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Developing an Early Warning System for BOP and Financial Crises: The Case of the Philippines

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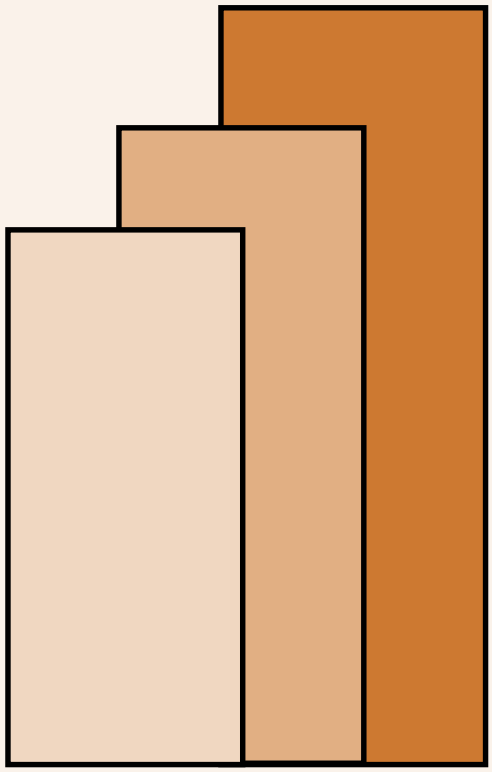

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DEVELOPING AN EARLY WARNING SYSTEM FOR BOP AND FINANCIAL CRISES: THE CASE OF THE PHILIPPINES[1]

Josef T. Yap[2]

I. Introduction

As the East Asian financial crisis enters its second year, the debate on its primary causes remains unresolved. This issue is quite important at least in terms of preventing similar episodes from recurring in the future. Regardless of the actual cause of the crisis, however, the recent debacle has led to economic reform efforts on three levels, not to mention the political repercussions.

The first is in the microeconomic level, particularly banking sector reforms. This is consistent with the view that the crisis was an offshoot of weaknesses in the financial sector where poor regulations allowed banks to lend imprudently to the real estate sector. Related to this is the sharp rise in unhedged foreign currency denominated loans to firms that did not receive foreign exchange revenues. On a more aggregate level, there has been an attempt to reform practices of business conglomerates that allowed credit to be directed to distressed firms belonging to the network. As a swipe against government intervention, some analysts contend that the close relationship forged between the bureaucracy and private sector in several of the East Asian economies to address information problems brought about political cronyism and a general lack of transparency in credit allocation leading to the bad loans.

More recently, the attention has shifted to reforms in the international financial system following the call for a world economic forum by President Bill Clinton of the US with strong support from Prime Minister Tony Blair. The key element is the monitoring and control of volatile capital flows that has created problems in Asia, Russia and Latin America. While timely and relevant, restructuring the international financial system is quite a formidable task.

Structural reforms should definitely dominate the medium term economic program but there is still a need to monitor short-term fluctuations of key economic variables in order to anticipate currency or Balance-of-Payments (BOP) crises. This the logic behind developing and Early Warning System (EWS). In this paper we adopt the methodology of Kaminsky and Reinhart (1996) which is a nonparametric approach. After presenting their framework, the system is applied using Philippine data. The results could shed light on the debate regarding the causes of the East Asian financial crisis.

II. Crises and Their Causes

Interest in early warning systems has been revived after the spate of currency and banking crises in the 1990s. The basic idea is to monitor key economic variables which would enable policy makers to predict a crisis, allowing them sufficient time to implement the appropriate measures to stem the crisis or at the very least minimize its adverse impact. The contrarian view would be that predicting a BOP crisis or financial crisis is like predicting an earthquake although such an analogy refers only to the actual timing of the crisis. An early warning system is designed to signal an

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impending crisis and the exact moment is not crucial if there is sufficient lead time to react to the signal properly.

The economic indicators to be monitored are readily derived from the theory of the causes of banking and currency crises. The 1997 East Asian financial crisis spawned not only economic turmoil in the region but also an intense debate on the source of the debacle. The debate finds its roots in the literature which distinguishes three types or, more precisely, three generations of BOP crises. Krugman▲s seminal paper of 1979 stressed that crises are caused by weak economic fundamentals such as excessively expansionary fiscal and monetary policies, which resulted in a persistent loss of international reserves that ultimately forced the authorities to abandon the fixed exchange rate regime (Kaminsky, et al. 1998).

