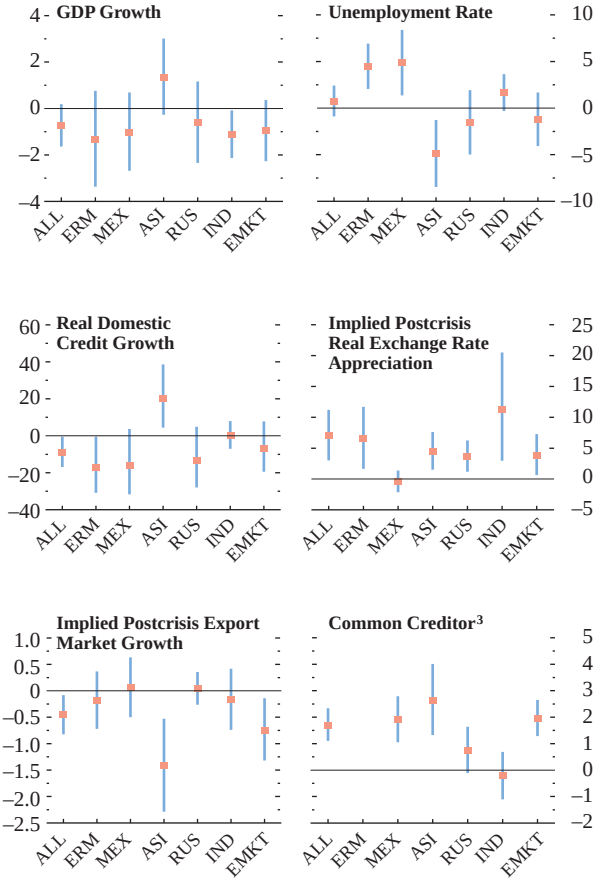
ratio in the year before the crisis was 30 percentage points higher, on average, than in noncrisis economies. There were, however, no significant differences between crisis and noncrisis industrial countries. The real short-term interest rate during the year before the crisis was 4 percentage points higher in crisis countries than noncrisis countries. A high real interest rate could indicate the response of authorities to an overheating economy or could indicate pressures on the currency market in advance of the onset of the global crisis. For industrial countries and Latin American countries, a banking crisis in the year before the onset of a global currency crisis was also an indication of vulnerability to currency market pressures.[18] All of the industrial countries and two-thirds of the Latin American countries that had a banking crisis in the year prior to a global currency crisis suffered currency market pressure. For the other emerging market economies, banking crises did not indicate vulnerability, since only 11 percent of the countries that had a banking crisis suffered currency market pressure the following year.[19]

- In the year prior to the crisis, *GDP growth* was slower in the crisis countries than in the noncrisis ones. In particular, in the industrial countries suffering crises, output growth was over 1 percentage point lower on average. Before the ERM crisis, the difference in industrial country growth rates between crisis and noncrisis countries was even larger, 2 percentage points on average. The differences in growth between crisis and noncrisis countries were smaller for the emerging market economies. Low output growth may be an indicator that external or domestic imbalances, such as large external current account or fiscal deficits, may become increasingly untenable. In addition, for the industrial countries before the ERM crisis, the weakness in economic activity, along with high unemployment rates, which were 4 percentage points higher on average in the crisis countries, could indicate that governments would be unwilling to defend exchange rate arrangements by implementing policies, such as raising short-term interest rates, that could slow down real activity even further.
- Other macroeconomic variables that could indicate internal imbalances, such as the fiscal deficit, public debt, inflation, and real broad money growth, were found to be indistinguishable on

[18]The data set for banking crises is described in Chapter IV, "Financial Crises," in the May 1998 *World Economic Outlook*. It was augmented to cover the additional ten countries included in the analysis of this chapter.

[19]Banking crises may only be a lagging indicator of banking sector problems. See Chapter IV, "Financial Crises," in the May 1998 *World Economic Outlook* for a more complete discussion of this issue.

Figure 3.8 *(concluded)*



[1]The square near the midpoint of each line is the difference between the average for crisis and noncrisis countries. The top and bottom of each line represents the 1.645 standard error bands. If the variables are distributed normally, 5 percent of observations would lie above each line, another 5 percent below. ALL includes all countries and crises; ERM, all countries and the ERM crisis; MEX, all countries and the Mexican crisis; ASI, all countries and the Asian crisis; RUS, all countries and the Russian crisis; IND, industrial countries and all crises; and EMKT, emerging market economies, excluding the ERM crisis. The real effective exchange rate appreciation is the three-year appreciation of that exchange rate, and real domestic credit growth is the three-year growth of domestic credit deflated by the consumer price index in the years prior to the crisis. The ratio of current account deficit to GDP, the ratio of short-term external debt to total external debt, the ratio of short-term external debt to reserves, the ratio of M2 to reserves, GDP growth, the unemployment rate, and the common creditor variable (defined in the text) are in the year before the crisis. The real interest rate is the average of the short-term nominal interest rate in the 12 months before the crisis less 12-month inflation. The implied postcrisis real exchange rate appreciation and the implied postcrisis export market growth are defined in the text.

[2]Data unavailable for industrial countries.

[3]Data unavailable for ERM countries.

average between crisis and noncrisis countries during the period before the major crises.[20] Relatively high real domestic credit growth may be an indicator not only of balance of payments or exchange rate pressures, but also of an unsustainable lending boom that could later lead to a weakened banking system. This variable was found to be significantly different in crisis and noncrisis countries only for the Asian crisis episode. Nevertheless, when it is combined with the appreciation of the real exchange rate and the growth of unbacked domestic banking sector liabilities (the ratio of broad money to international reserves), the resulting aggregate variable was found to be significantly different between crisis and noncrisis emerging market economies in all but the ERM crisis.[21] While this aggregate variable performed reasonably well as an indicator of vulnerability to currency crises and financial contagion for emerging market economies, it generally does not do so for the industrial countries. Moreover, it combines variables that indicate internal and external imbalances as well as susceptibility to a reversal of investor sentiment.

