

Commentary: The Causes and Propagation of Financial Instability: Lessons for Policymakers

Morris Goldstein

Rick Mishkin is to be commended for providing us with a rich paper that really takes the asymmetric information view of financial crises through its paces. Of particular interest is his argument that the four key factors behind most financial crises have been increases in real interest rates, increases in uncertainty, asset market effects on balance sheets, and problems in the banking sector.

Since I agree with the bulk of Rick's conclusions and policy implications, I want to focus my remarks on the relevant related question of what we know about early warning indicators of financial crises, especially in emerging markets. Do the factors that Rick highlights show up as among the better early warning indicators of banking and currency crises? In seeking to answer that question, I'm going to draw on work in progress with my Institute for International Economics colleague, Carmen Reinhart, (Goldstein and Reinhart, 1997), as well as on some other recent literature.¹

Why an early warning of financial crises matters

Perhaps the best place to start is to ask why one might care about identifying early warning indicators of financial crises? I think there are two answers.

First, when financial crises do occur, they can be extremely costly

for the countries involved. Since 1980, there have been more than a dozen banking crises in developing countries where the public-sector resolution costs have amounted to 10 percent or more of the country's GDP.² To take the most recent case, the public-sector bailout costs of the Thai financial crisis have already reached over 10 percent of GDP and are likely to climb further. For comparison, the bailout costs of the U.S. savings and loan crisis are generally put in the neighborhood of 2 percent to 3 percent of U.S. GDP. Indeed, if one makes a list of the 50 worst banking crises relative to the size of the economy over the past fifteen to twenty years—what I like to call the “Misfortune 50”—the U.S. savings and loan crisis doesn't even make the list. In contrast, the ongoing Japanese banking crisis is clearly a world-class banking crisis. In addition to the enormous fiscal costs of banking crises, research tells us that banking crises also exacerbate recessions, prevent national saving from flowing to its most productive use, constrain adversely the conduct of monetary policy, and increase the risk of undergoing a currency crisis as well.³

In a similar vein, currency crises too can be costly. In 1995, for example, Mexico's real output fell by about 6 percent—its worst recession in decades. During the exchange-rate-mechanism crisis of 1992-93, on the order of \$150 billion to \$200 billion was spent on official exchange market intervention in a fruitless effort to stave off devaluations and forced floating of exchange rates.

In short, we want to be able to recognize vulnerability to a crisis *beforehand* so that authorities can take pre-emptive action.

A second reason for analyzing early warning indicators is that market signals of default or currency risk may not provide much advance warning—especially when either public information on the borrower's creditworthiness is poor or when market participants expect an official bailout of the borrower. The estimated default risk on Mexican *tesobonos* jumped up after the Colosio assassination but then remained pretty flat right up until a few days before the outbreak of the peso crisis. Likewise, market measures of currency risk for the peso, while frequently departing from the government's announced exchange rate path, did not paint a picture of growing

devaluation risk.⁴ Nor did market measures of currency risk point strongly before the fact to devaluations in the ERM crisis.⁵ If interest rate spreads and/or private credit ratings only blow the whistle on future crises some of the time, are there other early-warning indicators that history suggests would do a better job, and if so, what are they?

Identifying good early warning indicators

Assume then, that we want to identify early warning indicators of banking and currency crises. How should we go about it? There are at least six issues we need to settle.

First, we need to decide on the sample of countries. One possibility would be to take a sample of one, namely the country that had the last big crisis—be it Thailand, Mexico or whatever. But you are not likely to be able to generalize much from one crisis. For example, did Mexico have a crisis because it had an 8 percent current-account deficit in 1994, or because the composition of its borrowing was too heavily weighted toward short-term and foreign-currency denominated debt, or because the banking system was already struggling with a rising share of nonperforming loans, or because the authorities did not tighten monetary and fiscal policy enough after a series of unfortunate political shocks, or because the government's commitment to the nominal anchor of a fixed exchange rate had allowed the peso to become too appreciated, or because, after the North American Free Trade Agreement (NAFTA), market participants reckoned that the U.S. government could not allow Mexico to default on its sovereign debt, or what?

