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Leading Indicators of Banking Crises: Was Asia Different?

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Abstract

This paper examines episodes of the banking system distress and crisis in a large sample of countries. The empirical results identify several macroeconomic and financial variables as useful leading indicators. The main macroeconomic indicators were of limited value in predicting the Asian crises; the best warning signs were proxies for the vulnerability of the banking and corporate sector. Full-blown banking crises are shown to be more associated with external developments, and domestic variables are the main leading indicators of severe but contained banking distress.

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SUMMARY

This paper examines episodes of banking system distress in 38 countries over the past two decades in an attempt to identify the role of macroeconomic, banking sector, and real sector indicators in the lead-up to banking system difficulties, and to evaluate whether the recent Asian crisis was different from other episodes of banking crises. The empirical findings suggest that banking distress is associated with a largely contemporaneous fall in real GDP growth; boom-bust cycles in inflation, credit expansion, and capital inflows; rising real interest rates and a declining incremental capital output ratio; a sharp decline in the real exchange rate; and an adverse trade shock.

The results also demonstrate that country-specific and regional circumstances need to be recognized in assessing the likelihood of banking distress. In particular, certain factors seem to have been especially pronounced in the recent Asian crises: the real appreciation followed by a very sharp depreciation, and the buildup followed by the collapse of banks' foreign borrowing seem characteristic of those episodes. Banking distress in primary-product exporting countries also have their own set of leading indicators.

Banking sector difficulties may be severe without reaching the level of a crisis. Evidence suggests that severe banking problems are more domestic in origin and effect than full-blown crises, and that different leading indicators are relevant. Credit expansion funded mainly by capital inflows and leading to overinvestment, and movements in the real effective exchange rate were often critical in the lead-up to crisis. In case of significant distress, credit expansion fueling consumption, and movements in the real interest rate on (domestic) deposits are usually better indicators.

I. Introduction

Recent events in East Asia have reminded the world of how rapidly and with what disruptive force banking crises can erupt, and of how difficult it is to foresee the timing and full ramifications of these dramatic events. Yet financial crises have a long history, as documented for example by Kindleberger (1978). In recent decades many countries have experienced financial sector distress of various degrees of severity, and some have suffered repeated bouts (Lindgren, Garcia and Saal, 1996, provide a listing and discussion). In Latin American countries such as Chile and Mexico the government had to take over the extensive foreign debts of the financial institutions when they collapsed starting in the early 1980s. Many African countries had to take action to restructure and recapitalize their banking systems during the 1980s and 1990s. In the late 1980s in a number of industrial countries, particularly in the Nordic countries, banks' financial performance deteriorated to the point where governments had to support some of the largest banks to preserve financial stability. Mexico's economic distress of 1994-95 involved not only a currency crisis, but also the insolvency of major banks. That episode, and the 1997-1998 episodes of financial sector distress in Thailand, Indonesia, Korea, and, to a lesser extent, the Philippines, have made manifest the possibility of rapid regional contagion. All these examples show that a government faced with a banking crisis is usually prepared to intervene heavily and at great expense for fear of allowing a vicious circle of slow growth, bank failure, and general distrust to develop.

This history lends importance to the study of the causes of financial crises and the identification of leading indicators. The ultimate aim is to identify the conditions under which a crisis is likely to occur, and with this understanding and predictive ability, to preempt them or prepare for their resolution. This paper in particular is meant to contribute to a new but growing body of research that attempts to evaluate econometrically the economic precursors and causes of banking sector weakness or crisis. The special focus is on robust coincident and leading indicators that might be available in most countries as far as possible in advance of a crisis. Indeed, banking sector distress typically has a long gestation period, and is recognized as such only once it becomes acute and intervention is necessary. Hence, the period leading to crisis may display certain distinct characteristics, some of which will be identified through the approach used here. The results presented below suggest that certain indicators of crises have value and could therefore be useful in prompting preemptive action or well-designed remedies.

While banking sector distress is relatively frequent and contains some common elements across countries, it needs to be recognized that the causes need not be uniform, and therefore the policy response needs to be tailored to the situation at hand. The recent East Asian crises, for example, surely differ from those suffered in most transition or hyperinflation countries, and may have differed significantly from recent banking crises in Europe and countries relying on the export of primary products. Hence, in this paper the causes and leading indicators are differentiated by region, which also allows one to discover

what trends seem to be common across crises. In particular, the recent Asian crises are shown to differ in several regards from episodes elsewhere.

Banking sector difficulties may also differ greatly in severity: some may be categorized as severe distress, and others as full-blown crises. Results will be presented showing that the precursors of crises and coincident economic developments are rather different from those of severe but limited financial system distress.

With these objectives we examine developments in the years leading up to and including 43 episodes of financial sector distress or crisis (including episodes of repeat crisis) in a total sample of 50 countries. The variables used as indicators are aggregates and readily available in most countries, and include measures of banking system trends, real and external sector conditions, and other shocks. Thus, the focus is on the types of events surrounding crises; the observable and internationally comparable variables that must be used in such a study cast only indirect light on the structural characteristics of a banking system that make it more susceptible to crisis. The main econometric technique relies on a multinomial logit model, which relates the occurrence of several possible outcomes to the explanatory variables, that is, the indicators. We also distinguish between non-crisis periods, periods leading up to a crisis, and crisis periods, and relate each to a particular constellation of indicators. A fixed effects model is also estimated to capture country-specific factors.

Empirical findings suggest that banking distress is associated with a largely contemporaneous fall in real GDP growth; boom-bust cycles in inflation, credit expansion, and capital inflows; rising real interest rates and a declining incremental capital output ratio; a sharp decline in the real exchange rate; and an adverse trade shock. The paper finds that the Asian crises indeed differ from other episodes of financial crises in terms of the predictability of the crisis using traditional macroeconomic indicators. Instead, the main warning indicators in the case of Asia are variables which proxy the vulnerability of the banking and corporate sector, such as credit growth and rising foreign liabilities. The results suggest that banking system distress takes a different form in different countries, and that country-specific circumstances need to be recognized in assessing the likelihood of such difficulties. The paper also contains evidence to suggest that severe banking problems are more domestic in both origin and effect than full-blown crises, that increasing risk of the one or the other is signaled by different leading indicators.

The paper is structured as follows. Section II provides a brief review of the literature. Section III presents the econometric methodology, and Section IV discusses the variables used in the study. The results of the empirical analysis are discussed in section V. Section VI concludes.

II. Survey of Empirical Literature

The phenomenon of financial sector and in particular banking sector crisis has long been a subject of study.[2] An extensive literature published mostly in the last two decades discusses at a theoretical level when the banking sector may fall into crisis. This literature emphasizes that certain features of banking, such as maturity transformation and asymmetric information, make it exceptionally vulnerable to sudden and systemic collapse following either a large negative shock (as, for example, in Jacklin and Bhattacharya, 1988), or even a relatively minor disturbance leading to a shift in sentiment, as in Diamond and Dybvig (1986).

On a more applied level, detailed examination of actual cases of banking sector crises suggests that macroeconomic disturbances, sectoral and microeconomic developments, and institutional structures are associated with crises (see Sundararajan and Baliño, 1991, and Lindgren et al., *op. cit.*).

