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Some Policy Issues Regarding an Early Warning System

Assessing Financial Vulnerability: An Early Warning System for Emerging Markets

Notes from Chapter 4

Morris Goldstein, Graciela L. Kaminsky, and Carmen M. Reinhart

(Washington, DC: Institute for International Economics, 2000)

The previous discussion has ranked the indicators, be it the individual indicators or the composite index, according to their ability to predict crises while producing few false alarms. However, such criteria do not speak to the lead time of the signal. From the vantage point of a policymaker who wants to implement pre-emptive measures he/she will not be indifferent between an indicator that sends signals well before the crisis occurs and one that signals only when the crisis is imminent. Parallels are to be found in the Conference Board's composite indices for the United States, which are published on a monthly basis. Clearly, both financial market participants and policy makers alike find the leading indicator composite index more valuable than the coincident and lagging indices. Market participants incorporate this information in their investment decisions while policy makers give it weight in their policy reaction. Over the years, monetary policy in the United States, at least, has become increasingly forward-looking and hence pre-emptive rather than reactive. In part, this transition was made possible the fact that collectively the economics profession has gained a better understanding of the business cycle and early signs of its cycle turning points.

In focusing on the 24-month window prior to the onset of the crisis, the criteria for ranking the indicators presented in Chapters 3-5 does not distinguish between a signal given 12

months prior to the crisis and one given one month prior to the crisis. In what follows we examine this issue, by tabulating for each of the monthly indicators the average number of months in advance of the crisis when the **first** signal occurs; this, of course, does not preclude the fact that the indicator may continue to give signals through the entire period immediately preceding the crisis. Indeed, for the more reliable indicators signals tend to become increasingly persistent ahead of crises. For the low frequency indicators, this is not much of an issue since some of these are published with a considerable lag and, hence, these tend to be of less use from an early warning standpoint.

Is there scope for preemptive policy?

Table 8.1 presents the results for both currency and banking crises. For currency crises, the most striking observation about these results is that, on average, all the indicators send the first signal anywhere between a year and a year-and-a-half before the crisis erupts, with banking sector problems (our secondly-ranked indicator) offering the longest lead time—19 months. The average lead time for these early signals is 15.1 months for currency crises. Hence, on this basis, all the indicators considered are leading rather than coincident, which is consistent with the spirit of an “early warning system.” For banking crises there is a greater dispersion in the lead time across indicators and the average lead is also lower (11.6 months).

The main conclusion that follows from the discussion above is that the signals approach can be useful as the basis for an early warning system of a country’s **vulnerability** to a currency crisis and, to a lesser degree, banking crises. Within this approach, a number of indicators, as well as a composite index, have shown to be helpful in anticipating crises. From the vantage point of an early warning system, the results are encouraging in that the signaling,

on average, occurs sufficiently early to allow for pre-emptive policy actions.

Table 8.1 How leading are the signals?
(Average number of months from which the first signal is issued to the crisis month)

Indicator	Currency Crisis	Banking Crisis
Bank deposits	15	8
Beginning of banking crisis	19	n.a.
Domestic credit/GDP	12	7
Domestic-foreign interest rate differential	14	16
“Excess” M1 balances	15	6
Exports	15	16
Imports	16	11
Lending/deposit interest rate ratio	13	6
M2 multiplier	16	12
M2/reserves	13	14
Output	16	13
Real exchange rate ¹	17	10
Real interest rate	17	16
Reserves	15	10
Stock prices	14	12
Terms-of-trade	15	18

Limitations and scope for future research

In this book we have stressed that an effective warning system for financial crises should take into account a broad variety of indicators, as these crises are, for the most part, preceded by symptoms that arise in a number of areas. We have stressed indicators of financial sector stress. Perhaps, one of the reasons why some of the Asian crises had such an element of surprise had to do with the narrowness of the “traditional” definition of what was the relevant set of economic indicators. Indeed, this traditional view attached much weight to the role of fiscal policy and granted comparatively little weight to financial markets. Indicators that have proven to be particularly useful in anticipating currency crises include the behavior of the real exchange rate, stock prices, exports, output, and the ratio of M2 (a proxy for short-term debt) to international reserves. Real interest rates, and the money multiplier appear to do better for banking crises.