Following the EMS collapses in 1992 and 1993, later models of currency crises dealt with cases where the depletion of international reserves might not be at the root of currency crises. These models focus on the different, and oftentimes conflicting, objectives of government policy makers. In the case of the twin goals of reducing inflation and achieving a target economic growth rate, fixed exchange rates may help in achieving the first goal but at the cost of a loss of competitiveness and a recession. With sticky prices, a devaluation may restore competitiveness and help in the elimination of unemployment, thus prompting policy makers to abandon the parity during recessions (Kaminsky, 1998).

More recent models have shown that a crisis may develop without a significant change in economic fundamentals. In these models, economic policies are not predetermined but respond to changes in the economy, and economic agents take this relationship into account in forming their expectations. This set of assumptions opens the possibility for multiple equilibria and self-fulfilling crises.[3] This type of model suggests that it may be difficult to find a close relationship between fundamentals and crises, as the latter may take place without a preceding significant change in economic fundamentals. (Kaminsky, et al. 1998)

Corollary to the possibility of self-fulfilling crises is the role of contagion effects. These may arise if investors pay little heed to countries' economic fundamentals, and thus do not discriminate properly among countries (Kaminsky, et al. 1998). This has been attributed as one of the primary causes of the spread of the "Asian flu." The incentive scheme among fund managers penalizes those who deviate (on the low end) from the average performance of a regional portfolio (Montes, 1998). This gives rise to herd behavior on the part of investment managers, making self-fulling crises more likely.

The literature on banking crises is both more abundant and straightforward. The health of the banking system revolves around the relation of the value of bank liabilities and the value of their assets. When the value of their assets falls short of the value of their liabilities, banks become insolvent. A full blown crisis ensues when the insolvency becomes systemic.

Under credit risk, borrowers become unwilling or unable to service their debt (due to specific factors) reducing the value of bank assets. Credit risk can be minimized through greater capitalization, prudential regulation, closer supervision, and greater portfolio diversification. The

[3]See for example Obstfeld (1996).

risk of widespread default increases in the event of economy wide shocks, e.g. a BOP crisis, and a systemic banking crisis will likely develop even under the best financial conditions.

Bank balance sheets can deteriorate even without an increase in the number of defaults if the rate of return on bank assets falls short of the rate that must be paid on liabilities. Perhaps the most common example of this type of problem is an increase in short-term interest rates that forces banks to increase the interest rate paid to depositors. Because the asset side of bank balance sheets usually consists of long-term loans at fixed interest rates, the rate of return on assets cannot be adjusted quickly enough, reducing the profits or losses of banks. Even if banks are able to pass on the higher interest rate cost of their liabilities to their borrowers, higher lending rates may result in an increase in nonperforming loans. Thus, a large increase in short-term interest rates is likely to be a major source of systemic banking sector problems. (Demirguc-Kunt and Detragiache, 1998)

Recently, currency mismatch became a prominent source of banking sector difficulties. This happens when banks borrow in foreign currency and lend in domestic currency and an unexpected depreciation occurs threatening the banks profitability. The banks can pass on the risk to borrowers if they lend in dollars as had been the case in many of the East Asian economies, but if the borrowers do not have a natural hedge, the unexpected currency depreciation would still affect bank profitability negatively through an increase in nonperforming loans.

The last consideration with respect to banking crises is the role of deposit insurance. When bank deposits are not insured, a deterioration in the quality of a banks assets may trigger a run. There may even arise a situation when a bank run may be self-fulfilling, that is, they make take place simply because depositors believe that other depositors are withdrawing their funds even in the absence of an initial deterioration of the bank♠s balance sheet.

Deposit insurance minimizes the chances of self-fulfilling crisis and a systemic bank run. On the other hand, the presence of deposit insurance creates moral hazard problems which are amplified in a more liberalized financial environment. With greater competition and greater access to funds, bank managers choose riskier loan portfolios knowing that in the event of a crisis, they will be bailed out by deposit insurance.

The extension of the theory on economic crises is to link currency and banking crises. Kaminsky and Reinhart (1998) provide a brief survey of the literature related to this topic. One chain of causation runs from BOP problems to banking crises. An initial external shock, such as an increase in foreign interest rates, coupled with a commitment to a fixed parity will result in the loss of reserves due to capital outflows. If not sterilized, this will lead to a credit crunch, increased bankruptcies and a financial crisis. Moreover, if a devaluation occurs the position of banks could be weakened further if a large share of their liabilities is denominated in foreign currency.