Clearly, we need a larger sample to sort this out. In my work with Carmen Reinhart, we utilize a sample of 25 larger emerging-market economies and smaller industrial countries. Those countries are listed in Table 1. Our main reason for choosing this sample is that we wanted countries for whom data would be available on a monthly basis over the 1970-96 period. If we were prepared to use annual data, we could get a much larger sample—over 100 countries—but then we wouldn't be able to learn much about the timing of early warnings. In addition to the data constraint, Carmen and I chose to

Table 1
Countries and Time Periods Used in Goldstein & Reinhart
(1997)

Countries				
Argentina	Czech Republic ¹	Israel	Peru	Sweden
Bolivia	Denmark	Indonesia	Philippines	Thailand
Brazil	Egypt	Malaysia	South Africa	Turkey
Chile	Finland	Mexico	South Korea	Uruguay
Colombia	Greece	Norway	Spain	Venezuela

Time Periods

Monthly data from 1970-1995 used for estimation.

1996 and 1997 used for out-of-sample exercises.

¹ Majority of the data available only from January 1993 - November 1996.

restrict our attention to countries that already have some presence in international financial markets. At the same time, we excluded the larger industrial countries because they have characteristics (ranging from reserve currency status to their debt-servicing history) that may well make their vulnerability to financial crises different from that of emerging economies. Here too, it's notable that Rick in his paper argues that the crisis propagation mechanism is different for the larger industrial countries than for emerging economies.

Second, we need to decide what is a crisis. There are, of course, many possible definitions. In our work, we draw on a set of detailed International Monetary Fund (IMF) and World Bank country case studies and define a banking crisis in terms of bank runs, closures, and mergers, or large-scale public-sector takeovers of important financial institutions.⁶ One would get a pretty similar identification of banking crises if a crisis were instead defined as a case where all or most of the banking system's capital was exhausted. In the lion's share of these crises, nonperforming loans reach 10 percent to 15 percent or more of total loans.

For currency crises, we construct an index of exchange market pressure by taking a weighted average of changes in nominal exchange rates and changes in international reserves; when the nominal exchange rate depreciates and international reserves fall, exchange market pressure is greater. Note that this index applies both to fixed and flexible exchange rate regimes. Extreme values of this index—that is, readings of three or more standard deviations above the mean—are regarded as currency crises. If the sample were made up primarily of industrial countries, one would probably want to add interest rate changes to the index as another element of the response to currency attacks.⁷ But that is less appropriate for our sample where many countries were relative latecomers to capital market liberalization and/or used non-price controls during currency attacks.

Based on these definitions of banking and currency crises, our twenty-five sample countries experienced about 120 financial crises over the 1970-96 period; roughly three-quarters of these were currency crises, and one-quarter were banking crises. The banking crises are bunched in the 1980-95 period, whereas currency crises are somewhat more evenly distributed over time, albeit with the highest frequency in the 1980s. Each month in our sample is categorized either as a crisis or non-crisis period.

Task number three is to define what we mean by early. For currency crises, we define early as between one month and twenty-four months before the beginning of the crisis. For banking crises, we adopt a laxer definition of early—namely, either one month to twelve months before the start of the crisis or up to twelve months after the beginning of the crisis. We do that because banking crises frequently last four to five years—much longer than currency crises (typically less than a year), and because the peak of a banking crisis often takes place several years after the beginning. As such, there is some benefit in getting a warning even after the crisis starts.

The fourth task is to pick out a list of potential early warning indicators, using economic theory and past empirical work as a guide. In my work with Carmen, we've been focusing on a set of about twenty-five indicators; this represents less than one-third

of the indicators that have been tried in earlier empirical studies.⁸ These indicators are listed in Table 2. For about two-thirds of these indicators, monthly data are available; for the others, one has to settle for annual data. If there is one indicator I'd like to have but don't (because of data availability), it would be the share of bank lending going to the property sector cum the change in property prices.

Much like the approach used in selecting leading indicators to forecast business cycles, we draw these indicators from various sectors of the economy (that is, the real sector, the financial sector, the current account, and the capital account). In addition, we include indicators (that is, the money multiplier and the real interest rate) that often accompany the process of financial liberalization, along with those that should capture market expectations about either the future course of the economy or the likelihood of currency or banking crises occurring in the future (for example, interest rate spreads of various kinds, changes in private credit ratings, changes in equity prices, and so forth).