Needless to say, there is much scope for improving upon and complementing these results. Higher frequency data on the extent of short term debt, which appears to be a key source of vulnerability in many of these episodes remains largely unavailable. As discussed in Chapter 3, there appears to be a great deal of scope for incorporating microeconomic data, including but not limited to banking and corporate sector balance sheet items.

This book has summarized the workings of a specific early warning system for currency and banking crises. This system basically involves monitoring the behavior of a number of indicators, and recording the “signals” issued by these indicators as they move beyond certain threshold levels. A continuous measure of the probability of a currency or banking crisis can also be traced. On any given month, the system would estimate the probability of a crisis within the following 24 months conditional on the type of indicators issuing signals at that moment. Since

the group of indicators that are issuing signals would be identified, this would provide information about the source and breath of the problems that underlie the probability of a crisis. The evidence presented in this book, part of which is based on the out-of-sample forecasting performance of this approach, has provided some support for the signals approach in identifying which countries are most vulnerable to crisis at a point in time as well as how that vulnerability evolves over time—contagion notwithstanding.

Finally, it is important to recognize that while an early warning system would be an useful tool for a timely assessment of the likelihood of a currency crisis, any such system is also subject to limitations. There could be a number of issues, including of a political and institutional nature, that may be relevant for a particular country at a particular moment in time, and which are not incorporated in a more systematic or mechanical approach, such as that delineated here. A comprehensive assessment of the situation would necessarily need to take those issues into account. Only then it would be possible to have a coherent interpretation of events and a firm base for policy decisions.

Issues regarding the publication and use of such early warning indicators

A concern, often voiced in policy circles, as regards the desirability of making such indices of vulnerability publicly available on a timely basis, is that deteriorating readings may prompt a self-fulfilling run on a country's currency or its banks. While this consideration merits some concern, the conditions for generating self-fulfilling runs are likely to be relatively rare. As we have stressed throughout this book, the signals approach is useful in identifying cases of high vulnerability to crises—explaining the timing of the crises remains an elusive goal. To the extent that timing matters and investment decisions are made under uncertainty, there is little reason to expect that moderate increases in the extent of vulnerability are likely to prompt a speculative attack. Negative announcements of the readings in the leading indicator index do not cause a recession, although investors certainly take into account these readings.

Of course, a drastic rise on a given month in the vulnerability index could be a powerful “sell” signal. However, the analysis presented here and in Kaminsky and Reinhart (1996) suggest such sudden and marked declines in fundamentals **ahead** of the crisis are rare (these could be linked to contagion). Indeed, the build-up of economic and financial fragility in the periods preceding crises appears to be a gradual protracted process. Needless to say, once the crisis has begun is a different matter and the volatile behavior of most indicators and sudden implosion of economic activity is consistent with the predictions of many multiple equilibria theories. But that, is **after** the crisis.

Another issue that surfaces in the discussion of early warning systems is that, to the extent that the relevant authorities heed the signals of distress, the indicators are likely to lose some of their predictive ability. The loss of usefulness will certainly occur if: i) preemptive policy is an every-time and everywhere phenomenon; ii) preemptive policy **is** successful in stalling off the crisis. These are strong assumptions. First, policy makers are all too often inclined to ignore distress signals on the grounds that, this time, the situation is really different

or on the basis of political objectives. Second, even if the signals are heeded, the crisis may not be averted. While avoiding the crisis is, no doubt, a goal to be aspired to—realistically, what policy may succeed in delivering is a softer landing. Given the severity of the recent crises, this in itself may be classified as a success.

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APPENDIX A: DATA AND DEFINITIONS

Crisis index: The index is a weighted average of exchange rate and reserve changes, with weights such that the two components of the index have equal conditional volatilities. Since changes in the exchange rate enter with a positive weight and changes in reserves have a negative weight attached, readings of this index that were three standard deviations or more above the mean were cataloged as crises. For countries in the sample that had hyperinflation, the construction of the index was modified. While a 100 percent devaluation may be traumatic for a country with low-to-moderate inflation, a devaluation of that magnitude is commonplace during hyperinflations. A single index for the countries that had hyperinflation episodes would miss sizable devaluations and reserve losses in the moderate inflation periods, since the historic mean is distorted by the high-inflation episode. To avoid this, we divided the sample according to whether inflation in the previous six months was higher than 150 percent and then constructed an index for each subsample. Our cataloging of crises for these countries coincides fairly tightly with our chronology of currency market disruptions. Eichengreen, Rose, and Wyplosz (1995) also include interest rates in this index, however, our data on market-determined interest rates for developing countries does not span the entire sample.