Regarding more formal econometric studies, one group of such studies concentrates on testing particular theories of bank failure using predominately microeconomic, bank-specific data.[3] The results, which mostly relate to the US experience, are suggestive, but not always easily applicable to other countries. Investors, policy makers and the concerned staff of international financial institutions often face situations where bank-specific data are unavailable or obtained only with a long lag, or are of dubious relevance due to poor accounting practices.

Another and more recent group of studies, to which this paper belongs, focuses primarily on macroeconomic variables and other indicators that are available in most countries on a fairly timely basis. Using these variables it is hoped that the risk of a banking crisis can be identified significantly in advance of its onset, or at least that the nature of a crisis can rapidly be diagnosed.

One of the pioneering works in this area is the study by Kaminsky and Reinhart (1996), which examines the behavior of various macroeconomic indicators during episodes of financial crises (banking and currency crises). Using monthly data for 20 industrial and developing countries during the period 1970-95 the authors identify a set of variables whose behavior prior to episodes of financial market crises is systematically different from that

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[2] See Demirgüç-Kunt and Detragiache (1998), González-Hermosillo (1996) and Gupta (1996) for a comprehensive review of theoretical and empirical literature on banking crises.

[3] See Gorton (1988), Park (1991), Donaldson (1992), Cole and Gunther (1995).

during tranquil periods.[4] The study focuses on variables that give information on the conditions in the financial sector, external sector and real sector. The main results are that banking crises are preceded by recession, decline in the terms of trade, stock market crash, real exchange rate appreciation (mainly in Latin American countries), lending booms, increase in money multiplier and an increase in real interest rates. The paper also attempts to determine linkages between banking and currency crises and concludes that, while banking crises are significant in predicting currency crises, the converse link does not seem to exist.

González-Hermosillo, Pazarbaşıoğlu and Billings (1997) apply a duration model of time to crisis for individual banks using Mexican data to examine empirically the proposition that bank soundness is determined by bank-specific factors and macroeconomic conditions. The empirical results suggest that bank-specific indicators as well as banking-sector variables (proxying for contagion effects) explain the likelihood of bank failure, while macroeconomic variables largely determine the time of failure. Moreover, the explanatory power of the model is greatly increased by extending the basic model comprising only bank-specific variables to include macroeconomic and aggregate banking-sector information. The paper also develops an index of fragility for the overall banking system based on the estimated degree of fragility of individual banks.

Demirgüç-Kunt and Detragiache (*op. cit.*), which was written concurrently with the research reported here, attempt to identify the features of the economic environment that tend to breed banking sector fragility, and, ultimately, lead to systemic banking crises. Rather than focussing on the behavior of high frequency time series around the time of the crisis, the authors study the determinants of the probability of a banking crisis in a multivariate, binomial logit specification with annual data. Demirgüç-Kunt and Detragiache find that low GDP growth, excessively high real interest rates, and high inflation significantly increase the likelihood of systemic problems. They also find weak evidence that adverse terms of trade shocks increase the probability of a banking crisis. The size of the fiscal deficit and the rate of depreciation of the exchange rate do not seem to have an independent effect. An interesting finding is that a weak macroeconomic environment is not the sole factor behind systemic banking problems and that structural characteristics of the banking sector and the economy also play a role. The authors also conclude that the presence of an explicit deposit insurance scheme makes bank unsoundness more likely. The paper uses mostly contemporaneous variables on the right-hand side, and therefore the direction of causality is not always unambiguous. In particular, movements in the 'explanatory' variables may precipitate a banking crisis, but equally they may be among its consequences, or both may be the result of some unobserved factor.

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[4] See Frankel and Rose (1996), and Eichengreen, Rose and Wyplosz (1996) for application of a similar approach to currency crises.

Most of the econometric studies summarized here do not differentiate between crises, even when casual empiricism suggests that the proximate causes of banking crisis differ significantly from one episode to another. While applying a common specification to all crises may be appropriate for some purposes, it is also important to know what differences there are. We concentrate on four main issues which differentiates our methodology from those used in earlier literature. In particular, the causes and leading indicators are differentiated by (i) region, (ii) severity of the crisis, and (iii) pre-crisis and crisis episodes. In addition, we modified the specification of the model to exclude all contemporaneous variables in order to isolate the leading indicators with best predictive power.

III. Econometric Approach

The phenomenon of banking system distress is difficult to quantify in a single, continuous variable, especially one that needs to be comparable across countries. Therefore, attention focuses on an indicator variable that identifies periods of banking system distress. The econometric problem is then to relate this discrete indicator of banking system distress, or the run-up to such an episode, to other, usually continuous economic series.

The main econometric approach used here is a multinomial logit model, which is designed to identify the conditions under which one observes one or another of a set of n+1 discrete outcomes (details of the approach can be found, for example, in Greene, 1990). Formally, the model's dependent variable is an indicator y that can take on values 0, 1, 2, ... n that identifies which of the n possible outcomes. The binomial model is a special case of this general formulation with $n = 1$. The explanatory variables $\mathbf{x}$ determine the 'utility' of each outcome according to

$$\text{U(alternative } i) = \beta_i'\mathbf{x} + \epsilon_i ,$$

These 'utilities' can be interpreted as the probabilities of observing the different outcomes, given the realization of the explanatory variables. Note that the model allows the parameters β_i to differ across outcomes. It is also possible to include restrictions on some of the parameters, for example, to require that different subsets of parameters are zero for different outcomes. For each observation one obtains outcome i if it offers the maximum 'utility:'

$$\text{U(alternative } i) > \text{U(alternative } j) \quad \forall j \neq i .$$

One can interpret this approach as assuming that the realized outcome for each observation is that with the highest probability of occurrence under those conditions. A positive coefficient on a particular explanatory variable for some outcome i indicates that the greater is the realization of that variable, the more probable is the occurrence of i rather than

one of the alternatives. As a normalization, the parameters β_0 for alternative $i = 0$ are set to zero, and the logistic functional form is assumed, such that

$$\text{U(alternative } i) = \frac{\exp(\beta_i' \mathbf{x})}{\sum_{j=0}^{n} \exp(\beta_j' \mathbf{x})} .$$

Then the model can be estimated by maximum likelihood. Once the parameters are estimated, it is possible to calculate the probabilities of occurrence of each possible outcome both in-sample and out of sample. For each observation the 'predicted' outcome is the one with the highest estimated probability.[5]

In the binomial case one can introduce 'fixed effects,' which are meant to capture certain permanent, non-variable differences between individuals in a panel of data, using the conditional maximum likelihood procedure introduced by Chamberlain (1980). In particular, the methodology deals with data that has a group structure. The simple specification that is employed is as follows:

$$E(y_{it} \mid x, \beta, \alpha) = \beta' \mathbf{x}_{it} + \alpha_i \qquad (i = 1,\ldots\ldots, N;\ t = 1,\ldots\ldots T)$$

where there are T observations within each of N groups (countries). The α_i are incidental parameters which are intended to capture group effects whose omission would result in biased estimates of β, a parameter vector common to all groups. The joint maximum likelihood estimator in the fixed effects probability models is inconsistent; the solution proposed by Chamberlain is to maximize a conditional likelihood function that conditions on sufficient statistics for the group-specific parameters. It is important to note that the only observations that enter the conditional likelihood function are those for which the examined event (banking system problems in this context) takes place in one and only one period per group. In the context of this paper, this implies that fixed effects models can only be estimated for countries which had banking system difficulties.