Such problem becomes more acute when the capital flows are in the form of portfolio flows or short-term capital movements rather than foreign direct investment. The liberalization of capital account transactions, by allowing this type of short-term capital flows, may contribute to the instability of the flow of reserves and adversely affect the ability of the country to peg the domestic currency (Kaminsky, 1998).

Meanwhile, other models point to the other direction--financial sector problems give rise to the currency collapse. Such models stress that when the central banks finance the bail-out of troubled financial institutions by printing money, there arises the classical situation of a currency crash caused by excessive money creation.

A third set of models contend that currency and banking crises have common causes. An example of this may be found in the "perverse" dynamics of an exchange rate-based inflation stabilization plan: Because inflation converges to international levels only gradually, there is a marked cumulative exchange rate appreciation. Also, at the early stages of the plan, there is a boom in imports and economic activity, financed by borrowing abroad. As the current account deficit continues to widen, financial markets become convinced that the stabilization program is unsustainable, fuelling an attack against the domestic currency. Since the boom is usually financed by a surge in bank credit, with a significant share of foreign borrowing, when the capital inflows become outflows and asset markets crash, the banking system caves in.

The debate on the causes of economic crises, particularly the East Asia financial crisis, is one that is not easily resolved. A key issue is whether self-fulfilling crises and panic among investors had a major role to play or whether all the economies involved had weak enough fundamentals to justify the downward spiral. The use of an Early Warning System (EWS) can help shed light on the debate by determining whether the 1997 crisis, on a country by country basis, could have been predicted by the behavior of specific economic variables. If the values of many of the indicators had crossed their respective thresholds prior to September 1997, then the crisis was indeed related to weak fundamentals. On the other hand, if no signals were flashing, then the crisis could be attributed to contagion and panic on the part of foreign investors.

III. Monitoring Economic Indicators Through an EWS

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, economic variables to watch out for are excessive monetary growth, deteriorating fiscal balances, and rapidly depleting international reserves. The next step would be to determine a threshold that would signal an impending crisis with sufficient lead time.

The literature on the different indicators and the 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 the 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 study the 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 find significant are real interest rates, economic growth, inflation and M2/Reserves. In some variations of their regression model, they find institutional variables, like 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 variables 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 does, however, have some important limitations. First, it does not provide a metric for ranking the 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 which are the more reliable indicators, they provide no information on whether the relative strength of that indicator lies in accurately calling 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.

Second, this method does not provide a transparent reading of where and how widespread the macroeconomic problems are. Within this approach, it is difficult to judge which of the variables is "out of line," making it less than suited for the purpose of surveillance and preemptive action.[4] 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.

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 and Kaminksy 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 the indicators.

Second, the definition of a crisis must be delineated. In the work of Goldstein, Kaminsky and Reinhart, they 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--are regarded as currency crises.

Third, the term "early" must be defined. For currency crises, Kaminsky and Reinhart define early as between one month and twenty-four months before the beginning of the crisis. For banking crises, a laxer definition is adopted--namely, either one month to twelve months before the start of the crisis or up to twelve months after the beginning of the crisis. This is done

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.

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

[4]The discussion on the limitations of the probability approach is quoted from Kaminsky et al. (1998), p. 14.

The fourth task is to pick out a list of potential early warning indicators, using economic theory and past empirical work as a guide. The background was presented in the first section. One criterion used for selecting an indicator is the availability of high -frequency data. A list of the indicators used by Kaminsky and Reinhart as applied to this study is presented in Table 1. The list is accompanied by a brief explanation for the inclusion of each variable.

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. In other words, the point at which the behavior of the indicator signals a crisis must be set. The 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. Note that depending on the nature of x it can be the upper or lower tail. Looking down the time series of x, any observation that falls in the 10 percent tail is regarded as a signal. It is considered a true signal if a currency crisis occurs within twenty-four 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. In short, the tail that minimizes the noise-to-signal ratio is used.

The optimal threshold will generally be different for each indicator; it may also differ for a given indicator as between banking and currency crises. The optimal threshold can then be applied to a particular country. The actual threshold value for an indicator x will differ from country to country.

Sixth and last step is that the countries and time periods in which the probability of a crisis was higher than elsewhere or at other times must be identified. This can be done by using a composite index and then computing the probability of a crisis within a specified period given the value of the index. These composite indices are calculated as follows.

After applying the basic steps of the signals approach, the data for the indicators Xjt--indicator j at time t--are transformed in the following manner:

Sjt = 1 if the value of Xjt crosses the threshold

= 0 otherwise.