Given the indicators, step number five is to find an optimal threshold for each indicator that, once reached, is going to give us an accurate signal of a future crisis. Put in other words, what watermark has to be crossed before one considers the behavior of an indicator to be anomalous? We find those thresholds using an iterative procedure. Suppose, for example, we want to know the optimal threshold for current-account imbalances preceding currency crises. We start with an arbitrary tail of the frequency distribution for current-account imbalances, say, the 10 percent tail (in each country) that includes the largest ratios of current-account deficits to GDP. We then pool these observations on large current-account deficits. We regard any observation that falls in the 10 percent tail as a signal. We call it a true signal if a currency crisis occurs within twenty-four months after the signal was given, and a false signal if no crisis occurs within that early-warning time frame. We then experiment with different tails until we find the one that is the optimal threshold, that maximizes the number of true signals and minimizes the number of false signals. Too inclusive a threshold will

Table 2
**Selected Leading Indicators of Banking
and Currency Crises**

Indicator	Transformation	Data Frequency
Real output	12 month growth rate	Monthly
Equity prices	12 month growth rate	Monthly
International reserves	12 month growth rate	Monthly
Domestic/foreign real interest rate differential	Level	Monthly
Excess real M1 balances	Level	Monthly
M2/international reserves	12 month growth rate	Monthly
Bank deposits	12 month growth rate	Monthly
M2 multiplier	12 month growth rate	Monthly
Domestic credit/GDP	12 month growth rate	Monthly
Real interest rate on deposits	Level	Monthly
Lending interest rate/ deposit interest rate	Level	Monthly
Real exchange rate	Deviations from trend	Monthly
Exports	12 month growth rate	Monthly
Imports	12 month growth rate	Monthly
Terms of trade	12 month growth rate	Monthly
Moody's sovereign credit ratings	1 month change	Monthly
Institutional investor sovereign credit ratings	Semi-annual change	Semi-annual
General government consumption/GDP	Annual growth rate	Annual
Overall budget deficit/GDP	Level	Annual
Real credit to the public sector/GDP	Annual growth rate	Annual
Short term capital inflows/GDP	Level	Annual
Foreign direct investment/GDP	Level	Annual
Current account imbalance/GDP	Level	Annual
Current account imbalance/ investment	Level	Annual

Source: Goldstein and Reinhart (1997)

Table 3
Illustrative Examples of Optimal Thresholds
for Crisis Indicators

Indicator	Optimal Threshold (Upper or bottom tail)	
	<u>Currency crises</u>	<u>Banking crises</u>
Real exchange rate	10	10
Exports	10	10
Equity prices	11	10
Real output	11	14
M2 multiplier	14	10
Real interest rate on deposits	12	20
M2/international reserves	13	10

Sources: Kaminsky and Reinhart (1996) and Goldstein and Reinhart (1997).

generate too many false alarms; too selective a threshold will miss too many crises. In short, we look for the tail of the distribution that will minimize the noise-to-signal ratio.

The optimal threshold will often be different for each indicator; it will also frequently differ for a given indicator as between banking and currency crises. Table 3 presents some illustrative calculated optimal thresholds for a subset of indicators. But how do we go from the optimal threshold for a given indicator to the critical value of the indicator for a given country? Suppose, for example, we find that the optimal threshold for changes in exports preceding banking crises is 10 percent. What size export decline is cause for concern in Mexico versus say, Malaysia? To get that answer, we take the 10 percent global threshold but apply it to Mexico's and Malaysia's own distributions of changes in export receipts. Because those distributions typically differ across countries, the critical export signal is likely to differ as well. Table 4 illustrates that point by presenting some earlier calculated threshold values for changes in exports and changes in equity prices (preceding currency crises) in

Table 4
Illustrative Examples of Individual Country Thresholds
for Currency Crises

Country	Critical Value	
	Exports (Annual percentage change)	Equity Prices
Malaysia	-9.05	-15.20
Mexico	-13.01	-38.30
Sweden	-11.23	-20.78

Source: Kaminsky and Reinhart (1996).