We construct a Likelihood Ratio test for the joint significance of the coefficients on the group-specific effects, against the alternative of a single intercept. We also apply a Wu-Hausman test of whether or not the remaining estimated parameters are significantly affected by the inclusion of fixed effects. However, it is not possible to calculate predicted probabilities for each period of the sample or out of sample, nor can the fixed effects be extracted.

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[5] These predictions will be reported in the form "Predictions | $y = i$: $p0/p1/ \ldots /pn$" to indicate that, for observations when in fact event i occurs, the model predicts event 0 a total of $p0$ times, event 1 a total of $p1$ times, etc.

IV. Data and Choice of Explanatory Variables

The definition of a financial crisis and the determination of the period in which one begins is a matter of judgement and debate. The identification of episodes of banking system distress used here follows that provided in Lindgren *et al., op. cit.*, Table 2 (pp. 21-35), where significant banking sector problems are distinguished from crises.[6] On this basis, a variety of dependent variables were defined for use in the estimation process:

(1) A dummy variable (designated $y1$) taking on the value 1 in a period preceding the emergence of banking sector difficulties, and zero otherwise;

(2) A dummy variable (designated $y2$) taking on the value 1 in a period when banking sector difficulties emerged, and zero otherwise;

(3) A dummy variable (designated $y3$) taking on the value 2 in a period when banking sector difficulties emerged, 1 in the preceding period, and zero otherwise;

(4) A dummy variable (designated $y4$) taking on the value 1 in a period when banking sector difficulties (without a systemic crisis) emerged, the value 2 when a banking crisis emerged, and zero otherwise.

The approach of treating the pre-crisis year and the crisis year as separate events has several advantages. First, in many countries the crisis is defined to start when intervention became necessary, but often the difficulties might have been widely known and causing serious disruption for some time before then. Thus, economic behavior in the run-up to the declared start of an episode may differ significantly from that in more normal times, and the differences may themselves be of interest.[7] Second, this approach, rather than using just the crisis as the dependent variable and including lagged values of the explanatory variables, allows one to establish the predictive power of the leading indicators independently of what is only known in the crisis year, and provides a rough indication of the time to crisis.

As for candidate explanatory variables, at least eight, and usually more years of annual data on were obtained from *International Financial Statistics* for each of a large number of countries.

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[6] For concision, the term "crisis" will be used to denote banking sector difficulties generally when the distinction between crises and severe problems is irrelevant.

[7] Estimation was also performed for a dependent variable that identified separately crisis years and the two preceding years (i.e., a dummy variable with the values 0,1,2,3). However, it was difficult to find any significant explanatory variables singling out the periods two years before crises.

Many of the countries that experienced banking sector problems are formerly socialist transition economies, which suffered a special range of problems that make them non-comparable with most of the other countries, and which were therefore dropped from the sample. For many other countries sufficient data are not available, and these countries were likewise dropped from consideration. However, the experience of countries that have not recently experienced significant banking sector problems should also be relevant, because they constitute a kind of control group; most, but not all of these countries are in Europe. Therefore, data on a number of such non-crises countries were also collected.

The data were carefully examined for outliers, mostly those arising from the difficulty of measuring real variables when hyperinflation prevails; the somewhat arbitrary rule was imposed that observations would be excluded when the absolute change in the real interest rate exceeded 50 percent. The full sample eventually obtained covered 50 countries, 38 of which suffered a total of 43 episodes of banking system crisis or significant problems (23 instances of severe problems and 20 crises), and comprised 323 observations (253 from crisis countries). The full list of countries and dates for which data were available are contained in Table 4 of Appendix I. Also defined was a shorter sample of 300 observations excluding four recent cases of banking system distress in East Asia, namely Indonesia, Korea, Philippines, and Thailand, all in 1997. These four episodes were used for out of sample prediction.

Generally explanatory variables are included in first difference form, and up to two lags of explanatory variables are included in the most general, unrestricted specification. All variables except where noted are in logs and differences (denoted by a prefix 'D' in the acronym). The prefix 'Ln' denotes the n-th lag relative to that observation.

Regarding candidate explanatory variables, in line with existing literature we use three groups of variables as indicators of banking system problems.[8] The first group of indicators relate to the real sector in an attempt to capture the degree of efficient use of credit as well as changes in the repayment capacity of borrowers. Real GDP growth (DRGDP) slows down during the pre-crisis year and actually becomes negative during the crisis year (Table 1 contains summary statistics). The growth rate of private consumption (DRPCN) and investment (DRFCF) are used as proxies for evidence of a consumption or an investment boom. The mean values for these variables become negative during the pre-crisis and crisis years suggesting overheating preceding the banking system difficulties. The incremental capital output ratio (ICOR) is used as a proxy for efficient use of investment. A sharp increase in this ratio may imply investment in low productivity sectors such as over-investment in non-tradables (e.g., real estate). It is interesting to note that the mean value of this ratio increases sharply compared to the non-crisis period.

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[8] All candidate explanatory variables are listed in Table 5 of Appendix I.

Table 1. Sample Means of Explanatory Variables

	Non-crisis countries	All countries		
		Non-crisis period	Pre-crisis year	Crisis year
Real sector variables				
Rate of growth (DRGDP)	0.037	0.036	0.014	-0.022
	0.030	*0.047*	*0.056*	*0.045*
Consumption growth (DRPCN)	-0.001	0.002	-0.002	0.003
	0.031	*0.042*	*0.041*	*0.043*
Investment growth (DRFCF)	-0.015	0.000	-0.016	-0.028
	0.074	*0.119*	*0.116*	*0.163*
Capital output ratio (ICOR)	3.293	3.262	4.179	4.764
	3.553	*11.860*	*11.970*	*4.779*
Banking sector variables				
Deposit liabilities (DRBDL)	0.023	0.038	0.023	0.005
	0.049	*0.122*	*0.091*	*0.107*
Credit to private sector (DRBCP)	0.030	0.038	0.017	0.019
	0.059	*0.158*	*0.152*	*0.125*
Foreign gross liabilities (DSFGL)	0.012	0.008	0.016	0.004
	0.058	*0.026*	*0.061*	*0.028*
Potential shocks				
Inflation (DPGP)	0.039	0.123	0.121	0.108
	0.028	*0.142*	*0.150*	*0.119*
Real interest rate (DRDIR)	-0.060	0.178	0.371	1.977
	2.402	*8.681*	*10.739*	*8.537*
Real exchange rate (DERR)	0.008	0.004	-0.059	0.003
	0.040	*0.080*	*0.148*	*0.085*
Real growth in imports (DRIMP)	0.050	0.035	0.022	0.021
	0.122	*0.155*	*0.130*	*-0.006*
Terms of trade (DTOT)	0.006	0.007	-0.017	0.183
	0.042	*0.108*	*0.096*	*0.074*

Standard deviations are shown in italics.

