

Lamberte, Mario B.; Yap, Josef T.

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Monitoring Economic Vulnerability and Performance: Applications to the Philippines

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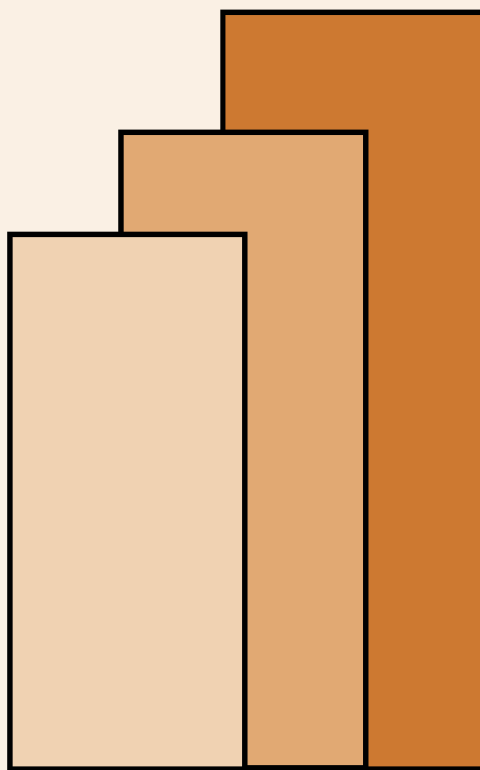
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For comments, suggestions or further inquiries please contact:

The Research Information Staff, Philippine Institute for Development Studies
3rd Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines
Tel Nos: 8924059 and 8935705; Fax No: 8939589; E-mail: publications@pidsnet.pids.gov.ph
Or visit our website at <http://www.pids.gov.ph>

MONITORING ECONOMIC VULNERABILITY AND PERFORMANCE: APPLICATIONS TO THE PHILIPPINES

Josef T. Yap and Mario B. Lamberte¹

Abstract

The recent spate of banking and currency crises has underscored the need to develop early warning systems. These are based on economic indicators of vulnerability, which can be identified from models and theories of crises. First generation models focus on the inconsistency of macroeconomic policies and the exchange rate peg. Examples of economic indicators derived from this framework are the fiscal deficit, growth of money supply, current account balance and the level of foreign exchange reserves. Second generation models revolve around the possibility of self-fulfilling crises and multiple equilibria. Meanwhile, the 1997 East Asian financial crisis spawned research on third-generation models, which integrated balance sheets of banks and corporations in the framework of second-generation models. The next step is then to combine all the variables in a meaningful way that will allow the prediction of economic crises. There are two popular approaches: the probability model using limited dependent variables estimation and the signals approach of Kaminsky and Reinhart. Both these methodologies have their own advantages and disadvantages but their usefulness would be constrained by the availability and timeliness of high-frequency data.

Key words: currency and banking crisis, early warning system, leading indicators, economic vulnerability

I. Introduction

As the East Asian economies recover from the 1997 financial crisis, there is increasing concern about a possible relapse. Economic growth has slowed in the five countries most affected by the crisis (Table 1) and the progress of corporate and financial reform has been patchy. To address this concern, it is necessary to understand the nature of the recent crisis and implement appropriate policies that will minimize chances of similar incidents in the future. At the very least, a system must be developed that will help policymakers anticipate future crises.

Table 1. Quarterly GDP Growth Rates for 5 Most Affect East Asian Countries

	Indonesia	Korea	Malaysia	Philippines	Thailand
2000 Q1	4.2	12.6	11.7	3.3	5.2
2001 Q1	4.0	3.7	3.2	2.5	1.8

Source: Asia Recovery Information Center (ARIC) Website

¹ Senior Research Fellow and President of the Philippine Institute for Development Studies (PIDS), respectively. The usual disclaimer applies.

This paper looks at empirical work on early warning systems that has been applied to the Philippine case. There are two popular approaches, one where the probability of a crisis is estimated, and the signals approach of Kaminsky and Reinhart (1996). These two approaches will be discussed in more detail in Section II. The probability approach was applied by Gochoco-Bautista (2000) using Philippine data while Yap (1998) used the Kaminsky-Reinhart methodology. These two studies will be discussed in Section III and IV. A short description of an application of leading indicators for forecasting economic activity will also be presented.

The indicators used in the various methodologies are selected based on theories describing economic crises. The literature distinguishes three types or, more precisely, three generations of BOP crises. Krugman's 1979 seminal paper stressed that crises are caused by weak economic fundamentals, such as excessively expansionary fiscal and monetary policies. These resulted in a persistent loss of international reserves that ultimately forced authorities to abandon the fixed exchange rate regime.