Malaysia, Mexico, and Sweden. Note that Table 4 suggests that it takes a larger export decline and a larger equity price fall to signal a currency crisis in Mexico than it does in either Malaysia or Sweden. The message is that “one size doesn’t fit all” in identifying a good early-warning signal. You need to take some account of each country’s crisis history and the country-specific behavior of the indicator.

All of us have, I think, developed over the years a sense of “smell” for what kind of behavior in an economic indicator is cause for concern. What this signals approach—developed by Kaminsky and Reinhart (1996)—does, is force you to confront your priors with the data.

Sixth and last, you need to somehow identify the countries and time periods in which the probability of a crisis is/was higher than elsewhere or at other times. The way we do that is to take a weighted average of the number of indicators that have reached their optimal thresholds, where the weights are the past forecasting ability (that is, the noise-to-signal ratios) of the individual indicators. For example, if twelve of the twenty-four indicators are “flashing” (that is, have reached their optimal thresholds) for country A versus eighteen flashing for country B, then we conclude that country B is more vulnerable to a crisis than country A (assuming that flashing indicators for country B are just as reliable as those for country A). Similarly,

if many more indicators were flashing on the eve of the Mexican peso crisis than on the eve of the Czech kroner crisis, we would conclude that Mexico was more vulnerable than the Czech Republic.

You might ask, “Why do it this way?” Why not simply run a multivariate regression of the crisis index on the different indicators and let the regression give you both the probability of a crisis and the more important indicators. Indeed, some researchers have used that approach. We use the signals approach for two reasons. The regression approach, while it can tell you which indicators are statistically significant, can’t identify threshold values for monitoring purposes; also, there are some hints from earlier studies that the ability of the regression approach to generate accurate crisis forecasts tails off quickly as the forecast horizon moves beyond one period ahead.⁹ That being said, there’s clearly an advantage to checking the robustness of one’s results using both approaches.

Main findings

Enough foreplay. When you do this kind of exercise, what do you find out? Let me here quickly go through seven conclusions—some of them drawn from my ongoing work with Reinhart and some reflecting findings of earlier studies.

First, there are recurring patterns of behavior in the period leading up to banking and currency crises. The better leading indicators seem to anticipate correctly somewhere between 80 percent and 100 percent of the banking and currency crises that took place over the 1970-95 period. Of course, even the best leading indicators also send false alarms. In terms of adjusted noise-to-signal ratios, the best leading indicators send on the order of one false alarm for every two correct signals of currency and banking crises.¹⁰ In short, I do not read the evidence as suggesting that currency and banking crises typically come out of the blue—without any warning.

Second, on the whole, banking crises appear to be somewhat harder to forecast accurately than currency crises. I suspect that

much of the reason for that discrepancy is that banking crises also depend on various micro characteristics of the banking industry and of the (de facto) official safety net. Factors such as the perceived coverage and generosity of the official safety net, the extent of government ownership/involvement in the banking system, the level of bank capital, the degree of connected lending, and the quality of the accounting, disclosure, and legal framework, matter for vulnerability to banking crises. Unfortunately, data constraints and conceptual measurement issues mean that empirical work on forecasting banking crises is just beginning to include some of these variables in the model.¹¹

Third, there is wide variation in performance across leading indicators, with the best performing indicators displaying noise-to-signal ratios that are at least two or three times better (lower) than the worst-performing ones.¹² In addition, empirical work suggests that the leading indicators that show the best forecasting accuracy also tend on average to send the earliest and most persistent signals of banking and currency crises.