- *Trade linkages* may also help to identify countries vulnerable to contagion. They can be measured by the implied appreciation of the real exchange rate and the implied decline of export market growth because of the changes in the international environment in the months after the onset of the global crisis. These can be used to assess the impact of trade linkages on the competitiveness of an economy and the potential for export growth when other economies suffer from crises.[22] These variables were found to be different, on average, between crisis and noncrisis economies in many cases. The implied appreciation of the real exchange rate, for example, was significantly higher in general for the crisis countries in the sample. However, for all countries during the Mexican crisis and for industrial countries during the ERM crisis, the averages for crisis and noncrisis economies were not significantly different. The difference between crisis and noncrisis countries with respect to the implied slowdown in export market growth was greatest for the Asian crisis and for emerging market economies. The evidence of trade spillovers through a slowdown in export market growth was weakest for the industrial countries in the ERM crisis, where the implied slowdown was actually larger on average for noncrisis economies than for crisis ones.
- Common creditor *financial market linkages* proved to be very important in explaining differences between crisis and noncrisis emerging market economies. The common creditor was identified by the country that lent the most to the first country in crisis in each of the major crises.[23] The common creditor variables—that is, the importance of the common creditor for the borrowing country and the importance of the borrowing country for the common creditor in the year prior to the crisis—were significantly higher in the crisis emerging market economies than in the noncrisis ones. On average, the common creditor held a 10 percentage point higher share of the external bank liabilities of the crisis countries than of the noncrisis countries, whereas the average crisis country held a 5 percentage point higher share of the external loan portfolio of the common creditor

[20]Other studies, however, have found that some of these macroeconomic variables may be significantly different in crisis and noncrisis countries. For example, Jeffrey A. Frankel and Andrew K. Rose, "Currency Crashes in Emerging Markets: Empirical Indicators," NBER Working Paper 5437 (Cambridge, Massachusetts: National Bureau of Economic Research, January 1996), find that public sector debt as a share of total debt helps to predict crises one year in advance. Sebastian Edwards, *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries* (Cambridge, Massachusetts: MIT Press, 1989), finds that the fiscal deficit in the three years prior to a devaluation is higher for those countries that devalue than for a control group. In addition, data on public sector debt was available only for a very limited number of countries.

[21]See Jeffrey D. Sachs, Aaron Tornell, and Andres Velasco, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity*, No. 1 (1996), pp. 147–215, for a fuller discussion of the interaction between these variables; see also Chapter IV, "Financial Crises," in the May 1998 *World Economic Outlook*, and Aaron Tornell, "Common Fundamentals in the Tequila and Asian Crises," (unpublished; Cambridge, Massachusetts: Harvard University, 1998), for additional evidence concerning the usefulness of considering these variables together in indicating which economies suffered currency market pressures in the Mexican and Asian crises.

[22]The implied appreciation of the real exchange rate and the implied slowdown of export market growth are proxies, respectively, for the price and income effects induced by the crises in other countries. An ideal measure of this price effect would include all the effects of competitor-country devaluations, through both bilateral trade linkages and competition in third markets, but would exclude own-country exchange rate changes. The implied appreciation of the real exchange rate was constructed using annualized IMF data on actual real effective exchange rates that include these direct and indirect effects of exchange rate movements in partner countries during the crisis period. To neutralize the own-country real exchange rate effect, the data were adjusted by replacing the actual exchange rate changes and inflation of the specified country with projections based on the trend in the three years prior to the crisis. The implied slowdown of export market growth was constructed using the trade-weighted slowdown in output growth of partner countries during the year after the crisis compared with the average in the three years before the crisis. For the Asian and Russian crises, IMF estimates and projections were used because of data availability.

[23]These data, proxied by lending from Bank for International Settlements reporting banks, were available only for the Mexican, Asian, and Russian crises and generally only for emerging market economies. The results for industrial countries rely on data from only 5 of the 20 countries. The common creditor in the Mexican crisis was the United States; in the Asian crisis, Japan; and in the Russian crisis, Germany. Replacing Germany with the United States as primary lender in the case of the Russian crisis yielded similar results.

than the average noncrisis country. A variable indicating mutual importance, constructed by multiplying the two common creditor variables, also was almost always higher for crisis compared with noncrisis emerging market economies. These results suggest a potential financial market-linked transmission mechanism for contagion: the primary creditors for countries that suffer crises are likely to reassess their portfolios at the onset of a crisis and hence to withdraw funds from other countries as these portfolios are rebalanced. If there are regional differences in primary creditor relationships, this may help to explain the regional bunching of financial crises.[24]

Composite Indicators of Vulnerability to Contagion

The previous section examined differences in the behavior of a variety of variables between crisis and noncrisis countries. Although significant differences in the behavior of individual variables are suggestive of the factors underlying a crisis, they are not sufficient: a variable that may not be significant in isolation may be important because of its interaction with others; conversely, a variable that may appear relevant on its own may no longer be so when other variables are considered. For example, real effective exchange rate appreciation, while often an indicator of declining competitiveness and, hence, a potential precursor of balance of payments difficulties, is not necessarily worrisome if it is associated with stronger productivity growth in the domestic traded-goods and services sector than in the rest of the world.

The ideal procedure would be to consider the simultaneous importance of all the variables considered in the previous section. That would, however, lead to an overfitting problem, given the sample size (particularly, the number of crisis observations). To conserve degrees of freedom, an alternative procedure was employed, which aggregates these variables into composite indicators of external imbalances, internal imbalances, trade spillovers, and financial vulnerability.[25]

A composite measure of exchange rate appreciation, productivity growth in the export sector, and current account deficits was used as an indicator of the strength or weakness of the external position (Figure 3.9).[26]

[24]Evidence supporting financial market linkages as a channel of contagion is also provided by Graciela L. Kaminsky and Carmen M. Reinhart, "On Crises, Contagion, and Confusion" (paper prepared for the Duke University conference "Globalization, Capital Market Crises, and Economic Reform," November 1998).