The second group of indicators relate to banking sector variables. These include the change in the deposit liabilities of the banking system as a percent of GDP (DRBDL), which serves a proxy for the existence of deposit runs and loss of confidence in the banking system, or of the shrinkage of banks' balance sheets for other reasons. On average this variable shows a decline during the pre-crisis and crisis years. The growth of share of total bank credit to private sector to GDP (DRBCP) is used as a proxy for how extended is the banking sector. A significant increase in this ratio might suggest growing strains in the banking sector. The mean value of this variable starts to decline in the year prior to crisis suggesting the end of the credit boom. The changes in the ratio of gross foreign liabilities of the banking system to GDP (DSGFL) is used as a measure of the extent to which the banking system relies on foreign capital to fund its operations, and thus is a proxy for its vulnerability to a sudden withdrawal of capital inflows. The mean value of this variable increases during the pre-crisis year and then sharply declines during the crisis year.

The third group of indicators include shocks which may directly or indirectly (through the real sector) effect the health of the banking sector, or which may indicate the advent of such a shock. These include the inflation rate (proxied by GDP deflator, DPGP), the real deposit interest rate (DRDIR), changes in the real exchange rate (DERR), the growth of imports in real terms (DRIMP), and terms of trade developments (DTOT). Higher real interest rates would likely hurt the non-financial corporate sector, in particular the companies which are highly indebted. The mean value for the growth rate of real interest rate increases sharply during the pre-crisis and crisis years. An adverse terms of trade shock and a real exchange rate appreciation may effect the competitiveness of the country and lead to a deterioration of the corporate sector profitability. A subsequent correction, i.e., a sharp depreciation of the exchange rate may lead to losses for corporations (financial and non-financial) indebted in foreign currency. The mean values for these variables seem to suggest that the countries were subject to adverse shocks during the year before the crisis as well as the crisis year.

Several countries in the sample suffered repeated financial crises. Possibly economic behavior will be permanently affected by a banking crisis and economic agents may behave differently when faced with such events a second time. Furthermore, repeated crises may indicate that inherent weaknesses in the banking sector were not adequately resolved. A dummy variable (RPTD) equal one in a repeat crisis and its lead-up, and zero otherwise, was used to capture this effect.

A number of what will be termed "regional variables" were defined. These were constructed by multiplying the macroeconomic explanatory variables with dummy variables that identified the region to which a country belongs (for example, the "Asia" dummy equals unity for Korea, Thailand, Indonesia, etc.). Since there were relatively few cases from Europe, attention focused on the Asian and African regional variables; of course, when such variables are included in the specification, the "non-regional" variables explain events in the remaining regions.

A specification search was undertaken to eliminate insignificant terms, starting from a very general specification containing a large number of candidate explanatory variables. The risk of omitted variable bias, and the presence of multicollinearity suggest that variables on the border of significance should not be excluded. However, the dependent variables all contain a preponderance of "zeros," that is, the proportion of non-zero terms is low. For $y1$, for example, in only 13 percent of observations is the indicator variable equal to unity. The danger exists that particular right-hand side variables serve only to "explain" one or two episodes, and results will not be robust. Hence it is important to be parsimonious. The final specification of the regression equations was determined so as to balance these considerations. Of course, when out of sample predictions were made, the specification search was conducted using just the short sample. For the sake of comparability, the same specification was used *mutatis mutandis* for all the explanatory variables and different estimation procedures. In addition, the principal specification was modified to exclude all coincidental indicators in order to isolate explanatory power of leading indicators.

V. Empirical Results

Table 2 contains the estimation results and standard errors for the dependent variable $y3$, which takes on a value of 2 in the crisis period and 1 in the pre-crisis period.[9] The first two columns report the results for the full sample and using the same explanatory variables for all countries, and the second pair of columns contain the results taking into account regional effects. The final pair of columns reports results for a specification that excludes all indicators that are coincidental with the crisis.[10] Statistics on the number of observations, the "constrained" log-likelihood (before estimation), the minimized log-likelihood, and the number of times the predicted value (the outcome with the highest estimated probability) corresponds to the true value.

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[9] The results for $y1$ and $y2$ are generally similar to those for $y3=1$ and $y3=2$, respectively. For concision they are not included in this paper but are available from the authors upon request.

[10] Thus, instances of $y3=2$ are explained using only lagged values, but instances of $y3=1$, the pre-crisis year, are explained in part with contemporaneous values.

Table 2. Estimation results for dependent variable y3

	Excluding regional variables		Including regional variables		Including regional variables, only pre-crisis indicators	
No. of observations	323		323		323	
Constrained log-likeli.	-246.79		-246.79		-246.79	
Max. log-likelihood	-198.63		-169.43		-193.31	
Predictions | y3=0	227/5/5		226/7/4		226/8/3	
Predictions | y3=1	31/10/2		28/12/3		29/13/1	
Predictions | y3=2	30/0/13		20/0/23		31/0/12	
Parameter estimates	y3 = 1	y3 = 2	y3 = 1	y3 = 2	y3 = 1	y3 = 2
Constant	-2.118	-2.132	-2.336	-2.623	-2.409	-2.478
	0.335 **	*0.381* **	*0.392* **	*0.502* **	*0.039* **	*0.476* **
DRGP	-6.438	-14.585	-8.048	-14.303	-6.178	--
	4.149	*4.306* **	*4.305* +	*4.824* **	*4.218* +	
LDRGP	--	--	--	--	--	-6.044
						4.783
LDRPCN	--	6.562	--	8.610	--	7.281
		5.017		*5.725*		*5.500*
LICOR	0.019	--	0.028	--	0.026	--
	0.014		*0.027*		*0.025*	
L2ICOR	--	0.019	--	0.009	--	0.047
		0.014		*0.030*		*0.041*
DPGP	-8.453	--	-10.731	--	-9.806	--
	3.109 **		*3.356* **		*3.234* **	
LDPGP	10.992	-7.896	12.852	-10.955	12.842	-3.187
	2.992 **	*3.477* *	*3.235* **	*3.967* **	*3.122* **	*4.124*
L2DPGP	--	9.253	--	14.671	--	5.626
		3.057 **		*3.703* **		*3.787*
DRBDL	-5.213	-2.626	-4.092	-4.857	-2.970	--
	2.110 *	*2.341*	*2.281*	*2.624* +	*2.182*	
LDRBDL	--	-1.578	--	-0.839	--	-1.675
		1.476		*1.793*		*1.622*
DRBCP	-1.526	-2.863	-2.658	-4.329	-2.267	--
	1.942	*2.064*	*2.129*	*2.227* *	*2.044*	
LDRBCP	1.425	--	2.066	--	1.780	-1.301
	1.467		*1.481*		*1.493*	*2.198*
L2DRBCP	--	2.262	--	2.871	--	1.325
		1.482		*1.727* +		*1.593*
DRDIR	--	0.064	--	0.106	--	--
		0.026 *		*0.033* **		
LDRDIR	0.045	--	0.054	--	0.054	0.074
	0.029		*0.030* +		*0.030* +	*0.045* +
L2DRDIR	0.600	0.030	0.061	0.057	0.061	0.038
	0.025 *	*0.026*	*0.026* *	*0.027* *	*0.025* *	*0.027*

Standard errors in italics.