Fourth, among the high frequency indicators, we are so far finding—like some earlier studies such as Kaminsky and Reinhart (1996)—that the best leading indicators of banking crises are an upward deviation of the real exchange rate from trend, a decline in equity prices, a rise in the money multiplier, a decline in real output, a rise in the real interest rate, and a decline in export receipts (Table 5). For currency crises, real exchange rate appreciation, stock market decline, a recession, and a decline in exports again enter into the top group, along with the presence of a banking crisis, and a rising ratio of broad money balances to international reserves.¹³ Tests on the low frequency indicators (including current-account imbalances) are still in midstream. Three of the variables highlighted in Mishkin's paper—namely, recession, stock market crashes, and higher real interest rates—do very well in these empirical horse races; moreover, the emphasis Rick put on the perils of currency mismatches and foreign-currency denominated debt in emerging economies receive support from the superior performance of the real exchange rate as a leading indicator of both banking and currency crises. In assessing these

Table 5
Currency and Banking Crises:
Best Versus Worst Performing Indicators

	Currency crises indicator	Banking crises indicator
BEST	Real exchange rate	Real exchange rate
	Banking crisis	Equity prices
	Exports	M2 multiplier
	Equity prices	Real output
	M2/international reserves	Real interest rate on deposits
	Real output	Exports
WORST	Terms of trade	International reserves
	Domestic/foreign real interest rate differential	Terms of trade
	Imports	Excess real M1 balances
	Bank deposits	Lending interest rate/ deposit interest rate
	Lending interest rate/ deposit interest rate	Imports

Sources: Kaminsky and Reinhart (1996) and Goldstein and Reinhart (1997).

results, we are also buoyed by the fact that a recent IMF/World Bank study using annual data, a much larger sample of developing countries, and a multivariate logit analysis (rather than our signals approach) also finds low economic growth and high real interest rates to be important determinants of banking crises.¹⁴

Fifth, while our tests are not yet completed and while data on sovereign credit ratings are available for only a subsample of crises, our preliminary results suggest that neither interest rate spreads nor changes in credit ratings have performed as well in anticipating

banking and currency crises as the best of the indicators of economic fundamentals themselves. It may well be that these market variables do a better job of anticipating trouble at the level of individual banks than on a systemwide basis; in that connection, a recent study by Rojas-Suarez (1997) finds that interest rate spreads on deposits are a promising leading indicator of which individual banks subsequently fail in several Latin American emerging markets.

Sixth, banking and currency crises are typically characterized by a high proportion—usually at least 50 to 75 percent—of the leading indicators reaching their danger thresholds—and not by one or two isolated crisis signals. In other words, when a country is lurching toward a banking or currency crisis, many of the wheels come off at once. Table 6 illustrates this point. Note, for example, that in the early warning window preceding the 1994 Mexican peso crisis, about 60 percent of the indicators were flashing.

Seventh, several recent studies suggest that vulnerability to currency crises is increased both when the composition of external borrowing is heavily tilted toward a short-term, floating rate, and foreign-currency denominated debt, and when currency attacks are occurring elsewhere.¹⁵ On the latter point, contagion appears to be stronger during periods of turbulence than during more normal times; it seems to operate more on regional than on global lines, and it is more likely to run from large countries to small ones than the other way around.¹⁶ The recent currency turmoil in Asia also highlights the role that trade competitiveness can play in the contagion process: among a group of economies, which depend heavily on buoyant exports to sustain high growth rates, an exchange rate depreciation that gives one country an improvement in competitiveness may induce downward pressure on the currencies of its (regional) competitors, as market participants anticipate a return to the original competitive equilibrium. It remains to be seen, however, how debt-composition and contagion variables will perform as leading indicators (rather than as contemporaneous determinants) of currency and banking crises.

Table 6
Indicators Flashing During Earlier Banking and Currency Crises

Country	Banking	Currency	Share of indicators flashing	Banking Crisis	Real exchange rate	Exports	Equity prices	M2/intl. reserves	Real output	Excess M1	Intl. reserves	M2 multiplier	Domestic credit/GDP	Real interest on deposit	Terms of trade	Domestic/foreign real interest rate diff.	Imports	Bank deposits	Lending deposit rate	
Argentina	Mar 1980		71		1	1	0	1	na	0	1	1	0	1	1	1	1	1	0	
		Jul 1982	80	0	1	1	1	1	1	0	1	0	1	1	na	1	1	1	1	
		Feb 1990	47	0	0	1	0	0	1	1	1	1	0	na	1	0	1	0	0	1
Bolivia		Nov 1983	67	0	1	1	na	1	1	1	0	1	1	0	1	1	1	0	0	
Brazil		Nov 1990	81	0	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1
		Oct 1991	69	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	1
Chile	Sep 1981		87		1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0
		Aug 1982	75	1	1	1	1	0	1	1	0	1	0	1	1	1	1	1	0	1
Colombia		Feb 1985	80	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	na	
Denmark		Aug 1993	71	0	0	1	1	1	1	1	1	1	0	1	na	1	0	1	na	
Finland	Sep 1991		80		1	1	1	1	1	0	1	1	1	1	1	1	0	1	0	
		Nov 1991	81	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0
		Sep 1992	81	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0
Indonesia		Sep 1986	53	0	0	1	na	0	1	0	0	0	1	1	1	1	0	1	1	
Malaysia		Jul 1985	73		0	1	1	1	1	0	1	1	0	1	1	1	0	1	1	