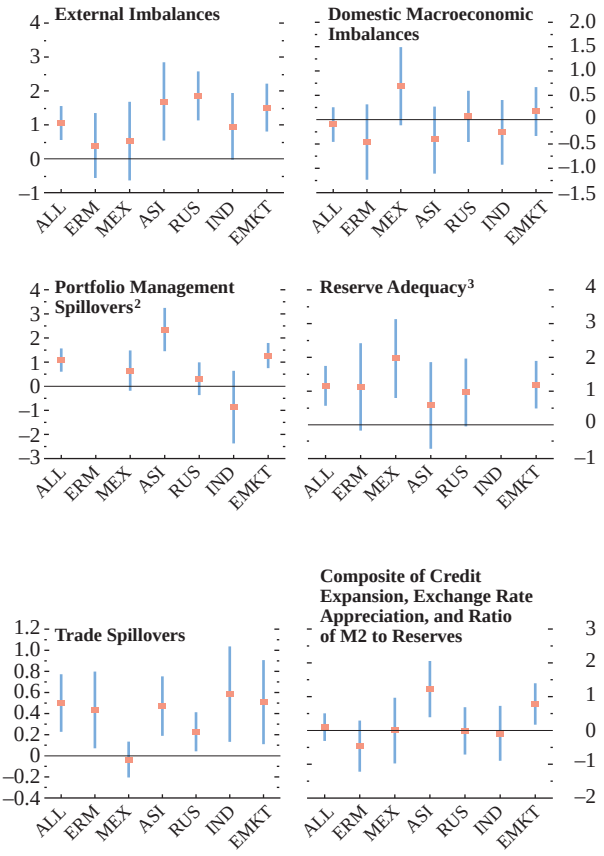
[25]The methodology used to construct the composite indicators is described in Figure 3.9. The choice of variables for the indicators was informed by analytical considerations, empirical evidence, and data availability.

[26]An increase in a composite indicator represents an increase in vulnerability to crises and is thus associated with high values of the index of exchange rate pressure.

Figure 3.9. Countries Vulnerable to Contagion: Characteristics of Composite Indicators[1]

(Differences in standard deviations between crisis and noncrisis countries, with standard error bands)

External imbalances, trade and financial linkages, and reserve adequacy differed significantly between crisis and noncrisis countries.



[1]See Figure 3.8 for definition of crises. The composite indicators, except for trade spillovers, are constructed by summing the underlying variables less their sample-specific means, weighted by the inverse of their sample-specific standard deviations. The underlying variables are: for external imbalances, the three-year appreciation of the real effective exchange rate, the negative of the three-year growth rate of exports relative to GDP, and the current account deficit in relation to GDP in the year prior to the crisis; for domestic macroeconomic imbalances, the fiscal deficit in relation to GDP and the growth rate of broad money relative to GDP in the three years prior to the crisis; for portfolio management spillovers, the common creditor variable, as defined in the text, and short-term as a percent of total BIS bank debt in the year prior to the crisis; and for reserve adequacy, the ratios of broad money to reserves and short-term external debt to reserves in the year prior to the crisis. The trade spillovers indicator is described in the text, while the composite of credit expansion, exchange rate appreciation, and M2 to reserves is constructed as described in the text after summing the underlying variables less their sample-specific means, weighted by the inverse of their sample-specific standard deviations.

[2]Data unavailable for ERM countries.

[3]Data unavailable for industrial countries.

Clearly, the greater is the real exchange rate appreciation, the slower is the productivity growth, and the larger is the current account deficit, the weaker is a country's external position, other things being equal. Government budget deficits and (excessive) monetary expansion were the indicators of internal macroeconomic weakness. Thus, large fiscal imbalances and rapid monetary growth, which may lead to expectations of a surge in inflation, are viewed as signals of weak domestic policies.[27] Both of these measures, however, may be discounted in the presence of robust economic growth: if rapid output growth is expected to persist, it will ease repayment of both domestic and external debt.

As noted earlier, crises may spread across countries because of trade and financial linkages and financial fragilities that render a country vulnerable to a self-fulfilling speculative attack. The measure of trade spillovers used in this chapter aggregates the price and income effects induced by the crises in other countries or, respectively, the implied appreciation of the real exchange rate and the implied decline of export market growth, as described previously.[28] Two measures of vulnerability to financial contagion were used. One measure, which operates through portfolio-management spillovers, includes the common creditor variable described earlier and the share of short-term bank debt to BIS banks. A second measure (reserve adequacy), intended to capture vulnerability to contagion from self-fulfilling speculative attacks, includes the ratio of M2 to reserves and of short-term external debt to reserves.[29]

Perceptible differences were found on average between crisis and noncrisis countries for several of the composite indicators (see Figure 3.9). In particular, indicators of external imbalances, reserve adequacy, and portfolio-management and trade spillovers were higher on average for the countries that suffered currency market pressure during the ERM, Mexican, Asian, and Russian crises than those countries that did not. The indicator for domestic macroeconomic imbalances examined in isolation, however, was not significantly different on average in crisis and noncrisis countries.[30] While this is not surprising for the Asian crises, where fiscal weaknesses were not at the heart of the problem, it is somewhat surprising for the Russian crisis, where the fiscal situation was the underlying fundamental reason for the crisis, as well as for the more recent Brazilian crisis, where weaknesses in the fiscal situation (and the associated political difficulties) contributed to the run on the real. This result may be partly a result of the choice of variables—in particular, it may not be simply the recent deficits that matter, but rather the broader fiscal situation including the outstanding stock of public sector debt and its maturity and currency composition, as well as prospective deficits. To some extent, debt considerations are captured by the ratio of short-term external debt to international reserves and the ratio of short-term external debt to total external debt. Another point to note is that, although fiscal weaknesses may be the underlying reason for a crisis in a specific country, such as Russia, if the crisis spreads to other countries through, say, trade or financial sector linkages, then the average fiscal positions of crisis and noncrisis countries may not be all that different.

The above results were generally corroborated in an econometric analysis of the simultaneous importance of these composite indicators.[31] Of interest, however, was that domestic macroeconomic imbalances, when associated with slow GDP growth in the years before a crisis, were important in identifying countries subject to currency market pressures when considered with other composite indicators. In other words, domestic imbalances added to a country's susceptibility to a crisis when other vulnerabilities were present.

External imbalances were particularly important in differentiating between crisis and noncrisis countries for emerging market economies and during the Asian and Russian crises. In fact, among the emerging market economies, there were only a few instances (for example, Kenya during the Mexican crisis, Taiwan and Korea during the Asian crisis, and Mexico during the Russian crisis) in which external imbalances were not worse in a crisis country than the average for noncrisis countries.