**: significant at 1 percent. *: significant at 5 percent. +: significant at 10 percent.

Table 2 (Continued). Estimation results for dependent variable y3

	Excluding regional variables		Including regional variables		Including regional variables, only pre-crisis indicators	
Parameter estimates	y3 = 1	y3 = 2	y3 = 1	y3 = 2	y3 = 1	y3 = 2
DERR	-2.099	-7.215	-3.796	-6.223	-2.451	--
	2.290	*1.899* **	*2.660*	*2.500* *	*2.536*	
LDERR	4.567	--	3.630	--	3.368	-1.562
	2.392 +		*2.420*		*2.445*	*2.368*
L2DERR	--	4.357	--	2.133	--	2.969
		2.419 +		*2.690*		*2.548*
DRGFL	-7.765	--	-9.685	--	-8.262	--
	6.782		*7.725*		*7.431*	
LDRGFL	10.241	-7.456	3.673	-7.065	4.837	-2.606
	7.170	*7.707*	*8.790*	*10.747*	*8.851*	*9.960*
L2DRGFL	--	16.064	--	10.703	--	6.475
		8.886 +		*11.454*		*9.596*
DRIMP	-1.028	--	-1.829	--	-1.849	--
	1.402 +		*1.751*		*1.684*	
LDRIMP	--	-1.058	--	-4.465	--	-2.753
		1.351		*1.965* *		*1.790*
RPTD	1.191	1.130	0.850	1.040	0.708	--
	0.613 +	*0.725*	*0.664*	*0.888*	*0.652*	
ADERR	--	--	19.421	-22.482	21.224	--
			8.683 *	*12.372* +	*8.059* **	
ALDERR	--	--	--	35.048	--	16.131
				10.775 **		*7.166* *
ADRGFL	--	--	--	-91.762	--	--
				33.824 **		
ALDRGFL	--	--	30.595	--	28.487	-14.204
			16.830 +		*16.366* +	*18.592*
AL2DRGFL	--	--	--	38.689	--	32.615
				21.948 +		*18.618* +
BDPGP	--	--	--	20.527	--	--
				9.151 *		
BLDPGP	--	--	--	--	--	15.118 +
						8.129
BL2DPGP	--	--	--	-23.227	--	-14.823
				11.428 *		*9.366*
BDTOT	--	--	-10.210	--	-9.962	--
			4.033 *		*3.968* *	
BDLTOT	--	--	--	-9.148	--	-9.891
				4.298 *		*4.574* *
BDRIMP	--	--	3.727	--	3.070	--
			3.211 +		*3.184*	
BLDRIMP	--	--		7.967		4.389
				3.534 *		*3.213*

A. Predictive Power and Dynamic Structure

Reviewing the results across the tables shows that reasonable predictive power has been obtained. For example, when the specification for $y3$ including regional variables is estimated across the full sample, more than half of the episodes of banking system distress are predicted correctly, and about one third of the pre-crisis periods are identified correctly or as a crisis period.[11] [12] A visual impression of the ability of this model to differentiate crisis or pre-crisis periods can be obtained from Figure 1, where the estimated probabilities of $y3=1$ and $y3=2$ are plotted. Even when these probabilities sum to less than 50 percent in a crisis and pre-crisis period, in a number of instances an upward "spike" can be detected.

Predictive power for crisis years ($y3=2$) is usually somewhat better than for pre-crises years ($y3=1$), largely because in the former case several contemporaneous variables (such as the change in the real effective exchange rate, DERR) are highly significant. However, the model's ability to predict pre-crisis years, or crisis years on the basis largely of lagged indicator variables, seems satisfactory; it is this ability which is needed to take preemptive action. As can be seen from the last pair of columns in Table 2, about 30 percent of crises can be predicted using just leading indicators. When only pre-crisis variables are used, the estimated coefficients tend to be less significant and somewhat smaller in magnitude, but are otherwise qualitatively similar to those obtained when coincident indicators are included.

The $y3$ specification excluding regional variables was estimated over a sample that omits the four recent East Asian crises.[13] The estimated coefficients are robust to this change, except that estimated coefficient on the real effective exchange rate term is somewhat larger in the full sample.[14] As can be seen in Figure 2, when predictions are made out of sample, three of the four crises are correctly identified. Even in the case of the Philippines (the least severe of these episodes), the predicted probability of a crisis or pre-crisis rises sharply in 1997. However, in none of these cases was the pre-crisis period identified, confirming the impression that these crises were not preceded by the typical macroeconomic disturbances.

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[11] Joint estimation for crisis and pre-crisis periods seems to yield gains in efficiency. The predictions for $y3$ are more reliable than when either $y1$ or $y2$ alone is the dependent variable.

[12] In a few crisis or pre-crisis years, the estimated probability of $y3 = 0$ is larger than that of each of the other two possibilities, but still less than 50 percent. Hence, the model predicts either $y3=1$ or $y3=2$ in 41 out of 86 instances where this is the case. Conversely, it predicts either $y3=1$ or $y3=2$ in 14 of 167 instances where in fact $y3=0$.

[13] Detailed results are available upon request.

[14] The similarity of the estimated coefficients obtained for $y1$ and $y2$ to those obtained from joint estimation for $y3$ is also suggestive of robustness.