According to the definition of Kaminsky and Reinhart the indicator is considered good if in most of the cases when Sjt is one, a BOP crisis occurs during the period t + 24 months. As mentioned earlier, a laxer definition is adopted for banking crises--Sjt assumes a value of one when Xjt crosses the threshold either one month to twelve months before the start of the crisis or up to twelve months after the beginning of the crisis.

The Early Warning System should enable policy makers 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 the flashing signals, which is the composite index labelled S by Kaminksy (1998) and defined as:

$$St = \sum_{j} Sjt$$

This statistic, however, does not fully use the information provided by the univariate indicators because it does not account for the different forecasting accuracy of each variable. One possible 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, labelled K, is defined as:

$$Kt = \sum_{j} Sjt/nj$$

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

The above composite leading indicators assign the same weight to a signal provided by a mild anomalous behavior of a variable and the signal 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 Ym and an extreme threshold Ye. Note that $|Ym| < |Ye|$ and based on the criterion defined earlier, $Sjt = 1$ when $|Xjt| > |Ymj|$. Ymj is the mild critical threshold for indicator j.

An extreme signal D is then defined based on Ye such that $Djt = 1$ when $|Xjt| > |Yej|$. Note, too, that $Sjt = 1$ whenever $Djt = 1$. The third composite indicator that accounts for the intensity of the signal of each univariate indicator, labelled W is defined as:

$$Wt = \sum_{j} (Sjt + Djt)$$

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 as follows:

$$Pr(Ct,t+h \mid St = I) = \frac{\text{Months with St = I and a crisis within h months}}{\text{Months with St = I}}$$

$$Pr(Ct,t+h \mid Kt = I) = \frac{\text{Months with Kt = I and a crisis within h months}}{\text{Months with Kt = I}}$$

$$Pr(Ct,t+h \mid Wt = I) = \frac{\text{Months with Wt = I and a crisis within h months}}{\text{Months with Wt = I}}$$

These steps are then applied using data from the Philippines.

IV. Application to the Philippines

The signals approach developed by Kaminsky and Reinhart can be applied to individual countries. The idea of course is to use the indicators they have identified along with the respective optimal thresholds. Extending the number of indicators--particularly those that seem to work well for a specific country--is a feasible task but in order to determine the optimal threshold for the additional indicators in a robust manner, the same cross-country format must be adopted. Herein lies the limitation when using this methodology. High frequency data for the indicators must be obtained for a large number of countries. This requires a bigger effort and more time than is allotted for this study.

In the meantime, the signals approach using the basic indicators will be applied to the Philippines for the period January 1981- December 1997. Two episodes of currency crises were identified: October 1983 and September 1997. Another BOP crisis actually transpired during the sample period and this was during the Gulf War in August 1990. This was excluded for the following

reasons: 1) the particular period was not in the list of Kaminsky and Reinhart; 2) the crisis was prompted primarily by external causes; and 3) the signals at that time were relatively weak.

Table 2 shows the values of Sjt for the entire sample period along with the values of the three composite indices. The noise-to-signal ratio, the optimal threshold and the corresponding cut-off value for the thirteen indicators are likewise presented.

In the 1983 crisis, the indicators that were consistently flashing were 1) total foreign exchange reserves; 2) the ratio of M2 to total reserves and 3) the interest rate differential. The indicators are ranked according to the number of signals they emitted during the period defined as "early." On the other hand, during the 1997 crisis, the indicators that were most active were: 1) the real effective exchange rate; 2) excess M1 balances and 3) the real growth of M2. It should be noted though that these signals were not flashing on a consistent basis during the two year period prior to the crisis. The difference in the sets of active indicators in the two episodes implies that the source of a crisis varies.

When computing for the time-series probabilities, a slight modification is made to the methodology of Kaminsky and Reinhart. We excluded the 24 month period after the crisis in order to account for the adjustment period. This is particularly relevant for the interval between January 1984 and November 1985 when signals were flashing but no crisis occurred in the following 24 month period. It was at this time that the Philippine economy contracted by a combined 15 percent, a good enough reason for excluding the period in the analysis.

The frequency table of the probabilities for the different values of each composite index is shown in Table 3. A composite index is considered more desirable when the probability of a crisis obtained from the index rises in the periods close to the crisis. Moreover, the probability should also rise along with the value of the signal. The time-series probabilities are graphed for the K composite index (Figure 1).

Using both these criteria, it seems that the composite indices generally do not perform well. In particular, the probability of a crisis does not increase with the value of the index. In fact it is even zero for the higher values in the case of the S and W index. This observation is supported by a summary measure called Brier's quadratic probability score (Table 3). The QPS evaluates the average closeness of predicted probabilities and observed realizations as measured by a zero-one dummy variable.