[27]The indicator of external imbalances was derived by aggregating the real effective exchange rate appreciation and (negative) the growth in the ratio of exports to GDP over the three years prior to the crisis, and the ratio of the current account deficit to GDP in the year prior to the crisis (similar results were obtained with the average of the current account deficit relative to GDP in the three years prior to the crisis). Growth in exports relative to GDP was taken as a proxy for the Balassa-Samuelson effect: in the absence of significant demand effects, this variable (normalized), should approximate the relative growth of productivity in the tradable sector vis-à-vis the nontradable sector, relative to other countries. The indicator of domestic macroeconomic imbalances combines the average ratio of general government fiscal deficit to GDP and the growth of the ratio of M2 to GDP in the three years prior to the crisis.

[28]For the trade spillover variable, a relative weight of one to two for the price and the income effect is chosen on the basis of the export elasticities estimated over a large sample of countries by Abdelhak Senhadji and Claudio Montenegro, "Time-Series Analysis of Export Demand Equations: A Cross-Country Analysis," Working Paper 98/149 (Washington: IMF, October 1998).

[29]Both measures are based on the values of the respective variables in the year prior to the crisis.

[30]Composite indicators that substituted other measures of monetary or credit expansion for the growth in broad money in relation to GDP were also insignificantly different on average for crisis and noncrisis countries.

[31]The multivariate econometric analysis used a pooled probit model to estimate the impact of the indicators of vulnerability on the probability of suffering a crisis. The analysis was limited to the emerging market economies during the past three major crises (Mexican, Asian, and Russian)—see Francesco Caramazza, Luca Ricci, and Ranil Salgado, "Trade and Financial Contagion in Currency Crises," Working Paper (Washington: IMF, 1999, forthcoming).

Portfolio-management spillovers and reserve adequacy were also strong indicators of currency market pressure for emerging market economies. For example, they help to explain the foreign exchange market pressures experienced by Argentina, Brazil, and South Africa during the Mexican crisis; those experienced by several Asian countries (including Indonesia, Korea, and Taiwan) and Russia during the Asian crisis; as well as the pressures on the Brazilian and Mexican currencies during the Russian crisis. The only exceptions among emerging market countries for the portfolio-management spillovers were during the Russian crisis, when a global flight to quality and liquidity affected a broad group of countries, not just those with close financial market linkages to Russia. A few countries that were less financially vulnerable, or that had stronger foreign reserve backing for domestic banking liabilities and short-term external debt, than the average of noncrisis countries suffered currency market pressure during the major financial crisis episodes. These included Hungary during the Mexican crisis, Malaysia during the Asian crisis, and Romania during the Russian crisis.

Trade spillovers were significantly greater on average for both industrial and emerging market crisis countries than for noncrisis countries in most instances other than the Mexican crisis, when many of the affected countries either were financially fragile or had financial market links to Mexico. For emerging market economies, they were particularly important during the Asian crisis because of the scale of regional trade between the Asian countries and the intensity of their competition in third markets, as well as the size of the devaluations during the crisis.

In brief, all indicators of spillovers and contagion are on average higher for crisis countries than for noncrisis countries. Trade spillovers arising from price competition and export market growth effects combined seem particularly relevant for industrial countries during all crises, and during the Asian crisis and the ERM crisis episodes. Portfolio-management spillovers are particularly significant for the Asian crisis and for the emerging market economies, while reserve adequacy appears very important in all cases except the Asian crisis.[32] The generally consistent significance of variables indicating vulnerabilities because of financial market linkages and reserve adequacy for emerging market economies suggests that contagion through financial channels may have played a role in the spread of recent emerging market crises.

In view of the significance of these financial channels, it is relevant to examine whether the presence of capital controls lowers the likelihood that a country will experience a currency crisis for a given set of fundamentals and financial vulnerabilities to contagion. There is some tentative evidence that capital controls helped to reduce a country's probability of suffering a crisis during the Mexican and the Asian crises; but they were less effective for the type of widespread withdrawal of investors from emerging markets that followed the outbreak of the Russian crisis. This result should be interpreted cautiously, however, because of the lack of accurate, comparable measures of the extent and effectiveness of restrictions on capital flows. The result is derived using a variable that indicates either the presence or the absence of capital controls based on the existence of restrictions on payments for capital transactions as reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.[33] This measure does not distinguish between controls on inflows and outflows—and it does not capture the breadth of controls or the extent to which they are binding. Furthermore, owing to a change in reporting, the measure used ends in 1995, and alternative ways of extending it to later years yield different conclusions, including that controls were not significant in reducing the probability of a country experiencing a crisis. This study does not, of course, explore the broader effects of capital and exchange controls through the market distortions they create.

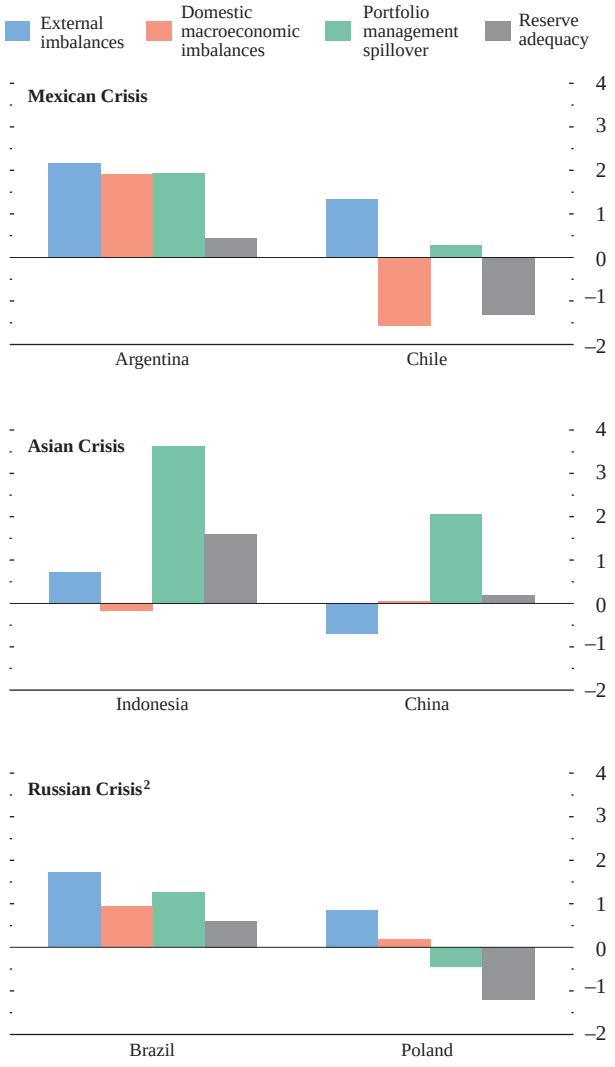
Finally, it may be of interest to compare the behavior of the composite indicators for some specific countries, some that did and some that did not experience considerable foreign exchange market pressures during the Mexican, Asian, and Russian crises (Figure 3.10). At the onset of the Mexican crisis, Argentina (which suffered contagion effects) had worse external and much worse internal imbalances than Chile (which was not much affected by contagion effects), as indicated by a larger real effective exchange rate appreciation, a larger fiscal deficit relative to GDP, and stronger growth of monetary aggregates. Argentina also seemed much more vulnerable to financial contagion, since its reliance on a common creditor in bank lending—the United States, which is the major lender to Mexico and to the region—was three times higher than Chile's and because it had a relatively small stock