The second-generation model as developed by Obstfeld (1996) stresses the role of self-fulfilling expectations. These models focus on the different, and oftentimes conflicting, objectives of government policymakers. The policies are generally not pre-determined but conjectured on the public's beliefs and expectations. The public, in turn bases its actions on expected fundamentals conditional on an attack taking place, rather than current economic fundamentals absent an attack. For example, for the twin goals of reducing inflation and achieving a target economic growth rate, fixed exchange rates may help achieve the first goal but at the cost of a loss of competitiveness and a recession. Sensing that the public expects an abandonment of the peg, the government may raise interest rates to defend it. This will raise the cost to the government of defending the peg that it could have otherwise maintained. As it becomes costly to defend the peg, it may be abandoned. If the public correctly anticipated the abandonment of the peg, the result would be a self-fulfilling prophecy.

Some analysts classified the 1997 East Asian crisis as a second-generation type due to the role of foreign investors. Their abrupt and large withdrawal of foreign capital in anticipation of economic difficulties led to an actual deterioration of the economies. However, Yoshitomi and Ohno (1999) pointed out that the depth and duration of the Asian crisis cannot be explained sufficiently by the second-generation model. The Asian crisis reveals a need to incorporate the problems of the financial sector with its balance sheet effects, a sharp reversal of capital flows, a plunge in absorption, and a free fall of the exchange rate. In a recent paper, Krugman (2001) discusses several variants of a third-generation model, but emphasizes the balance-sheet effects of a currency depreciation. He proceeds to outline the elements of a fourth-generation model that extends the third generation model to cover other asset prices.

II. Methodology

Literature on the different indicators and various methodologies employing them is aptly reviewed by Kaminsky et al. (1998). They also provide a list of the main indicators used in empirical work classified by category (capital account, debt profile, current account, international variables, financial liberalization, real sector, fiscal variables, institutional/ structural factors, and political variables).

Four methodological categories are cited in the review paper. Two of them have been prominent in recent literature. The first estimates the probability of a devaluation, or more broadly, the probability of a crisis, based on regression estimates using any one of the limited dependent variables techniques. One such application is that of Demirguc-Kunt and Detragiache (1998) who studied factors associated with the emergence of systemic bank crises in a large sample of developed and developing countries using a multivariate logit model. Some of the variables they found significant are real interest rates, economic growth, inflation, and M2/reserves ratio. In some variations of their regression model, they found institutional variables, such as the presence of deposit insurance and law and order, significant.

The advantage of this methodology is that it summarizes all information in one useful number, the probability of a crisis. Also, this approach considers all variables simultaneously, and disregards those that do not contribute information that is independent from that provided by other variables already included in the analysis (Kaminsky et al. 1998).

This methodology has some important limitations. First, it does not provide a metric for ranking indicators according to their ability to accurately predict crises and avoid false signals, since a variable either enters the regression significantly or it does not. While measures of statistical significance can help pinpoint the more reliable indicators, they provide no information on whether the relative strength of a particular indicator lies in accurately predicting a high proportion of crises at the expense of sending numerous false alarms, or instead missing a large share of crises but seldom sending false alarms. However, by calculating the slope coefficient in the estimated equations, one can rank the variables in terms of their influence on the probability of a crisis.

Second, this method does not provide a transparent reading of where and how widespread macroeconomic problems are. Within this approach, it is difficult to assess which of the variables is "out of line," making it less than suited for surveillance and pre-emptive action.² Third, there is evidence that the ability of the probability approach to generate accurate forecasts tapers off quickly as the forecast horizon moves beyond one period ahead. Finally, in order to function as an early warning system, a suitable lag framework must be incorporated in the estimation procedure. This may cause problems

²The discussion on the limitations of the probability approach is quoted from Kaminsky et al. (1998).

if the lag variables are not significant or if the degrees of freedom are substantially reduced.

The shortcomings of the probability approach are addressed by the "signals" approach developed by Kaminsky and Reinhart (1996). This is the methodology used in this paper. The step-by-step procedure has been discussed extensively (Kaminsky et al. 1998, Kaminsky and Reinhart 1996) and we adopt the discussion of Goldstein (1998).

First, a sample of countries must be identified. It is possible to base the analysis on just one country, but the limited number of crises will prevent a robust generalization on the usefulness of indicators.

Second, the definition of a crisis must be delineated. Kaminsky and Reinhart define a bank crisis in terms of bank runs, closures, and mergers, or large-scale public sector takeovers of important financial institutions. For currency crises, they 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. Extreme values of this index—that is, readings of three or more standard deviations above the mean—signal currency crises.