Table 6 (continued)

Country	Banking	Currency	Share of indicators flashing	Banking Crisis	Real exchange rate	Exports	Equity prices	M2/intl. reserves	Real output	Excess M1	Intl. reserves	M2 multiplier	Domestic credit/GDP	Real interest on deposit	Terms of trade	Domestic/foreign real interest rate diff.	Imports	Bank deposits	Lending deposit rate
Mexico		Dec 1982	69	1	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0
		Oct 1992	67		1	1	0	0	1	1	0	0	0	1	1	1	1	1	1
		Dec 1994	63	0	1	0	0	1	1	1	1	0	0	1	1	1	0	1	1
Norway		Nov 1988	100		1	1	1	1	1	1	1	1	1	1	1	1	1	1	na
		Dec 1992	67	0	0	1	1	1	1	0	1	1	0	na	1	1	0	1	1
Spain		Nov 1978	42		1	0	1	0	0	1	0	0	0	na	1	na	1	0	na
		Sep 1992	50	0	1	0	1	0	1	1	0	1	0	1	0	1	0	1	0
		May 1993	75	0	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1
Sweden		Nov 1991	93		1	1	1	1	1	na	1	1	0	1	1	1	1	1	1
		Nov 1992	87	1	1	1	1	1	1	na	1	1	0	1	1	1	0	1	1
Thailand		Oct 1983	69		0	1	0	1	na	0	1	1	1	1	1	1	1	0	na
		Nov 1984	71	1	0	1	0	1	na	0	1	1	1	1	1	1	1	0	na
Turkey		Mar 1994	50	0	1	0	0	1	0	0	1	1	0	1	0	1	1	0	1
Uruguay		Oct 1982	93	1	1	1	na	1	1	0	1	1	1	1	1	1	1	1	na
Venezuela		Oct 1993	67		0	1	1	1	0	0	1	1	1	1	1	1	0	0	1
		Mar 1989	69	0	1	0	1	1	0	1	1	1	0	1	1	1	1	1	0

A “1” denotes that the indicator reached its optimal threshold at least once in the observation-window prior to a crisis. A “0” denotes that the indicator did not reach its optimal threshold; “na” denotes that data were missing.

Sources: Kaminsky and Reinhart (1996) and Goldstein and Reinhart (1997).

Table 7
Thailand: Selected Annual Data

Indicator	1992	1993	1994	1995	1996
Real GDP: % change ¹	8.1	8.3	8.8	8.7	6.7 ⁴
Value of merchandise exports: % change ¹	14.2	13.4	22.2	24.7	-1.8 ⁴
Real effective exchange rate (1990=100) ¹	97.5	94.5	94.4	93.5	102.2 ⁴
Equity prices (1992=100) ¹	100.0	188.4	153.8	145.1	92.6
Real interest rate on deposits ¹	5.9	4.0	3.9	4.1	5.8 ⁴
M2/reserves: % change ²	-1.5	-1.6	-4.2	-5.0	5.4
Current account/GDP ³	-5.7	-5.9	-5.6	-8.1	-8.2

¹ Source: Institute for International Finance; and International Monetary Fund, *International Financial Statistics*, July 1997.

² Source: International Monetary Fund, *International Financial Statistics*, July 1997.

³ Source: International Monetary Fund, *World Economic Outlook*, May 1997 and *International Financial Statistics*, July 1997.

⁴ Estimate.