Given T probability forecasts as given by the time series probabilities, labelled Pt, these are compared to the time series realizations of the crisis, Rt. Rt equals one if a crisis occurs between t and t + 24 and zero otherwise (with a slightly different definition in the case of a banking crisis). Brier's quadratic probability score, which is the analog of a mean squared error is:

$$QPS = 1/T \sum_{t} 2(Pt - Rt)^2$$

The highest possible value of the QPS is 2 while perfect accuracy implies a value of zero. The QPS for the Philippine composite indices are higher than the values obtained by Kaminksy and Reinhart which are in the order of 0.33.

Based on the behavior of the time-series probabilities, the K composite index seems to be better suited as an early warning signal. This is supported the lower value of the QPS. Kaminsky and Reinhart also find that the K measure performs better.[5]

V. Analysis of Results

Looking closely at Table 2, we observe that the major source of the inconsistencies in the probability tables (Table 3) is the year 1986 and the period covering August, 1994 to March 1995. During this period the indices were emitting relatively strong signals but no crisis occurred in the 24 month interval immediately after this period. One modification that could be introduced is to extend the ~early\ period to 36 months before and after the crisis, a combination of the definition for a BOP and banking crisis.

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[5]Contrast Table 3 to a similar probability table constructed for Malaysia:

S Composite Index

Sj	Pr(Banking Crisis)
0	0.15
1	0.17
2	0.31
3	0.56
4	0.75
5 and above	0.86

Brier=s QPS: 0.39

[5]The S composite index for the Malaysian study satisfies the two criteria rather well. The QPS though is higher than that of the Philippine case but it should be noted that the latter was computed excluding the period two years after the crisis. The QPS is also affected by outliers.

A modified Table 3 shows that this adjustment leads to more acceptable behavior of the composite indices in terms of the behavior of the probabilities. The only trade-off is the rise of the probability of a crisis when the value of the composite indices is zero. This explains why the values of Brier=s QPS rise.

The S and W index are relatively mild during the period prior to the 1997 East Asian financial crisis. On the other hand, the K composite index emits a relatively strong signal from March to April 1996 and on the months of December 1996 and January 1997. But as mentioned earlier the signals were intermittent and rather weak especially when compared with the 24 months prior to the 1983 crisis.

The results in a way support the contagion effect interpretation of the East Asian financial crisis. Many of the economies did indeed have weaker fundamentals than before but not weak enough to justify the extent of the deterioration in their economies, as in the case of Indonesia. The situation was exacerbated by the panic reaction of the international investors. This lends credence to the hypothesis of self-fulfilling crises. It would be useful to apply the same EWS to Indonesia and see whether indeed the fundamentals supported the resulting economic catastrophe.

Another explanation is that the economic structure of the Philippines and the global economy has changed implying that indicators relevant to the present crisis were excluded. Other indicators can be tested but as mentioned earlier this requires a more concerted effort than can be allotted in this study. By eyeballing some proposed indicators that are published only on an annual or quarterly basis, the following show some promise: a credit gap defined as the growth in domestic credit less the growth in nominal GDP and a money gap defined as the growth in money supply less the growth in nominal GDP.

It is also possible that the optimal thresholds are not applicable in a more liberalized economic environment. If this is the case then most like the critical levels are lower in absolute value. This is one reason that there were relatively weaker signals for the 1997 crisis based on the thresholds derived from historical data

Given the strong possibility of the importance of self-fulfilling crises, it has been suggested to account explicitly for multiple equilibria in modelling time series (Harding, 1998). Non-linear models that account for endogenous changes in asset prices will be useful. In addition, for monitoring and surveillance purposes, the importance of self-fulfilling crises makes it important to undertake regular market surveys among economic agents in order to obtain a feel of their sentiments and expectations.

In conclusion, the exercise shows that the EWS of Kaminsky and Reinhart has some promise but some modifications have to be made. To be more effective, the system must use additional indicators mainly from the financial sector but the study must involve other countries and the indicators should be tested for all the East Asian economies that were drawn into the present crisis. Moreover, the ~early\ period has to be adjusted to the conditions of a specific economy particularly in terms of the lag effects of changes in policy instruments. Given the weaknesses of traditional methods of monitoring, the EWS should be made part of a wider system of monitoring and surveillance.