Third, the term "early" must be defined. For currency crises, Kaminsky and Reinhart define early as between 1 month and 24 months before the beginning of the crisis. For banking crises, a laxer definition is adopted, namely, either 1 month to 12 months before the start of the crisis or up to 12 months after the beginning of the crisis. This is because banking crises frequently last 4 to 5 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 it starts.

The signals approach has been criticized as being arbitrary in delineating a period that is considered "early" (Demirguc-Kunt and Detragiache 1998). Corollary to this, it should be noted that indicators have different lags in their impact on the economy. Hence, the definition of an "early" period may vary from country to country. In this study, the definition of Kaminsky and Reinhart is adopted.

The fourth task is to pick out a list of potential early warning indicators. Knowledge of the theoretical causes of currency and banking crises provides a basis for identifying possible indicators that signal a crisis. For example, based on Generation I models (which emphasize macroeconomic variables out of line), economic variables to watch out for are excessive monetary growth, deteriorating fiscal balances, and rapidly depleting international reserves. Another criterion used for selecting an indicator is the availability of high-frequency data. A list of indicators used by Kaminsky and Reinhart that were applied to this study is presented in Section IV below. The list includes a brief explanation of each variable.

Given the indicators, step number five is to find an optimal threshold for each indicator that, once reached, will give an accurate signal of a future crisis. The point at which an indicator signals a crisis must be set. Thresholds are determined using an iterative procedure. Given an indicator X , an arbitrary tail of the frequency distribution for X —say the 10 percent tail—is set. Depending on the nature of X , it can be the upper or lower tail. Any observation that falls in the 10 percent tail of the time series of X is regarded as a signal. It is considered a true signal if a currency crisis occurs within 24 months after the signal was given, and a false signal (or noise) if no crisis occurs within that early-warning time frame. Various thresholds are then experimented with until the optimal one is found. The optimal threshold maximizes the number of true signals and minimizes the number of false signals. The tail that minimizes the noise-to-signal ratio is used. Optimal thresholds as determined by Kaminsky and Reinhart were used in the study.

After applying the basic steps of the signals approach, the data for the indicators X_{jt} indicator j at time t are transformed in the following manner:

$$S_{jt} = 1 \text{ if the value of } X_{jt} \text{ crosses the threshold} \\ = 0 \text{ if otherwise.}$$

According to the definition of Kaminsky and Reinhart the indicator is considered good if in most of the cases when S_{jt} is 1, a BOP crisis occurs during the period $t + 24$ months. As mentioned earlier, a laxer definition is adopted for banking crises S_{jt} assumes a value of 1 when X_{jt} crosses the threshold either 1 month to 12 months before the start of the crisis or up to 12 months after the beginning of the crisis. For this paper, only S_{jt} is monitored to determine which signals were flashing prior to the onset of the crisis in each country that was considered.

The early warning system should enable policymakers to determine when the economy is becoming fragile. One way to facilitate analysis and make the system tractable is to compress the various indicators into a composite index. The most straightforward procedure is a simple count of flashing signals, which is the composite index labeled S by Kaminsky (1998) and defined as:

$$S_t = \sum_j S_{jt}$$

This statistic, however, does not fully use the information provided by univariate indicators because it does not account for the different forecasting accuracy of each variable. One way of combining this information is to weight the signals of different variables by the inverse of their noise-to-signal ratio. The second composite index, labeled K , is defined as:

$$K_t = \sum_j S_{jt}/n_j$$

where n_j is the noise-to-signal ratio of indicator j . In this exercise we applied the noise-to-signal ratios calculated by Kaminsky and Reinhart.

The above composite leading indicators assign the same weight to a signal provided by a mild anomalous behavior of a variable and that provided by an extreme aberrant behavior of that variable. To account for this distinction, two different thresholds can be defined for each indicator: a mild threshold Y_m and an extreme threshold Y_e . $|Y_m| < |Y_e|$ and based on the criterion defined earlier, $S_{jt} = 1$ when $|X_{jt}| > |Y_{mj}|$. Y_{mj} is the mild critical threshold for indicator j .