Concluding remarks

There is, of course, one additional question about forecasting financial crises that's probably more intriguing than all the others I've already mentioned, namely, "Who's next?" Carmen and I are still in the process of testing the out-of-sample properties of these leading indicators. As such, I am not at this point in a position to make a forecast of which country is likely to be the next Mexico or Thailand. We hope to be able to do that soon. In the meantime, it is perhaps interesting to ask whether there were early warning signals for this summer's biggest currency crisis, namely, the Thai baht crisis. In that connection, Table 7 trots out six top indicators of

currency crisis, and asks how Thailand stacked up on each of them a year or so before the crisis. I look at 1996 because these warning indicators have lead times of twelve months to eighteen months, and the baht devaluation took place at the beginning of July 1997. What we see is that all six indicators—namely, appreciation of the real exchange rate, the growth in exports, the change in equity prices, the growth of real output, the real interest rate, and the ratio of a broad monetary aggregate to international reserves—deteriorated in 1996. In addition, by 1996, Thailand already was undergoing serious strains in its banking system (if not an outright crisis) and it had registered a current-account deficit equal to 8 percent of GDP.¹⁷ Until we complete our out-of-sample tests and apply more precise estimates of lead times, I cannot say whether these adverse developments in 1996 were large enough to cross the danger thresholds. But the indicators were clearly behaving in the direction of increased vulnerability.¹⁸

In sum, I do not regard the available empirical evidence on early warning signals as sympathetic to the view that financial crises are typically generated by the activities of outside agitators (be it Mr. Soros or whomever) attacking otherwise healthy economies. A particular warning should be directed at emerging economies which seek to defend overvalued fixed exchange rates with high interest rates against a backdrop of banking fragility and declining economic growth. They are bucking the odds.

Author's Note: I am indebted to C. Fred Bergsten and Carmen Reinhart for helpful comments on an earlier draft, and to Mark Giancola and Caroline Kollau for research assistance.

Endnotes

¹See especially Kaminsky and Reinhart (1996), Kaminsky and others (1997), Goldstein (1997b), Frankel and Rose (1996), Calvo and Reinhart (1996), and Eichengreen, Rose, and Wyplosz (1994).

²See Caprio and Klingebiel (1996), Lindgren and others (1996), and Goldstein (1997a).

³See Goldstein and Turner (1996).

⁴See Obstfeld and Rogoff (1995).

⁵See Rose and Svensson (1994).

⁶See Caprio and Klingebiel (1996), Lindgren and others (1996), and Kaminsky and Reinhart (1996).

⁷See Eichengreen and others (1995).

⁸See Kaminsky and others (1996).

⁹See the discussion in Kaminsky and others (1997).

¹⁰By “adjusted” noise-to-signal ratios, I mean ratios that are adjusted for the fact that the number of months in which a false signal could have been issued is different from the number of months that a good signal could have been issued; see Kaminsky and others (1997).

¹¹See, for example, Demirguc-Kunt and Detragiache (1997) who find that countries with weak law enforcement and an explicit deposit insurance scheme are more vulnerable to banking crises.

¹²Goldstein and Reinhart (1997) and Kaminsky and Reinhart (1996).

¹³The ratio of M2 to international reserves is meant to capture a potential mismatch between the liquid liabilities of the banking system and the liquid assets available to meet these liabilities if holders decide to “run” to foreign currency. Calvo and Goldstein (1996) show that the behavior of this ratio in the runup to the 1994 Mexican crisis pointed to rising vulnerability of the Mexican banking system.

¹⁴See Demirguc-Kunt and Detragiache (1997).

¹⁵See Frankel and Rose (1996), Eichengreen and others (1997), and Calvo and Reinhart (1996).

¹⁶See Calvo and Reinhart (1996).

¹⁷The BIS (1996) reports that nonperforming loans at Thai banks stood at 7.7 percent of total loans in 1995; many private analysts estimate the share of nonperforming loans to be higher in 1996 and 1997.