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Appendix: Definition of Noise-to-Signal Ratio

The economic indicators are said to emit a signal when their values cross the specified critical threshold. A good signal is defined as one that occurs within the specified period delineated as "early." A bad signal is one that occurs outside this period and is said to be generating noise. An indicator that emits more bad signals than good can be described as noisy. In the terminology of Kaminsky and Reinhart (1996) a good signal is referred to as a "signal" and a bad signal is referred to as "noise."

An indicator can be evaluated based on its noise-to-signal ratio. The latter can be defined based on the following contingency table:

	Crisis (within "early" period)	No Crisis (within "early" period)
Signal was issued	A	B
No signal was issued	C	D

In this matrix A is the number of times (in the application, it is the number of months) in which the indicator issued a good signal; B is the number of times the indicator issued a bad signal or "noise"; C is the number of months in which the indicator failed to issue a signal (a bad thing); and D is the number of times the indicator refrained from issuing a signal (a good thing).

The standard definition of the noise-to-signal ratio is B/A but Kaminsky and Reinhart use a modified noise-to-signal ratio which is [B/(B+D)]/[(A/(A+C)]. The latter is the ratio of false signals to good signals adjusted to take into account that in the sample used, the number of opportunities for false and for good signals differ.

FIGURE 1
Graph of Time Series Probabilities, K index

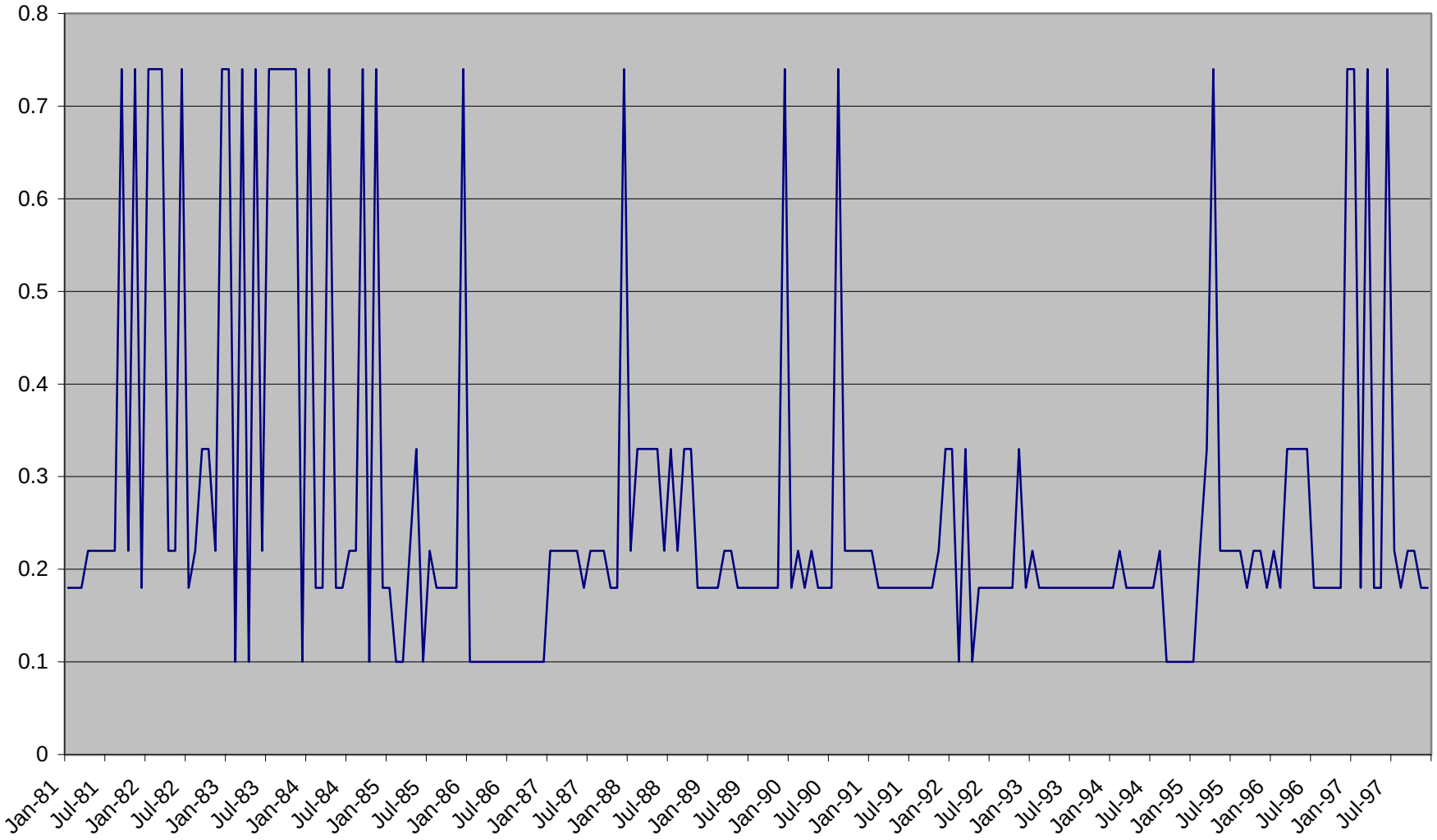

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TABLE 1
Leading Indicators

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**: This is related to the M2 multiplier and domestic credit variable. Excess money balances reflects excess money supply which puts pressure on the exchange rate. The difference in the growth of M1 and the production index was used as an indicator in this study.

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**: Two versions could be used. One is the simple year-on-year rate of growth to indicate an appreciation or depreciation. Excessive appreciation was used as an indicator of currency overvaluation which may eventually lead to problems in the trade balance. Another version based on Kaminksy and Reinhart was to estimate the deviation from trend. The trend values were taken to be the equilibrium value. We used the first version in this study.

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 domestic interest rates less foreign interest rates as measured by the 90-day US Treasury Bill rate. The lower 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 to this 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 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 because of lack of data prior to 1987.

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TABLE 2

Individual and Composite Indicators

	RER	M2/Reserves	Exports	M1gr-IPIgr	TReserves	IPIgr-inf.	M2 Mult.	M2gr-inf	RIR	Int. Diff.	Imports	Deposits	Lend/Dep			
N/S Ratio	0.2	0.5	0.4	0.5	0.6	0.5	0.6	0.6	0.8	1.0	1.2	1.2	1.7			
Optimal Cut-off	10	13	10	10	15	11	14	10	12	11	10	19	20			
Critical Value	0.12	0.51	-0.11	17.46	-0.11	-21.22	0.14	16.94	9.96	3.71	0.33	0.12	2.88	*S*	*K*	*W*
1981M1	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	2.67	4.00
1981M2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	2.67	4.00
1981M3	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	2.67	4.00
1981M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M9	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	3.00
1981M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	2.00
1981M11	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	3.00
1981M12	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	2.67	3.00
1982M1	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	3.00
1982M2	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	2.00
1982M3	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	3.00
1982M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00
1982M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00
1982M6	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	3.50	2.00
1982M7	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	2.00	2.67	3.00
1982M8	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	3.00	5.17	4.00
1982M9	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.17	3.00
1982M10	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.17	2.00
1982M11	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	1.00
1982M12	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1983M1	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M2	0.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	6.17	5.00
1983M3	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M4	0.00	1.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	6.17	5.00