An extreme signal D is then defined based on Y_e such that $D_{jt} = 1$ when $|X_{jt}| > |Y_{ej}|$. $S_{jt} = 1$ whenever $D_{jt} = 1$. The third composite indicator that accounts for the intensity of the signal of each univariate indicator, labeled W , is defined as:

$$W_t = \sum_j (S_{jt} + D_{jt})$$

Time series probability forecasts are then computed to evaluate the reliability of each of these composite indices. We can construct a sample-based vector of conditional probabilities:

$$\begin{aligned} \Pr(Ct_{t+h} | S_t = I) &= \frac{\text{Months with } S_t = I \text{ and a crisis within } h \text{ months}}{\text{Months with } S_t = I} \\ \Pr(Ct_{t+h} | K_t = I) &= \frac{\text{Months with } K_t = I \text{ and a crisis within } h \text{ months}}{\text{Months with } K_t = I} \\ \Pr(Ct_{t+h} | W_t = I) &= \frac{\text{Months with } W_t = I \text{ and a crisis within } h \text{ months}}{\text{Months with } W_t = I} \end{aligned}$$

III. Application of the Probability Approach to the Philippine Case

The methodology used by Gochoco-Bautista (2000) is quite straightforward. First, she identifies relevant indicators based on the aforementioned models of economic crises. Second she divides the sample period into tranquil and crisis or pressure periods based on the following procedure. An arbitrary band is constructed by taking the mean of percentage changes in the nominal exchange rate plus or minus 1.5 times the standard deviation of changes in the exchange rate. Those periods in which percentage changes in the exchange rate fall outside the 1.5 times the standard deviation band are included as pressure periods. From the remaining non-selected observations, periods where percentage changes in gross international reserves are outside the 1.5 times standard deviation band are selected as pressure periods. From the remaining non-selected observations after this, periods where changes in logs of short-term interest differentials between the Philippine 91-day Treasury bill rate and the US 3-month Treasury bill rate are outside the 1.5 times standard deviation band are selected as pressure periods. The remaining non-selected observations are identified as periods of tranquility.

So as not to identify an ongoing speculative episode as a new one, a five-month exclusion window is used. For example, periods identified by changes in gross-international reserves were not treated as a separate speculative episode if they fell within the five-month window of an episode previously identified by changes in the exchange rate.

The third step is to examine whether there are differences in the behavior of the indicator variables during tranquil periods and pressure periods. This is done by comparing the mean values of month-to-month changes in these variables. A selection of the variables and the results are shown in Table 2. Gochoco-Bautista stresses that it is important to test the robustness of the findings with respect to how the pressure periods are selected and to see whether the story told by the mean values of the variables is consistent across these periods. This is done by first calculating the mean values of the variables using pressure periods identified using only the percentage changes in the exchange rate (Case A in Table 2). Next, the same exercise is repeated using both percentage changes in the exchange rate and in gross international reserves to identify the pressure periods (Case B). Finally the mean values of the indicator variables are calculated when pressure periods are identified using percentage changes in the exchange rate, in gross international reserves, and changes in the logs of short-term interest rate differentials (Case C).

Gochoco-Bautista argues that if there are differences in the behavior of these variables during tranquil periods and during periods of speculative pressures, then there may be some evidence to show inconsistent macroeconomic policies. On the other hand, if there are no discernible differences in the means of these variables during tranquil periods and during periods of speculative pressures, then it is possible that arbitrary shifts in expectations are largely responsible for currency pressures.

The fourth step is to use a probit model to formally test the statistical significance of the indicator variables on the probability that speculative currency pressures will occur. The dependent variable distinguishes between pressure periods and tranquil periods. It is 1 during periods of currency pressure and 0 during tranquil periods. Currency pressure periods are not distinguished by whether they are depreciation pressure periods or appreciation pressure periods. Three different specifications of the dependent variable are used, depending on how the currency pressure periods were identified. The dependent variables D1, D2, and D3 correspond to Case A, Case B and Case C as defined earlier. An example of estimation results is presented in Table 3.

Table 2. Stylized Facts: Behavior of Indicator Variables (partial)

Indicator Variable	Tranquil Period Mean	Depreciation Pressure Mean	Appreciation Pressure Mean
Change in Nominal Exchange Rate			
A	0.28%	14.51%	-6.55%
B	0.27%	11.46%	-1.88%
C	0.29%	8.16%	-1.70%
M3 Multiplier			
A	3.10	3.30	2.83
B	3.11	3.23	2.84
C	3.11	3.22	2.84
Growth in Total Domestic Credit			
A	1.45%	3.98%	-1.04%
B	1.58%	3.23%	-1.54%
C	1.55%	3.19%	-1.54%
Growth in Total Bank Deposits			
A	1.43%	4.30%	1.93%
B	1.39%	3.86%	2.20%
C	1.37%	3.30%	2.14%
Inflation			
A	0.91%	1.45%	1.23%
B	0.89%	1.27%	1.35%
C	0.89%	1.13%	1.53%
GIR Growth			
A	1.48%	-6.45%	12.08%
B	0.81%	-10.09%	24.59%
C	0.71%	-5.99%	22.46%
Interest Rate Differential			
A	8.70%	13.66%	18.83%
B	8.59%	12.38%	14.02%
C	8.70%	10.74%	12.67%
M3/GIR			
A	4.42	6.90	5.41
B	4.36	6.50	5.58
C	4.40	5.75	5.16
Trade Balance (USD mil.)			
A	-334	-368	-199
B	-344	-322	-154
C	-347	-309	-151
Nat'l. Power Corp. Sales Growth			
A	0.66%	1.21%	0.15%
B	0.77%	0.83%	-1.25%
C	0.68%	1.28%	-0.44%