[32]Data limitations prevented testing the portfolio-management spillover variable for the ERM crisis and the reserve adequacy variable for industrial countries.

[33]Similar data were used by Eichengreen, Rose, and Wyplosz, "Contagious Currency Crises," in their study of contagious crises in industrial countries. They found controls to be insignificant, generally, in reducing the probability of a country experiencing a crisis. Similar data were also used by Vittorio Grilli and Gian Maria Milesi-Ferretti, "Economic Effects and Structural Determinants of Capital Controls," *IMF Staff Papers*, Vol. 42 (September 1995), pp. 517–51, to study the effects and determinants of capital controls for a large group of countries. Sebastian Edwards, "Interest Rate Volatility, Capital Controls, and Contagion," NBER Working Paper 6756 (Cambridge, Massachusetts: National Bureau of Economic Research, October 1998), finds that Chile's controls on capital inflows may have played a role in preventing contagion from Mexico during the Mexican crisis by providing the Chilean monetary authorities greater short-term control over domestic interest rates.

Figure 3.10. Selected Countries: Indicators of Vulnerability[1]
(Deviations from sample averages)

Countries that experienced strong foreign exchange market pressures during the Mexican, Asian, and Russian crises exhibited greater vulnerability to contagion than countries that did not.



[1]Variables are defined in Figure 3.9, and the values refer to precrisis periods.

[2]For Brazil and Poland during the Russian crisis, the indicator of domestic macroeconomic imbalances is the average ratio of the normalized fiscal deficit to GDP in the three years prior to the crisis. The ratio of M2 to GDP is excluded from the indicator for Brazil because it is affected by the rapid decline in inflation; it is also excluded for Poland for the purpose of comparison.

of foreign reserves backing its domestic banking and short-term external liabilities.[34]

In the Asian crisis, the external and internal positions of Indonesia before the summer of 1997 were neither particularly weak nor overall worse than those of China, which escaped the crisis. Indonesia looked more susceptible to financial contagion, given its larger ratio of short-term debt to reserves and the larger importance of Japan in bank lending. However, it is likely that China's large international reserves and current account surplus, together with capital controls, played a key role in sheltering it from the widespread financial contagion that affected the region.

At the onset of the Russian crisis, Brazil (which experienced foreign exchange market pressures) appeared more vulnerable than Poland (which also suffered some financial market and exchange rate pressures, but recovered relatively quickly) on account of both fundamentals and susceptibility to contagion. Brazil's poor export performance, and relatively large current account and fiscal deficits, highlighted weak external and internal positions,[35] while a much higher share of short-term bank debt, a greater mutual link to a common creditor (Germany, the largest lender to Russia), and a larger ratio of short-term external debt to international reserves indicated a greater vulnerability to financial contagion.[36]

Contagion and Currency Crashes

The above analysis provides some evidence that the characteristics of countries that experienced foreign exchange market pressures during the major crisis episodes in the 1990s differed from those that did not. It also suggests that to the extent that there was contagion, the contagion was not completely random; rather, it was usually associated with weaknesses in economic fundamentals before the crisis, especially in the external position, and with financial vulnerability and, in some cases, trade spillovers. In a few instances, however, some countries that did not appear to have weak economic fundamentals also suffered financial market pressures in these contagious crisis episodes. Not all currencies that experienced pressure crashed, however. This raises the question of why some currencies collapsed and others did not, or of what determines whether contagion leads to a currency crash.

[34]However, the need for international reserves may not be as great if a country is prepared to use the automatic mechanisms of a currency board, and if it has contingent credit lines with commercial banks, as is the case for Argentina.

[35]Brazil's larger current account deficit is even more problematic, since it is a relatively more closed economy.

[36]Although Poland's dependence on German banks is greater than Brazil's, Brazil's representation in the loan portfolio of German banks is much greater than Poland's. Taking these two common creditor variables together, Brazil shows a stronger financial link to Germany than does Poland.

The answer would seem to depend on several factors, including the state of the economy, the firmness of market sentiment about the government's ability and willingness to defend a particular value of the exchange rate, and the policy response to contagion. Clearly, the weaker the economy's fundamentals, the more difficult it is to withstand an attack, while at the same time the firmer will be the market's belief that the peg will not be sustained. In such circumstances, the more intense contagion effects are likely to be, increasing the likelihood that contagion leads to a currency crash. Policy responses are just as important—and they too interact with the state of the economy and market expectations. Apart from the effectiveness of the policy measures per se, the credibility of the policy response depends on how successful the market will judge them to be in light of current and prospective economic conditions.[37]

Brazil's experience is a case in point. It was successful in fending off contagion effects during the Asian crisis in October 1997 but not subsequently. In part this may have been because, with Brazil's relatively strong growth, the vigorous interest defense mounted in October 1997 was credible. But with growth slowing during 1998, and with critical macroeconomic weaknesses—particularly the fiscal deficit—having remained unaddressed, markets became increasingly skeptical of the sustainability of the pegged exchange rate of the real. Brazil failed to use the window of opportunity provided by its earlier success in deflecting contagion to take more determined steps to address macroeconomic imbalances, including by tackling the fiscal problems at the heart of investors' concerns as well as adjusting what was widely perceived to be an overvalued exchange rate. The defensive measures that had earlier been successful were no longer judged sufficient in a weaker domestic setting and a more risk-averse global financial environment.