Figure 1. Estimated probabilities for y3

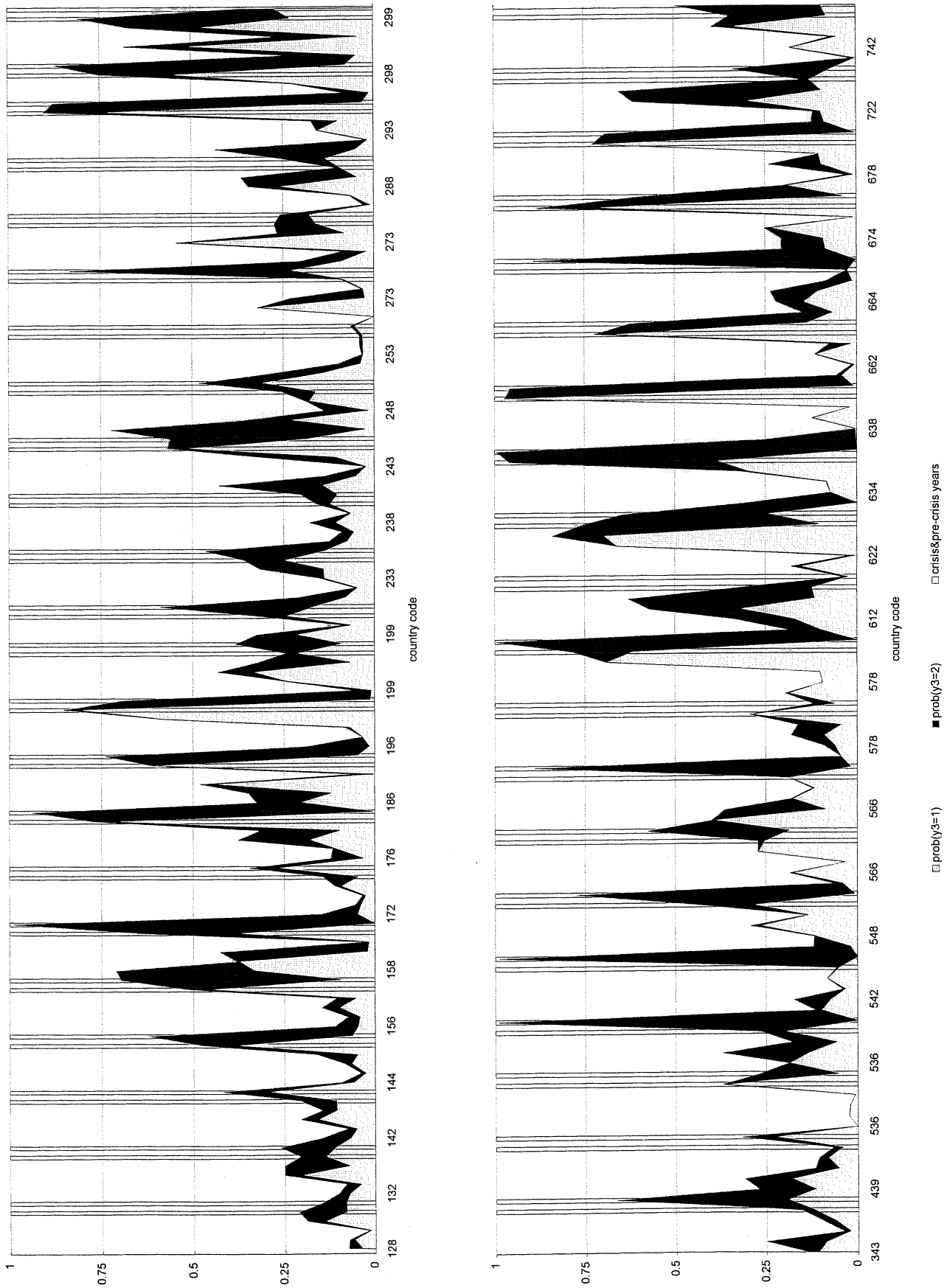
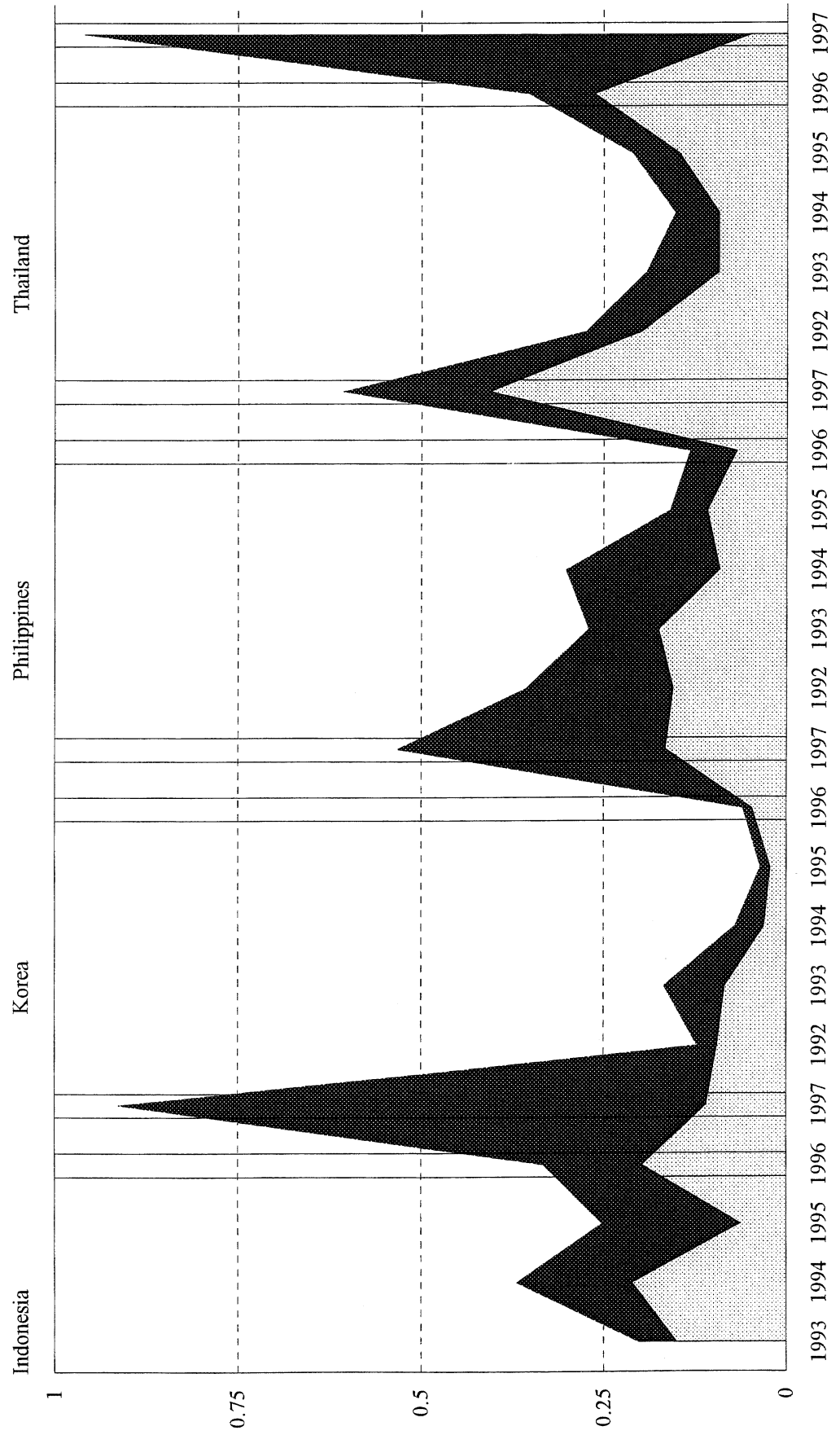


Figure 2. Out of sample predicted probabilities for y3



An examination of the lag structure of the estimated equations reveals several regularities. First, the explanatory variables for $y2=1$ or $y3=2$ (except for contemporaneous terms) tend to be lagged one period relative to those for $y1=y3=1$, which is as one would expect. Second, a number of explanatory variables display a "boom and bust" pattern, with a large positive coefficient lagged one or two years, and a large negative coefficient in the crisis or pre-crisis year. This pattern, which accords with some of the proposed explanations of banking crises, applies to inflation, credit growth, the real effective exchange rate, and banks' gross foreign liabilities. In some instances the interval from "boom" to "bust" is at least two years. Third, variables capturing financial market prices (the real exchange rate and the real effective exchange rate) are the main contemporaneous indicators of banking crises; the variables measuring quantities, such as stocks of financial assets or GDP components, more often enter with a lag.

B. Significance of Individual Indicator Variables

The estimation results for individual explanatory variables largely corroborate the findings of others. Ignoring for the moment the regional variables, the following points are worth noting:

- Banking distress is associated with a largely contemporaneous fall in real GDP growth, but for at least some countries the fall in GDP growth begins earlier, and this variable has some information content in predicting $y1= y3=1$.

- The empirical findings suggest that a consumption boom in the years preceding a crisis (LDPRCN) can be a leading indicator.