Source: Gochoco-Bautista (2000), p. 133

Table 3: Example of Results Using Probit Estimation

Dependent Variable	Indicator Variable	Coefficient	t-stat	Probit slope coefficient	Durbin Watson	Likelihood Ratio
D3	IDIFF(-1)	3.30	2.01	0.65	2.02	0.47
	GIRG(-1)	-1.55	-1.58	-0.31		
	NPCG(-1)	-3.55	-1.88	-0.71		
D3	IDIFF(-1)	4.06	2.27	0.78	2.04	0.49
	GIRG(-1)	-2.34	-2.21	-0.45		
	NPCG(-1)	-3.37	-1.71	-0.65		
	DCPUBG(-1)	3.40	2.61	0.65		

IDIFF- interest rate differential; GIRG – month-on-month growth in international reserves; NPCG – month-on-month growth in NPC sales; DCPUBG – month-on-month growth in credit to public sector. NOTE: Since probit coefficients are not easily interpretable, the probit slope coefficients are given. They show the effects of one unit changes in regressors on the probability of currency pressures arising, evaluated at the mean of the data. SOURCE: Gochoco-Bautista (2000), Table 4, p. 146.

Based on her findings, Gochoco-Bautista outlines the following conclusions:

1. Indicator variables such as the M3 multiplier, growth in total domestic credit, growth in domestic credit to the private sector, growth in total bank deposits, M3/GIR, M3/GIR growth, growth of GIR, and growth of National Power Corporation (NPC) sales tell a consistent story. It is that overly expansionary policies are associated with depreciation pressure periods.
2. There is little evidence for second-generation models, in which stylized facts reflect economic conditions that make it costly for the government to maintain a peg. In particular, the results suggest that inflation is higher and output growth lower during appreciation pressure periods. If the authorities were trying to counteract recession, for example, they would pursue expansionary policies which would lower domestic interest rates and raise inflation, but which lead to depreciation rather than appreciation pressures.
3. Overly expansionary monetary and fiscal policies, and increasing overvaluation of the domestic currency are associated with depreciation pressures. The findings suggest that weak economic fundamentals resulting from policies inconsistent with exchange rate stability, rather than arbitrary shifts in expectation, are probably more important in explaining the probability of pressures on the domestic currency.
4. In general, the full sample results of the probit estimation show that economic fundamentals matter as far as the probability of currency pressures arising is concerned. Among the indicators, those representing capital account developments, such as changes in gross international reserves, and short-term interest differentials between domestic and foreign rates, current account developments, such as (contemporaneous) changes in the real exchange rate, real sector indicators, such as output growth proxied by sales of the National Power Corporation, and fiscal variables such as the growth of domestic credit to

the public sector have a statistically significant effect on the probability of currency pressures occurring.

It should be mentioned that predicted probabilities were calculated using some of the estimated equations. The probability of a crisis did rise in July 1997 but it would be difficult to judge whether or not this was already a reaction to the brewing regional crisis.

IV. Application of the Kaminsky-Reinhart Methodology to the Philippines

The indicators that were used by Yap (1998) are listed in Table 4. The probability tables obtained using the three composite indicators described in Section II are shown in Table 5.

Table 4. Indicators of Currency and Financial Crises

Financial sector

1. **M2 multiplier:** A higher multiplier indicates higher growth in money supply which may lead to higher inflationary expectations and expectations of a future devaluation of the currency.
2. **Domestic credit:** A larger amount of credit increases the chances of bad loans and bank failures. Higher credit also implies a larger amount of money supply. In the absence of data on domestic credit, the growth of M2 in real terms was used instead.
3. **M2/Reserves:** Economic agents fearing a devaluation may substitute local currency for foreign currency. The M2/Reserves ratio is an indication of the extent to which the Central Bank can withstand this pressure.
4. **Lending/Deposit rate:** A higher spread indicates that the Central Bank is increasing interest rates to stem credit growth. Higher lending rates increase the chances of bad loans.
5. **Deposits:** A decline in the deposit base increases the chances of a bank run.
6. **Real interest rate:** Higher interest rates increase the probability of loan defaults.
7. **Excess money balances:** Equilibrium real M1 balance was estimated using the Hodrick-Prescott filter. The difference between actual and equilibrium values is equal to the excess money balances.