From the experience of Brazil, as well as that of other countries, it would appear that contagion need not result in a currency crash. The likelihood that contagion can be successfully countered depends on the strength of an economy's economic and financial structures, as well as the interplay of policy responses and market sentiment conditioned by the extent to which domestic imbalances and weakness are expected to persist.

Some Policy Implications

The waves of emerging market crises in the past few years have generated considerable discussion of their policy implications—both for crisis prevention and crisis management—with much attention being paid to proposals for reform of the "architecture" of the international financial system. Various aspects of this topic have been explored in previous issues of the *World Economic Outlook* and in the *International Capital Markets* reports, as well as in other IMF documents, and work is ongoing. The problem of contagion in financial markets has to be addressed at the individual country level and at the systemic level, including by improving the functioning of international lender-of-last-resort–type mechanisms; private sector involvement in the solution of crises; the adoption of international standards in banking, accounting, the operation of securities markets, and bankruptcy regulations; the adoption of appropriate exchange rate arrangements; and improved multilateral surveillance and data dissemination. This concluding section does not delve into all of these issues;[38] rather, it simply traces some of the implications of the chapter's empirical findings.

One key finding is the central role of domestic economic policies in preventing crises in the first place and in reducing vulnerability to contagion. On the macroeconomic side it is essential to avoid significant exchange rate overvaluation and to pursue fiscal and monetary policies consistent with the exchange rate commitment. External imbalances were a factor in a number of emerging market financial crises in the 1990s. Financial sector fragility has been another generally present factor in either precipitating crises or rendering economies vulnerable to contagion. Domestic policies aimed at strengthening banking and financial systems are another crucial element, therefore, of any comprehensive strategy to prevent crises. But ensuring that banks are reasonably sound may not suffice to prevent self-fulfilling financial crises: it is also important to ensure that banks are not exposed to liquidity crises. In this regard, it is important to pay attention to the maturity structure and currency composition of debt. Short-maturity debt is risky because it increases the potential magnitude of capital outflows. Hence, it may be necessary to go even further and adopt prudential standards that serve to limit short-term borrowing by domestic banks.[39] Similarly, the maturity structure of public debt should also be monitored, since a change in investor sentiment could make it difficult for the government to roll over a large stock of short-term debt, possibly leading to an attack on the currency.

[37]Differences in policy responses in recent crises have been described in previous issues of the *World Economic Outlook*—see, in particular, "The Role of Monetary Policy in Responding to Currency Crises," Box 2.3 in the October 1998 *World Economic Outlook*, pp. 40–43.

[38]The role and functions of an international lender of last resort are subject to considerable confusion and controversy, partly because they are not uniquely defined. For a discussion of these and related issues, see Stanley Fischer, "On the Need for an International Lender of Last Resort" (www.imf.org/external/np/speeches/1999/010399.htm).

[39]A case can be made for treating foreign loans differently from domestic loans because of the limited ability of the domestic central bank to be a lender of last resort on foreign borrowing.

The likelihood of an attack on a country's currency and the country's chances of repelling the attack depends on its stock of foreign exchange reserves. It is the ratio of short-term debt to international reserves that matters, rather than simply the level of short-term debt. Thus, policies to limit the accumulation of short-term debt could usefully be supplemented by the maintenance of larger amounts of foreign exchange reserves. Both of these measures may not suffice, however. First, although limiting the accumulation of short-term debt reduces the difficulties associated with the possible unwillingness of foreign creditors to roll over existing loans, it does not, in the absence of capital controls, limit the quantity of domestic bank liabilities in relation to the stock of foreign exchange reserves, and hence the potential for capital flight by domestic residents. Second, the accumulation and holding of international reserves is costly, both because of the consumption and investment forgone by the need to run trade surpluses and because of the interest cost to the government of holding relatively liquid foreign exchange reserves as opposed to the cost of issuing domestic debt. These considerations, among others, point to the need for arrangements to provide sufficient international liquidity to help countries deal with the type of large-scale financial crises that can spring from sudden shifts in investor sentiment.

Since emerging market crises in recent years have for the most part been characterized by the inability of monetary authorities to defend a fixed exchange rate, often following large reserve losses, the attractiveness of flexible exchange rates has increased. But freely floating exchange rates may not be suitable for all countries, either because exchange rates may be excessively volatile or because fixed exchange rates may be useful as a nominal anchor and in stopping high inflation. Several points should be noted in this regard. First, exchange rate–based stabilizations often have ended up in balance of payments crises (Box 3.1). As Brazil's recent crisis has again made clear, it is critical to have a strategy to adjust a peg when needed in an orderly fashion as part of an overall adjustment policy package. Second, while a pegged exchange rate, by providing a clear and transparent nominal anchor, can help to establish the credibility of government policies, an adjustable peg runs the risk that it may become unsustainable if confidence in the authorities' willingness or ability to sustain it is lost. A currency board may be an attractive option in some cases, but is also very demanding and not appropriate for all emerging market economies. Third, it is possible for a country to have greater exchange rate flexibility without going all the way to free floating—for instance, by adopting wide bands around central parities and intervening actively within the band.

Emerging market crises in recent years have highlighted the explosive combination of overvalued exchange rates, open capital markets, and poorly

Box 3.1. Recent Experience with Exchange-Rate-Based Stabilizations

Since the late 1980s, a significant number of developing countries have undertaken *exchange-rate-based stabilization programs*—that is, disinflation programs that have included preannounced limits on nominal exchange rate movements. Major programs of this type were implemented in several Latin American economies with histories of chronically high inflation, as well as in many transition economies that had suffered dramatic increases in inflation following the collapse of central planning. A list of these stabilization programs for the countries where 12-month inflation at the beginning of the program exceeded 100 percent is presented in the table. The experiences with these programs has tended to confirm the benefits and pitfalls of using the exchange rate as the nominal anchor for reducing high inflation.[1]

All of these programs had remarkable success in reducing inflation from extremely high levels (*see table*). After their implementation, the stabilizing effect of the exchange rate commitment on prices and expectations typically permitted inflation to be reduced rapidly, and by the third year of the program annual inflation in most cases had reached single-digit rates. Moreover, these gains in disinflation have been sustained, with inflation typically falling further subsequently. Even in those cases where the exchange rate commitment was abandoned, inflation remains substantially lower than before the start of the program.