- The estimated coefficient on the lagged incremental capital output ratio (ICOR) is not significant at conventional significance levels, but including the variable improves predictive power, and the estimate is robust to changes in specification. Furthermore, the (positive) sign accords with the theory that over-investment at decreasing returns often leads to a banking crisis.

- A rise followed by a sharp fall in inflation seems to be one of the most reliable early indicators of impending banking sector problems.

- Deposits at banks (DRBDL) tend to start falling in real terms before a banking crisis is fully acknowledged, possibly due to declining confidence in the domestic banking system, and continue to fall during the crisis. This fall presumably contributes to liquidity problems in the banking sector.

- There is a persistent and robust tendency for credit to the private sector (DRBCP and its lags) to follow a boom and bust pattern in advance of crises, with a further decline in credit growth during the crisis.

- Real interest rates (DRDIR) usually rise in the crisis year, and reliably tend to start increasing already in the preceding years.[15]

- Banking crises are associated with a sharp decline in the real effective exchange rate. However, an appreciation in the REER often precedes a crisis.

- The coefficients of the indicator used to capture the vulnerability of the banking system to private capital inflows (the change in the gross foreign liabilities of the banking sector relative to GDP, denoted by DRGFL) are sometimes significant and contribute to the predictive power for the model. They carry the expected sign, namely positive on a longer lag and negative as the crisis approaches.

- A sharp slowdown in the real growth in imports is a good leading indicator of a financial crisis. This contraction may be symptomatic of a general economic slowdown and especially a decline in certain sectors, or of foreign exchange shortage.

- The estimate of the coefficient on the "repeat crisis" dummy variable is close to significant and relatively robust.

- Other candidate explanatory variables found not to be systematically significant for this sample included: real gross fixed capital formation, the current account balance, reserve money, credit from the monetary authorities, banks' reserves, banks' net foreign assets, and foreign exchange reserves (relative to imports or deposits). These variables often seem to contain useful information and have predictive power when used in isolation, but their significance is lost when used in conjunction with the other explanatory variables.

C. Regional and Country-Specific Effects

The inclusion of regional variables has a major effect on the estimates, even if most of the qualitative results are preserved. Indeed, some estimated coefficients become larger and more significant when the regional variables are included (for example, on most of the interest rate terms, or the change in real GDP for $y3=1$); once certain regional factors are accounted for, the indicative value of other variables becomes clearer. The importance of regional effects is demonstrated by the improvement in predictive power that is obtained through their inclusion.

The banking crises in Asian countries are strongly associated with an appreciation followed by a sharp depreciation in the real effective exchange rate (DERR), and a parallel

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[15] Unfortunately, a measure of interest rate spreads was not available for many countries over most of the sample.

movement in the gross foreign liabilities of the banking sector (DRGFL). With this specification the estimated coefficients on these terms for the non-Asian countries are lower. These results are consistent with the weight given to capital inflows and real exchange rate movements in accounts of the recent Asian crises. Inclusion of the Asian regional variables also eliminates the significance of the "repeat crisis" dummy (RPTD), which largely serves to identify several of the recent Asian crises. However, the estimated coefficient on the "Asia dummy" itself (not cross-multiplied with another explanatory variable) was insignificant, suggesting that a pure regional reputation effect was small.

The results for the African regional variables suggest that banking crises in that region were not so much associated with a rise and sudden fall in inflation, nor is a slowdown in import growth a good leading indicator. Rather, a deterioration in the terms of trade seems to have been a major contributing factor in these countries, many of which rely heavily on the export of primary commodities.

Fixed effects model for $y1$ and $y2$ were estimated in order to capture the influence of structural differences between countries that might influence how susceptible they are to banking crises.[16] The fixed effects themselves were found to be always jointly highly significant, indicating that country-specific phenomena are indeed very important.[17] However, the estimated parameters on the variables of interest were not greatly affected by the inclusion of fixed effects, and in some instances their significance increased.[18] Hence, the macroeconomic, observable variables are still reliable indicators of the risk of banking sector difficulties, even after some allowance is made for idiosyncratic, structural factors.

D. Distinguishing between Crises and Severe Banking Problems

So far all cases of banking system distress have been considered without regard to how profound or pervasive they were, but it is obvious that they differ greatly in these respects, and possibly in their probable causes. An indication of the importance of these differences can be obtained by considering the estimated coefficients for $y4$ presented in Table 3, albeit with the caveat that the relatively small number of each type of event may reduce the generality of the results.

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[16] Detailed results are available on request.

[17] For each specification a Likelihood Ratio test was performed. The fixed effects were always found to be very highly significantly different from zero.

[18] The results of the Wu-Hausman test used indicate that the estimates of parameters on the explicit explanatory variables were no significantly affected by the inclusion o ffixed effects.

Table 3. Estimation results for dependent variable y4

	Full sample, excluding regional variables		Full sample, including regional variables	
No. of observations	323		323	
Constrained log-likeli.	-156.41		-156.41	
Max. log-likelihood	-114.54		-94.331	
Predictions | y4=0	277/1/2		276/3/1	
Predictions | y4=1	21/1/1		16/5/2	
Predictions | y4=2	9/0/11		9/0/11	
Parameter estimates	y4 = 1	y4 = 2	y4 = 1	y4 = 2
Constant	-3.026	-3.273	-3.613	-3.595
	0.489 **	*0.606* **	*0.635* **	*0.771* **
DRGP	-6.280	-23.753	-5.865	-22.438
	5.047	*6.673* **	*5.167*	*6.824* **
LDRPCN	12.151	-1.304	16.331	0.723
	6.149 *	*7.855*	*6.833* *	*8.584*
L2ICOR	0.005	0.029	-0.016	0.027
	0.025	*0.015* +	*0.034*	*0.025*
LDPGP	-6.892	-9.750	-11.185	-9.324
	3.644 +	*6.579*	*4.583* *	*6.593*
L2DPGP	8.745	6.266	14.770	8.088
	3.156 **	*5.353*	*4.201* **	*5.740*
DRBDL	-2.153	0.036	-4.335	-0.466
	2.668	*3.632*	*3.239*	*3.515*
LDRBDL	-1.773	-0.367	-1.437	2.307
	1.755	*2.931*	*1.987*	*3.194*
DRBCP	-3.396	-0.045	-4.136	-1.582
	2.356	*2.996*	*2.729* **	*2.932*
L2DRBCP	2.372	1.951	3.500	0.915
	1.552	*3.215*	*1.794* +	*3.750*
DRDIR	0.064	0.015	0.097	0.028
	0.033 +	*0.037*	*0.038* *	*0.047*
L2DRDIR	0.040	-0.026	0.063	-0.010
	0.030	*0.033*	*0.030* *	*0.039*

Standard errors in italics.