External sector

Note that variables from the external sector can be leading indicators of a banking crisis because of the relationship of a BOP crisis and banking crisis.

1. **Exports:** Lower export growth may signal problems with the trade balance.
2. **Imports:** Higher import growth may signal problems with the trade balance.
3. **Real exchange rate:** The equilibrium real exchange rate is estimated using the Hodrick-Prescott filter that allows for stochastic trends. The difference between the actual value and the equilibrium value is a measure of the degree of overvaluation. The real exchange rate published by JP Morgan was used in the computations.

4. **Reserves:** This is the classic indicator based on Krugman's seminal paper on BOP crises. A low level of reserves below a critical threshold may trigger a speculative attack against the currency.

5. **Interest rate differential:** This is defined to be foreign interest rates (as measured by the 90-day US Treasury Bill rate) less domestic interest rate (91-day Treasury Bill rate). The higher the differential, the larger is the probability of an outflow of reserves.

Real sector

1. **Output growth:** Lower output growth indicates a deceleration of the economy prior to a crisis. A modification would be to take the first difference of output growth to reflect more accurately an economic deceleration. The value index of manufacturing output was used and this was deflated by the consumer price index (CPI) to obtain an index in real terms.

2. **Stock market prices:** A decline in the growth rate of asset prices may lead to loan defaults. It also signals a loss of investor confidence. This index was not included in this paper because of lack of data prior to 1987.

NOTE: Due to data constraints the last two indicators were not incorporated.

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Table 5. Probability tables for composite indices

S Composite Index		W Composite Index	
<u>S_j</u>	<u>Pr(BOP Crisis)</u>	<u>S_j</u>	<u>Pr(BOP Crisis)</u>
0	0.07	0	0.07
1	0.12	1	0.07
2	0.29	2	0.21
3	0.43	3	0.51
4-5	.67	4	0.14
		5	0.60
		6 and above	0.20
Brier's QPS: 0.29		Brier's QPS: 0.19	

Table 5 (cont'd.)

K Composite Index

<u>K_j</u>	<u>Pr(BOP Crisis)</u>
0.0 - < 1.0	0.07
1.0 - <2.0	0.10
2.0 - <3.0	0.18
3.0 - <5.0	0.34
5.0 - < 7.0	0.67
7.0 - above	0.87

Brier's QPS: 0.21

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The Brier's quadratic probability score is a measure of goodness-of-fit and the results indicate that the K index is the better indicator among the three.

Empirical results using Kaminsky-Reinhart methodology indicate that the economic fundamentals of the Philippines were much sounder prior to the 1997 crisis than in the 2-year interval prior to the October 1983 BOP crisis. In another paper (Yap 1999) the methodology was extended to 11 other countries: Indonesia, Korea, Malaysia, Thailand, Denmark, Finland, Norway, Sweden, Mexico, India, and Pakistan. The first four countries plus the Philippines comprise the Asian 5, the economies hardest hit by the crisis. Key results can be summarized by ranking the cases by number of indicators flashing on a regular basis:

1. The Asian 5 during their respective economic crises prior to the 1997 debacle (e.g., the Philippines in 1983).
2. The Scandinavian countries during their crises in the late 1980s and early 1990s.
3. The Mexican crisis in 1994.
4. Pakistan prior to the 1997 crisis.
5. The Asian 5 prior to the 1997 crisis.

Results generally indicated that fundamentals cannot explain the depth of the 1997 crisis because the other episodes did not have as severe an impact—especially in the number of countries involved—and yet the fundamentals were weaker.

V. Other Indicators of Vulnerability

A weakness of both the studies of Gochoco-Bautista and Yap is that the variables directly related to the 1997 crisis were not included in the methodology. Examples are the amount of short-term foreign debt and the exposure of domestic banks to the real estate sector. Unfortunately these variables are not available on a high frequency basis, which is the reason why they were not included. If, indeed, the next generation crises would revolve around balance sheets of firms and other economic entities (including the government) then effort must be exerted to gather the relevant data. Not only will frequency be an issue, but timeliness of reporting as well.