¹⁸If one looks at the same indicators closer to the outbreak of the Thai currency crisis, say in

the April-June 1997 period, the picture does not appear much brighter. While (forecast) export growth for 1997 had turned positive (4 percent or so) and the real short-term interest rate had fallen some (by a percent or two), the condition of the banking system had deteriorated further; equity prices had continued to decline (falling by roughly one-third from their end-1996 level); the growth slowdown was continuing (with forecast 1997 growth then in the neighborhood of 5.5 percent); the real effective exchange rate had appreciated further (on the order of 5 above its 1996 average); the increase in the ratio of M2 to international reserves had accelerated; and the current-account deficit was expected to remain high (7 percent of GDP).

References

- Bank for International Settlements. *66th Annual Report*. Basle: BIS, (June 1996).
- Calvo, Guillermo, and Morris Goldstein. "What Role for the Official Sector?" in Guillermo Calvo and others, eds., *Private Capital Flows to Emerging Markets After the Mexican Crisis*. Washington: Institute for International Economics, (September 1996).
- Calvo, Sara, and Carmen Reinhart. "Capital Flows to Latin America: Is There Evidence of Contagion Effects?" in Guillermo Calvo and others, eds., *Private Capital Flows to Emerging Markets After the Mexican Crisis*. Washington: Institute for International Economics, (September 1996).
- Caprio, Gerard, and Daniela Klingebiel. "Bank Insolvencies: Cross-Country Experience." Washington: World Bank, 1996, unpublished.
- Demirguc-Kunt, Ash and Enrica Detragiache. "The Determinants of Banking Crises: Evidence from Developed and Developing Countries." Washington: IMF, (May 1997) unpublished.
- Eichengreen, Barry, Andrew Rose, and Charles Wyplosz. "Speculative Attacks on Fixed Exchange Rates," in Matthew Canzoneri and others, eds., *The New Transatlantic Economy*. Cambridge: Cambridge University Press, 1994.
- _____, _____, and _____. "Contagious Currency Crises." Paper presented at the CEPR Conference on "The Origins and Management of Financial Crises," Cambridge (England) and London, July 11-14, 1997.
- Frankel, Jeffrey, and Andrew Rose. "Exchange Rate Crises in Emerging Markets," *Journal of International Economics*, 1996 (forthcoming).
- Goldstein, Morris. *The Case for an International Banking Standard*. Policy Analyses in International Economics, no. 47. Washington: Institute for International Economics (April 1997a).
- _____. "The Seven Deadly Sins: Presumptive Indicators of Vulnerability to Financial Crises in Emerging Economies," in Priya Basu, ed., *Creating Resilient Financial Regimes in Asia*. Oxford: Asian Development Bank and Oxford University Press, (1997b) (forthcoming).
- _____, and Carmen Reinhart. *Forecasting Financial Crises: Early Warning Signals for Emerging Markets*. Washington: Institute for International Economics (1997), in progress.
- _____, and Philip Turner. "Banking Crises in Emerging Economies: Origins and Policy Options," *BIS Economic Papers*, no. 46. Basle: Bank for International Settlements, (October 1996).
- Lindgren, Carl, Gillian Garcia, and Mathew Saal. *Bank Soundness and Macroeconomic Policy*. Washington: International Monetary Fund, 1996.
- Kaminsky, Graciela, and Carmen Reinhart. "The Twin Crises: Causes of Banking and Balance of Payments Problems," unpublished, Washington, Board of Governors of the Federal Reserve System and the International Monetary Fund, September 1996.
- _____, Saul Lizondo, and Carmen Reinhart. "Leading Indicators of Currency Cri-

- ses,” Board of Governors of the Federal Reserve System, IMF, and the University of Maryland, (February 1997), unpublished.
- Obstfeld, Maurice, and Ken Rogoff. “The Mirage of Fixed Exchange Rates,” *Journal of Economic Perspectives*, vol. 9, no. 4 (1995).
- Rojas-Suarez, Lilia. “Early Warning Indicators of Banking Crises: Are They the Same in Emerging Markets and in Industrial Countries?” Paper presented at the 15th Meeting of the Latin American Econometric Society, Santiago, Chile, (August 1997).
- Rose, Andrew, and Lars Svensson. “European Exchange Rate Credibility Before the Fall,” *European Economic Review*, vol. 38 (June 1994).