As in earlier exchange-rate-based stabilization programs, disinflation during recent programs was generally accompanied by rapid real economic growth (*see figure*). In most cases, this phenomenon is perhaps explained more by the timing of the programs than by aggregate demand and supply effects induced by the stabilization itself: the programs typically were launched after a period of one or more years of recession or stagnation, and they generally followed or coincided with major structural reforms, which were especially radical in the transition economies. Nonetheless, the persistence of rapid real output growth during the recent programs is consistent with the evidence from earlier programs that stabilizations from high inflation that rely on the exchange rate as the nominal anchor tend to be expansionary.[2]

[1]For a recent review of the theoretical and empirical literature on exchange-rate-based stabilization, see Guillermo A. Calvo and Carlos A. Végh, "Inflation Stabilization and BOP Crises in Developing Countries," NBER Working Paper 6925 (Cambridge, Massachusetts: National Bureau of Economic Research, February 1999). Most of that literature focuses on stabilizations undertaken until the mid-1980s. See also "The Rise and Fall of Inflation—Lessons from the Postwar Experience," Chapter VI in the October 1996 *World Economic Outlook*.

[2]The expansionary effects of exchange-rate-based stabilization programs have been attributed to demand effects resulting from inflation inertia, lack of credibility, and the

The recent exchange-rate-based stabilizations also confirm the risks that can be associated with this disinflation strategy (see figure). In all countries there was a marked tendency during the first three years of the program for the domestic currency to appreciate in real terms, with a concomitant increase in the external current account deficit. This increase was generally financed by substantial capital inflows, partly attracted by the restoration of investor confidence and the expectation that the exchange rate commitment would be honored at least in the near future. These capital inflows often permitted international reserves to be maintained or even increased, but in general they implied a considerable buildup in external liabilities. As a result, the economies implementing these programs became increasingly dependent on international capital markets and more vulnerable to sudden reversals in capital flows.

In this context of heightened external vulnerability, inconsistencies between economic policies and the exchange rate regime led in some cases to severe currency crises, including the collapses of the Mexican peso in December 1994, the Russian ruble in August 1998, and the Brazilian real in January 1999. In each of these cases a combination of domestic and external factors led to the attack on and subsequent devaluation of the domestic currency. Policy slippages, however, invariably played an important role. In Mexico, the crisis came after a period of accommodating monetary policy and a strong expansion of credit that was inconsistent with the exchange rate anchor.[3] In Russia, the failure for many years to bring the fiscal situation under control led to levels of public debt and debt-service payments that became increasingly unsustainable. And in Brazil, the efforts of the government to cut the public sector deficit and reduce the public debt encountered opposition and delays in the Congress. All these crises were very costly in their effects on the credibility of the authorities and following the devaluations were accompanied by rising inflation and plummeting output.

Most of the recent programs, however, did not end in a currency crash.[4] In half of the countries that did not experience a currency crash, the consistency of economic policies and the exchange rate regime was ensured by the constraints imposed by the adoption of *currency board arrangements*, which, in addition to fixing the value of the exchange rate, limit the issuance of domestic currency to the amount that can be covered by the central bank's holdings of foreign exchange. This type of monetary and exchange rate arrangement was adopted by Argentina, Estonia, Lithuania, and, more recently,

(Box continues on next page.)

timing of the purchases of consumer durables, and to supply effects stemming from the response of labor supply and investment. For details, see Calvo and Végh, "Inflation Stabilization and BOP Crises in Developing Countries."

[3]The Mexican crisis was discussed in detail in Annex I of the May 1995 *World Economic Outlook*, and in Chapters II and III of the August 1995 *International Capital Markets* report.

[4]Defined as a nominal depreciation of the domestic currency of at least 25 percent in a year, along with a 10 percent increase from the previous year in the rate of depreciation. This definition is similar to the one used in Jeffrey A. Frankel and Andrew K. Rose, "Currency Crashes in Emerging Markets: Empirical Indicators," NBER Working Paper 5437 (Cambridge, Massachusetts: National Bureau of Economic Research, January 1996). It excludes a priori instances where a currency came under severe pressure but the authorities were able to defend it.

Major Exchange-Rate-Based Stabilization Programs Since the Late 1980s[1]

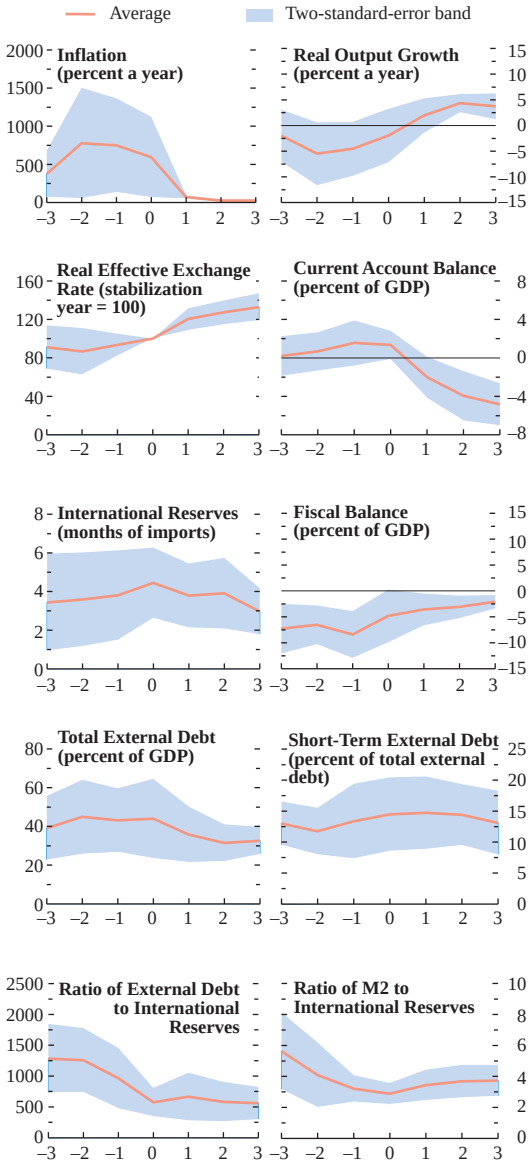
Country	Beginning Date	Exchange Rate Arrangement[2]	Twelve-Month Inflation: At start of program	Twelve-Month Inflation: Third year of program	Twelve-Month Inflation: In 1998	Did the Program End in a Currency Crash?
Mexico	December 1987	Peg, crawling peg, widening band	143.7	29.9	18.6	Yes (December 1994)
Poland	January 1990	Peg, crawling peg, crawling band	639.6	39.8	8.6	No
Uruguay	December 1990	Crawling band	129.8	52.9	8.6	No
Nicaragua	March 1991	Peg, crawling peg	20,234.3	3.4	. . .	No
Argentina	April 1991	Currency board	267.0	4.3	0.7	No
Estonia	June 1992	Currency board	1,085.7	29.2	4.4	No
Croatia	October 1993	Asymmetric peg, managed float	1,869.5	4.0	5.3	No
Lithuania	April 1994	Currency board	188.8	8.4	2.4	No
Brazil	July 1994	Peg, crawling peg	4,922.6	6.1	0.4	Yes (January 1999)
Russia	July 1995	Band, crawling band	226.0	5.5	66.8[3]	Yes (August 1998)
Bulgaria	July 1997	Currency board	1,471.9	. . .	3.2[3]	No