A useful transitional step would be to improve on macroprudential indicators (MPIs), which are broadly defined as indicators of the health and stability of the financial system. They comprise both macroeconomic indicators that affect the financial system (e.g. fiscal deficit) and aggregated microprudential indicators. The latter are obtained by aggregating indicators of individual financial institutions while the former are already covered by indicators used by Gochoco-Bautista and Yap.

One commonly used framework for analyzing the health of financial institutions using aggregated microprudential indicators is the so-called CAMELS framework (IMF 2000). This involves the analysis of six group of indicators as follows:

- Capital adequacy
- Asset quality
- Management soundness
- Earnings
- Liquidity
- Sensitivity to market risk.

Theoretically, the variables will not be of equal importance. However, the overriding criterion for choice would be data availability.

A. Capital Adequacy

Capital adequacy and availability ultimately determine the robustness of financial institutions to shocks to their balance sheets. The most commonly used indicator in this respect is the aggregate risk-based capital ratio (the ratio of capital to risk-adjusted assets). A declining trend in this ratio may signal increased risk exposure and possible capital adequacy problems. In addition to adequacy, it may also be useful to monitor indicators of capital quality. Bank capital consists of different elements that have varying availability and capability to absorb losses.

B. Asset Quality Indicators

Risks to the solvency of financial institutions often derive from impairment of assets, so it is important to monitor indicators of asset quality. These include indicators at the level of the lending institution, and indicators at the level of the borrowing institutions.

1. *Sectoral Credit Concentration.* A large concentration of aggregate credit in a specific economic sector or activity, especially real estate, may signify an important vulnerability to the financial system to developments in this sector or activity (e.g. fall in profit due to overinvestment). Data showing the disaggregation of outstanding credit across various sectors is generally available. The share of manufacturing and real estate are reported when data are available.

2. *Foreign currency denominated lending.* Several financial crises have been preceded by periods of fast growth of foreign-currency denominated credit to domestic firms that frequently lacked a stable source of foreign exchange reserves. Another situation is when banks intermediate foreign capital inflows, thus increasing their foreign exchange liabilities. .

3. *Nonperforming loans.* An increasing trend in the ratio of nonperforming loans to total loans signals a deterioration in the quality of credit portfolios and consequently, in financial institutions' cash flows, net income and solvency.

4. *Indicators at the Level of the Borrowing Entity.* This subgroup refers to indicators that take into account the likelihood that borrowers can repay their loans. The most common are corporate debt-equity ratios. Unfortunately, these data are not readily available.

C. Management Soundness Indicators

Indicators of the quality of management are primarily applicable to individual institutions and cannot be easily aggregated across the sector. Although aggregated indicators can be used, they are more likely to reflect financial sector structure and/or the country's economic situation, than management quality.

Bloomberg reports an efficiency ratio for a selected number of banks for the five countries. The efficiency ratio is equivalent to the expense ratio suggested by the IMF document. The data are available only on an annual basis.

D. Earnings and Profitability Indicators

It is important to monitor indicators of profitability because chronically unprofitable financial institutions risk insolvency. On the other hand, unusually high profitability may be a sign of excessive risk taking. However, it should be noted that

similar to management soundness indicators, aggregation across individual banks may not yield useful numbers.

Bloomberg reports two common profitability indicators: return on assets and return on equity. These ratios are aggregated across the top ten reporting banks using total assets as weights.

E. Liquidity Indicators

Initially solvent financial institutions may be driven toward closure by poor management of short-term liquidity, so it is important to monitor liquidity indicators. On the liability side, indicators should cover funding sources, including interbank and central bank credits.

1. *Central Bank Credit to Financial Institutions.* A large increase in central bank credit to banks and other financial institutions—as a proportion of their capital or their liabilities—often reflects severe liquidity problems in the financial system. Because of data considerations, we obtain the ratio of central bank credit to financial systems (or the private sector) to the monetary base.

2. *Loans-to-Deposits Ratios.* The ratio of credit to total deposits may give indications of the ability of the banking system to mobilize deposits to meet credit demand. A high ratio may indicate stress in the banking system and a low level of liquidity to respond to shocks.

F. Sensitivity to Market Risk Indicators

This set of indicators looks at the various components of market risk, the most significant of which are interest rate and foreign exchange risk. The latter is captured to a certain extent by the share of foreign liabilities of the banking system to total liabilities. The IMF document does not give a specific indicator to measure interest rate risk.