1983M5	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M6	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00	5.34	5.00
1983M7	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M8	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M9	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M10	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M11	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1983M12	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	4.00	7.34	4.00
1984M1	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	3.00
1984M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984M4	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1984M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1984M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	2.00	1.42	3.00
1984M8	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	4.00	5.09	5.00
1984M9	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	3.00	3.42	4.00
1984M10	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	4.00	8.42	7.00
1984M11	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	3.00	3.42	5.00
1984M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	2.00

	RER	M2/Reserves	Exports	M1gr-IPIgr	TReserves	IPIgr-inf.	M2 Mult.	M2gr-inf	RIR	Int. Diff.	Imports	Deposits	Lend/Dep			
1985M1	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	2.59	2.00
1985M2	1.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	4.00	10.09	6.00
1985M3	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	11.76	6.00
1985M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	2.00	1.42	2.00
1985M5	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.50	2.00
1985M6	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	7.00	3.00
1985M7	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	3.00	5.75	4.00
1985M8	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.50	2.00
1985M9	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.50	1.00
1985M10	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.50	1.00
1985M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1985M12	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	2.00	3.75	3.00
1986M1	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	6.00	10.25	11.00
1986M2	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M3	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M4	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M5	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M6	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M7	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M8	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M9	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	7.00
1986M10	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	9.00
1986M11	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	5.00	7.75	7.00
1986M12	0.00	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	4.00	6.50	7.00
1987M1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00
1987M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	1.00
1987M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	2.00
1987M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1987M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	2.00	1.66	2.00
1987M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1987M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	3.00
1987M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	3.00
1987M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	3.00
1987M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	3.00	2.25	4.00
1987M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	3.00	2.25	4.00
1987M12	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	4.00	3.92	6.00
1988M1	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	4.00	5.09	6.00
1988M2	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	5.00
1988M3	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	4.00
1988M4	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	4.00
1988M5	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	4.00
1988M6	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	4.00	5.09	6.00
1988M7	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	6.00
1988M8	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	4.00	5.09	7.00
1988M9	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	4.00
1988M10	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.00	4.26	4.00
1988M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	2.00
1988M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	2.00
1989M1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1989M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	3.00
1989M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	4.00
1989M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1989M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1989M7	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.00	2.26	2.00