The indicators:

Sources: International Financial Statistics (IFS), International Monetary Fund; Emerging Market Indicators, International Finance Corporation (IFC); World Development Indicators, the World Bank, when data was missing from these sources, central bank bulletins and other country-specific sources were used as supplements. Unless otherwise noted, we used **12-month percent changes**.

1. M2 multiplier: The ratio of M2 to base money, (IFS lines 34 plus 35) divided by IFS line 14.

2. Domestic credit/nominal GDP: IFS line 52 divided by IFS line 99b (interpolated). Monthly nominal GDP was interpolated from annual or quarterly data.

3. Real interest rates on deposits: IFS line 60l, monthly rates, deflated using consumer prices (IFS line 64) expressed in percentage points.

4. The ratio of lending rates to deposit rates: IFS line 60p divided by IFS line 60l; was used in lieu of differentials to ameliorate the distortions caused by the large percentage point spreads observed during high inflation. In levels.

5. “Excess” real balances: M1 (IFS line 34) deflated by consumer prices (IFS line 64) less an estimated demand for money. The demand for real balances is determined by real GDP (interpolated IFS line 99b), domestic consumer price inflation, and a time trend. Domestic inflation was used in lieu of nominal interest rates, as market-determined interest rates were not available during the entire sample for a number of countries; the time trend (which can enter log-linearly, linearly, or exponentially) is motivated by its role as a proxy for financial innovation and/or currency substitution. Excess money supply (demand) during pre-crisis periods (mc) is reported as a percent relative to excess supply (demand) during tranquil times (mt)--that is, $100 \times (mc - mt) / mt$.

6. M2 (in US dollars)/reserves (in US dollars): IFS lines 34 plus 35 converted into dollars (using IFS line ae) divided by IFS line 1L.d.

7. Bank deposits: IFS line 24 plus 25.

8. Exports (in US dollars): IFS line 70.

9. Imports (in US dollars): IFS line 71.

10. The terms of trade: the unit value of exports (IFS line 74) over the unit value of imports

(IFS line 75). For those developing countries where import unit values (or import price indices) were not available, an index of prices of manufactured exports from industrial countries to developing countries was used.

11. The real exchange rate: This measure used is based on consumer price indexes (IFS lines 64) and is defined as the relative price of foreign goods (in domestic currency) to the price of domestic goods. If the central bank of the home country pegs the currency to the dollar (Deutsche mark), the relevant foreign price index is that of the United States (Germany). Hence, for all the European countries the foreign price index is that of Germany while for all the other countries, consumer prices in the United States were used. The trend was specified as, alternatively, log-linear, linear, and exponential; the best fit among these was selected on a country-by-country basis. Deviations from trend during crisis periods (dc) were compared to the deviations during tranquil times (dt) and are shown in Figures 2 and 3 as a percent of the deviations in tranquil times (i.e., $100 \times (dc-dt)/dt$).

12. Reserves: IFS line 1L.d.

13. Domestic-foreign interest rate differential on deposits: Monthly rates in percentage points. IFS lines 60l. Interest rates in the home country are compared with interest rates in the United States (Germany) if the domestic central bank pegs the currency to the dollar (Deutsche mark). The real interest rate is given by $100 \times [(1 + i_t)p_t / p_{t+1}]$.

14. Output: For most countries, the measure of output used is industrial production (IFS line 66). However, for some countries (the commodity exporters) an index of output of primary commodities is used (IFS lines 66aa).

15: Stock returns (in dollars): IFC global indices are used for all emerging markets; for industrial countries the quotes from the main bourses are used.

16. Overall budget balance/GDP: Consolidated public sector balance as share of nominal GD