G. Market-Based Indicators

Market-based assessments of the financial sector as implied by the prices (yields) of financial instruments and the creditworthiness ratings of financial institutions and large corporations, are also useful indicators of financial system vulnerability. Another useful market-based indicator, which is readily available, is the stock prices of the financial sector relative to average stock prices.

The CAMELS system, particularly the capital adequacy ratio, has been described as inadequate for emerging market economies by Rojas-Suarez (2001). Two reasons are cited. One, because of severe deficiencies in the accounting and regulatory framework and the high concentration of wealth in emerging markets, the meaning of traditional ratios is extremely limited. Because of poor or unrealistic accounting standards, for example, there will be a divergence between the market value of an asset and its book value. Two, bank ratios become less effective when liquid markets for bank shares, subordinated debt and other bank liabilities and assets are not available to validate the “real” worth of a bank as opposed to its accounting value.

Rojas-Suarez then proposes alternative indicators for banking problems in emerging markets based on the general principle that good indicators of banking problems are those that reveal the “true” riskiness of individual banks because they are based on markets that work rather than just relying on accounting figures. The indicators that she proposes are: 1) implicit interest rate paid on deposits; 2) spread between lending and deposit rates; 3) rate of loan growth; and 4) growth of interbank debt. Significant changes in these variables indicate a change in the risk-taking behavior of banks.

The methodology applied by Rojas-Suarez is a two-step approach, which she applies to six countries: Mexico, Venezuela, Colombia, Thailand, Korea and Malaysia. The means of the variables are computed for tranquil and crisis periods and it determined whether the differences are significant. Rojas-Suarez then applies a modified version of the Kaminsky-Reinhart signals approach to determine the ability of each indicator to predict a crisis. The empirical results show that interest paid on deposits and interest rate spreads have proven to be strong performers by showing a high degree of accuracy in predicting bank problems.³

Given the possibility of self-fulfilling crises, another important indicator for monitoring and surveillance can be derived by undertaking regular market surveys among economic agents to obtain a feel of their sentiments and expectations. In addition Harding (1998) suggests that multiple equilibria in modeling time series be explicitly accounted for. Nonlinear models that account for endogenous changes in asset prices will be useful.

At present, the Asia Recovery Information Center (ARIC) of the Asian Development Bank is in the process of compiling data related to the CAMELS framework for the five most affected countries in East Asia.

VI. A Note on Leading Indicators System

The preceding sections focused on monitoring an economy for vulnerability to a crisis. This is different from tracking economic activity, which is related more to

³ However, the difference between lending and deposit rates was found to have a relatively high noise-to-signal ratio by Kaminsky and Reinhart.

forecasting. In this regard, a system of leading indicators can be developed to forecast a reference variable (e.g. quarterly GDP or monthly industrial production index).

The leading indicator approach to projecting activity is based on identifying economic variables whose movements tend to occur ahead of those of general economic activity. For example, if stock markets are forward looking, they should, on average, anticipate changes in the meter of economic activity and earnings growth before they actually occur. Examination of the behavior of equity prices might then turn out to provide useful clues as to what could happen to economic activity several months or quarters ahead.

The leading indicator approach to forecasting is agnostic about the impact that different policies might have on economic activity, and about other more general aspects of economic structure. Statistically, the approach rests on an analysis of bivariate correlations between a measure of economic activity and a variety of potential indicator variables. Typically, these indicator variables reflect some of the following considerations:

- **Production time.** For many goods it takes months or even years between the decision to produce and actual production. Therefore, indicators that record production intentions, such as new production orders or imports of raw materials and intermediate goods, might usefully give advance warning of changes in the direction or tempo of economic activity.
- **Market expectations.** Some economic variables tend to reflect, or to be especially sensitive to, anticipations about future economic activity. Survey results of business expectations would be a good example of such an indicator. Stock prices or futures prices are others.
- **Policy Impacts.** Fiscal and monetary policies are often used in an attempt to influence future levels of economic activity. To the extent that these policies are effective, measurable changes in their settings may provide useful leading indicators.
- **“Shocks”.** Economic activity is also likely to be influenced by a range of factors that are beyond the control of domestic policy makers. For example, changes in global demand, terms of trade or global interest rates may have an impact on domestic activity.
- **Buffer stocks.** Some variables can adjust more quickly than others. For example, producers may meet an unanticipated increase in demand by first running down their inventories, and then by increasing utilization rates before hiring new workers, purchasing new machines and increasing production. By observing changes in the levels of stocks and factor utilization we may get some indication of future changes in output.

The more useful and relevant variables for a leading indicators system are those classified under “Production time”. Unfortunately, these data are not readily available for most East Asian economies making it difficult to develop a robust leading indicator system.

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