Sources: National authorities; and IMF staff estimates.
[1]In countries where the 12-month inflation rate was above 100 percent at the beginning of the stabilization program.
[2]Where more than one arrangement is listed, the sequence of arrangements is indicated.
[3]November 1997–November 1998.

Box 3.1 *(concluded)*

Recent Exchange-Rate-Based Stabilizations: Selected Economic Indicators[1]

(Centered on the year of stabilization)



Sources: IMF and World Bank staff estimates.

[1]Includes data for the following exchange-rate-based stabilization experiences (year of stabilization in parenthesis): Mexico (1987), Poland (1990), Argentina (1991), Croatia (1993), Lithuania (1994), Brazil (1994), and Russia (1995).

Bulgaria. The currency boards implemented in these countries all remain in place, confirming that the decision to adopt such an arrangement should be made not only from the perspective of short-run inflation stabilization, but also taking into account the medium- or long-run consequences of the inability to implement an independent monetary policy after the stabilization is accomplished.[5]

In the other half of the countries that did not experience a currency crash, the consistency of macroeconomic policies was attained in part by accepting some degree of exchange rate flexibility. In Poland, for instance, the exchange rate regime during the stabilization started as a fixed peg to the U.S. dollar but was later modified, first to a fixed peg to a basket of currencies, then to a preannounced crawling peg, and subsequently to a preannounced crawling band with ±7 percent margins. To varying degrees, the stabilizations in Uruguay, Nicaragua, and Croatia also allowed for some degree of exchange rate flexibility, either by design of the exchange rate regime adopted at the beginning of the stabilization or by subsequent revisions of the original regime as stabilization progressed.[6] Without supporting economic policies, however, the introduction of some degree of exchange rate flexibility was generally insufficient to prevent a currency crash. Before their collapse, the exchange rate regimes in Mexico, Russia, and Brazil had all been made more flexible, although not sufficiently so to avoid a crisis as a result of other policy shortcomings.[7]

To summarize, recent experiences with exchange-rate-based stabilization programs confirm that they can be very effective in stopping high inflation, and that economic performance can improve significantly soon after the launching of the program. It is key, however, that disciplined macroeconomic policies support the exchange rate anchor. In addition, a decision needs to be made on whether to make a long-term binding commitment to a fixed exchange rate, or whether to allow for some degree of exchange rate flexibility after a while. In the latter case, the degree of flexibility should be sufficient to be consistent with the fiscal and monetary policies being implemented.

[5]For a review of currency board arrangements, see Tomás J. T. Baliño, Charles Enoch, and others, *Currency Board Arrangements: Issues and Experiences*, Occasional Paper 151 (Washington: IMF, 1997).

[6]These revisions typically pointed toward accepting greater exchange rate flexibility. In Croatia, however, the replacement of an original ceiling on the nominal exchange rate by a noncommital managed-float regime did not imply greater volatility in the exchange rate. Also, the exchange rate band in Uruguay recently was narrowed (in April 1998).

[7]For a discussion of methods for moving to greater exchange rate flexibility under alternative circumstances, see Barry Eichengreen, Paul Masson, and others, *Exit Strategies: Policy Options for Countries Seeking Greater Exchange Rate Flexibility*, Occasional Paper 168 (Washington: IMF, 1998).

supervised and regulated financial systems.[40] More effective supervision and regulation of financial systems is crucial to reduce the risk of crises. Open capital markets yield substantial benefits, even if they constrain national monetary and fiscal policies and may facilitate excessive borrowing. In some instances a case can be made for limiting short-term capital inflows through taxes on capital imports, foreign deposit reserve requirements, or similar measures, but global financial integration is driven by technological and economic forces that cannot easily be reined in and that generally carry many benefits. In addition to sound and adequately regulated financial systems, greater exchange rate flexibility can help to discourage the excessive buildup of uncovered foreign currency debt by making both foreign and domestic investors more aware of exchange rate risks. By establishing that exchange rate appreciations can be followed by depreciations, so that market participants face a two-way bet, some short-term capital inflows may be deterred, and the need for subsequent corrections of the exchange rate may be less acute. The importance of this is underscored by the fact that many emerging market crises in recent years have been preceded by large private capital inflows into the crisis country.

Regardless of the exchange rate regime, macroeconomic policies need to support the arrangement to guarantee its success. In this respect, the finding of this chapter that countries that experienced intense foreign exchange market pressures during the major financial crisis episodes of the 1990s generally exhibited weak fundamentals or financial vulnerabilities in one or more dimensions suggests that countries with weaker fundamentals are more likely to fall prey to the forces of contagion than are economies with stronger underlying structures and policies.

[40]For a comprehensive discussion of analytical issues and policy considerations that arise in conjunction with capital account liberalization, see Barry Eichengreen, Michael Mussa, and others, *Capital Account Liberalization: Theoretical and Practical Aspects*, Occasional Paper 172 (Washington: IMF, 1998).