	RER	M2/Reserves	Exports	M1gr-IPIgr	TReserves	IPIgr-inf.	M2 Mult.	M2gr-inf	RIR	Int. Diff.	Imports	Deposits	Lend/Dep			
1989M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	2.00
1989M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1989M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	1.00
1989M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.59	2.00
1989M12	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1990M1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	2.00	1.42	3.00
1990M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990M4	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	4.00	5.51	4.00
1990M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990M8	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1990M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	2.00
1990M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	2.00
1990M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1990M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1991M1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1991M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	2.00
1991M11	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	2.00	5.83	4.00
1991M12	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	2.00
1992M1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	1.00
1992M2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	2.00	6.25	3.00
1992M3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	2.00
1992M4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	3.00	6.66	3.00
1992M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1992M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1992M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	2.00
1992M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.83	2.00
1992M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.83	1.00
1992M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992M11	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	1.00
1992M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M1	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	2.00	5.83	2.00
1993M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.83	1.00
1993M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1993M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.83	1.00
1993M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994M1	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	2.00	2.50	2.00
1994M2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	1.00

	RER	M2/Reserves	Exports	M1gr-IPIgr	TReserves	IPIgr-inf.	M2 Mult.	M2gr-inf	RIR	Int. Diff.	Imports	Deposits	Lend/Dep			
1994M3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994M6	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	2.00	2.50	4.00
1994M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994M8	0.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	3.00	5.34	4.00
1994M9	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	6.67	4.00
1994M10	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	6.67	4.00
1994M11	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	6.67	4.00
1994M12	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	6.67	4.00
1995M1	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	6.67	3.00
1995M2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	2.00
1995M3	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	3.00	4.50	5.00
1995M4	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	4.00
1995M5	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	3.00
1995M6	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	2.00
1995M7	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	3.00
1995M8	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	2.00
1995M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995M10	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	2.00
1995M11	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	1.00
1995M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M1	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	1.00
1996M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.83	2.00
1996M3	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	1.00
1996M4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	2.00
1996M5	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	1.00
1996M6	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	5.00	1.00
1996M7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1996M12	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1997M1	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1997M2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997M3	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1997M4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997M5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997M6	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	2.00	3.67	2.00
1997M7	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.67	2.00
1997M8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997M9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1997M10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	1.25	1.00
1997M11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997M12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	2.00	2.08	2.00

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TABLE 3
Probability Tables for Composite Indices

S Composite Index

Sj	Pr(BOP Crisis)
0	0.28
1	0.13
2	0.44
3	0.25
4	0
5	0

Brier▲s QPS: 0.37

W Composite Index

Sj	Pr(BOP Crisis)
0	0.28
1	0.25
2	0.30
3	0.35
4	0.27
5	0.60
6 and above	0.0

Brier▲s QPS: 0.38

K Composite Index

Kj	Pr(BOP Crisis)
0.0 - < 1.0	0.18
1.0 - 2.0	0.22
2.0+ - 3.0	0.18
3.0+ - 4.0	0.74
4.0+ - 5.0	0.33
5.0+ - 6.0	0.22
6.0+ - above	0.10

Brier▲s QPS: 0.34

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TABLE 3 (Modified)
Probability Tables for Composite Indices

S Composite Index

Sj	Pr(BOP Crisis)
0	0.41
1	0.44
2-3	0.67
4-5	0.77

Brier▲s QPS: 0.46

W Composite Index

Wj	Pr(BOP Crisis)
0	0.41
1	0.33
2	0.61
3	0.67
4-5	0.69
6 and above	0.75

Brier▲s QPS: 0.45

K Composite Index

Kj	Pr(BOP Crisis)	
0.0 - < 1.0	0.29	
1.0 - 2.0		0.56
2.0+ - 3.0	0.67	
3.0+ - 4.0	0.89	
4.0+ - 5.0	0.42	
5.0+ - 6.0	0.45	
6.0+ - above	0.92	

Brier▲s QPS: 0.38

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