**: significant at 1 percent. *: significant at 5 percent. +: significant at 10 percent.

Table 3 (Continued). Estimation results for dependent variable y4

	Full sample, excluding regional variables		Full sample, including regional variables	
Parameter estimates	y4 = 1	y4 = 2	y4 = 1	y4 = 2
DERR	-3.980	-10.306	-3.605	-8.155
	2.417 +	*2.427* **	*3.266*	*3.144* **
L2DERR	3.935	3.823	1.167	2.627
	2.977	*3.863*	*3.295*	*4.409*
LDRGFL	-8.854	-12.940	-9.284	-15.758
	9.952	*11.012*	*13.533*	*13.480*
L2DRGFL	13.309	25.901	7.278	22.278
	10.822	*13.267* +	*14.886*	*15.908*
LDRIMP	-0.462	-3.242	-4.396	-6.321
	1.500	*2.211*	*2.322* +	*3.398* +
RPTD	0.668	1.647	0.653	1.259
	0.890	*1.110*	*1.024*	*1.426*
ADERR	--	--	-27.463	-29.477
			12.615 *	*13.053* *
ALDERR	--	--	35.932	30.259
			12.083 **	*14.285* *
ADRGFL	--	--	-92.661	-86.384
			35.410 **	*43.821* *
AL2DRGFL	--	--	38.104	26.424
			25.967	*31.605*
BDPGP	--	--	21.878	19.009
			9.186 *	*9.970* +
BL2DPGP	--	--	-25.317	-26.107
			12.363 *	*15.241* +
BDLTOT	--	--	-12.585	-5.206
			5.552 *	*5.737*
BLDRIMP	--	--	9.272	2.382
			4.007 *	*6.067*

The differentiation of the crisis versus significant distress episodes reveal important characteristics of these different episodes. In particular, a decline in growth is an important factor explaining the crisis episodes, but it is not significant for the distress cases. Furthermore, credit expansion funded mainly by capital inflows and leading to over-investment seems to be a critical factor in leading to crisis (significant parameters for L2DRGFL and L2ICOR). Likewise, movements in the real effective exchange rate seem to have been more important in the crises countries. These findings suggest that certain external developments, in particular heavy reliance on external funds, magnify the impact of a negative shock to the system and constrain the policy response to banking system distress, leading to a full-blown crisis. The causation need not be only one way: a very severe banking system crisis may itself precipitate exchange rate crises. In contrast, credit expansion seems to have fueled consumption in the case of significant distress cases, where also movements in the real interest rate on (domestic) deposits is a better indicator.

The inclusion of regional variables if anything reinforce this result, implying that it is not merely due to the recent Asian crises. Inclusion of the regional variables does improve the predictive power of the model considerably, as can be seen from comparing the first and second pairs of columns in Table 3. Figures 3 and 4 show the predicted probabilities of severe banking problems or a crisis, respectively, generated from the specification including regional variables; an upward "spike" in the estimated probabilities of either $y4=1$ or $y4=2$ is apparent at most dates at which one or the other event occurred. The estimated coefficients on the regional variables are mostly significant and corroborate the results obtained for the other dependent variables.

VI. Concluding Remarks

This paper examines the banking crisis episodes in 38 countries during 1980-97 in an attempt to identify the role of macroeconomic, banking sector and real sector indicators in the lead-up to banking system difficulties, and to evaluate whether the recent Asian crisis was different than other episodes of banking crises. Overall the empirical findings suggest that banking distress is associated with a largely contemporaneous fall in real GDP growth; boom-bust cycles in inflation, credit expansion, and capital inflows; rising real interest rates and a declining incremental capital output ratio; a sharp decline in the real exchange rate; and an adverse trade shock.

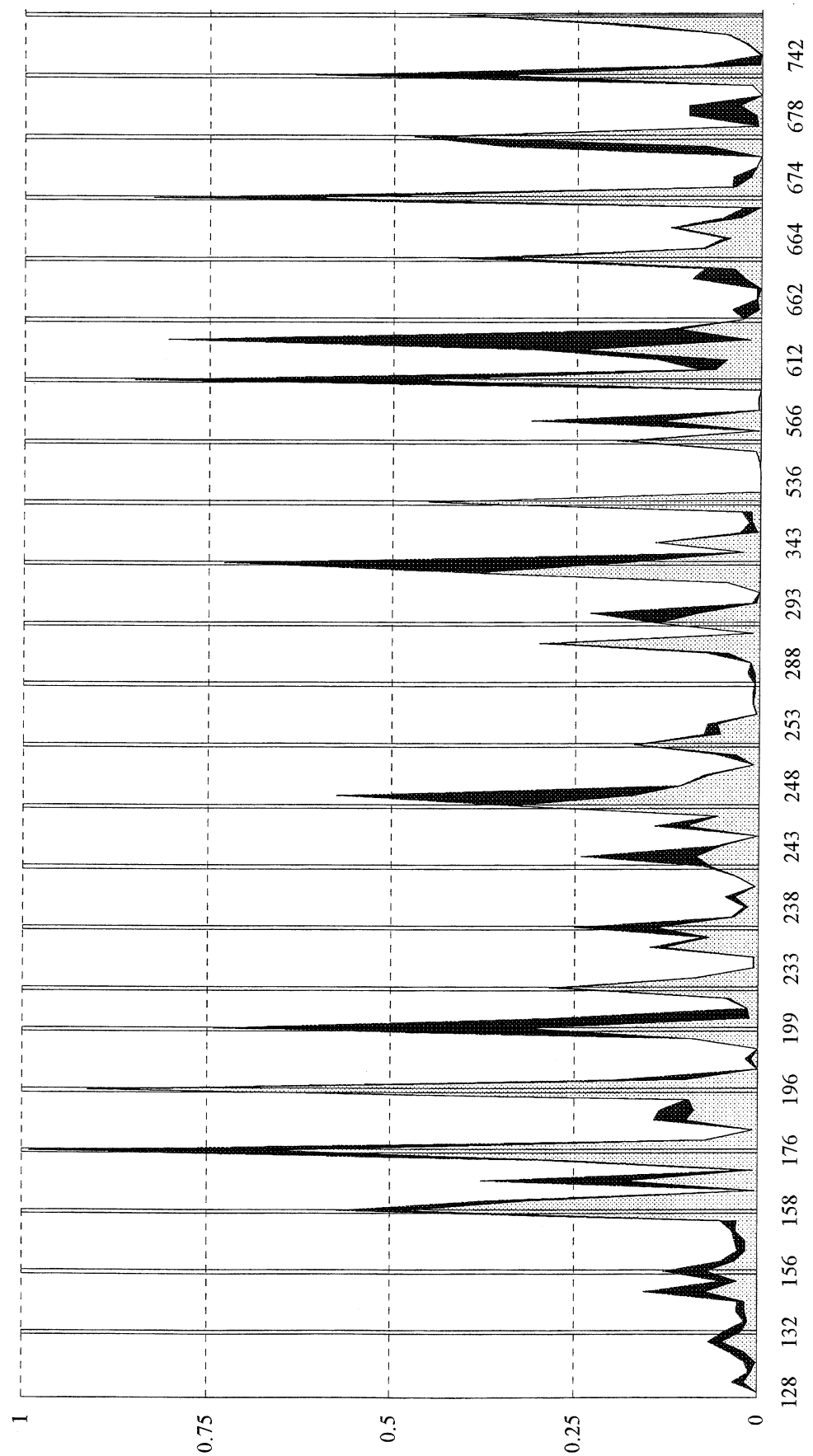

Figure 3. Estimated probabilities for y4, cases of severe banking system distress

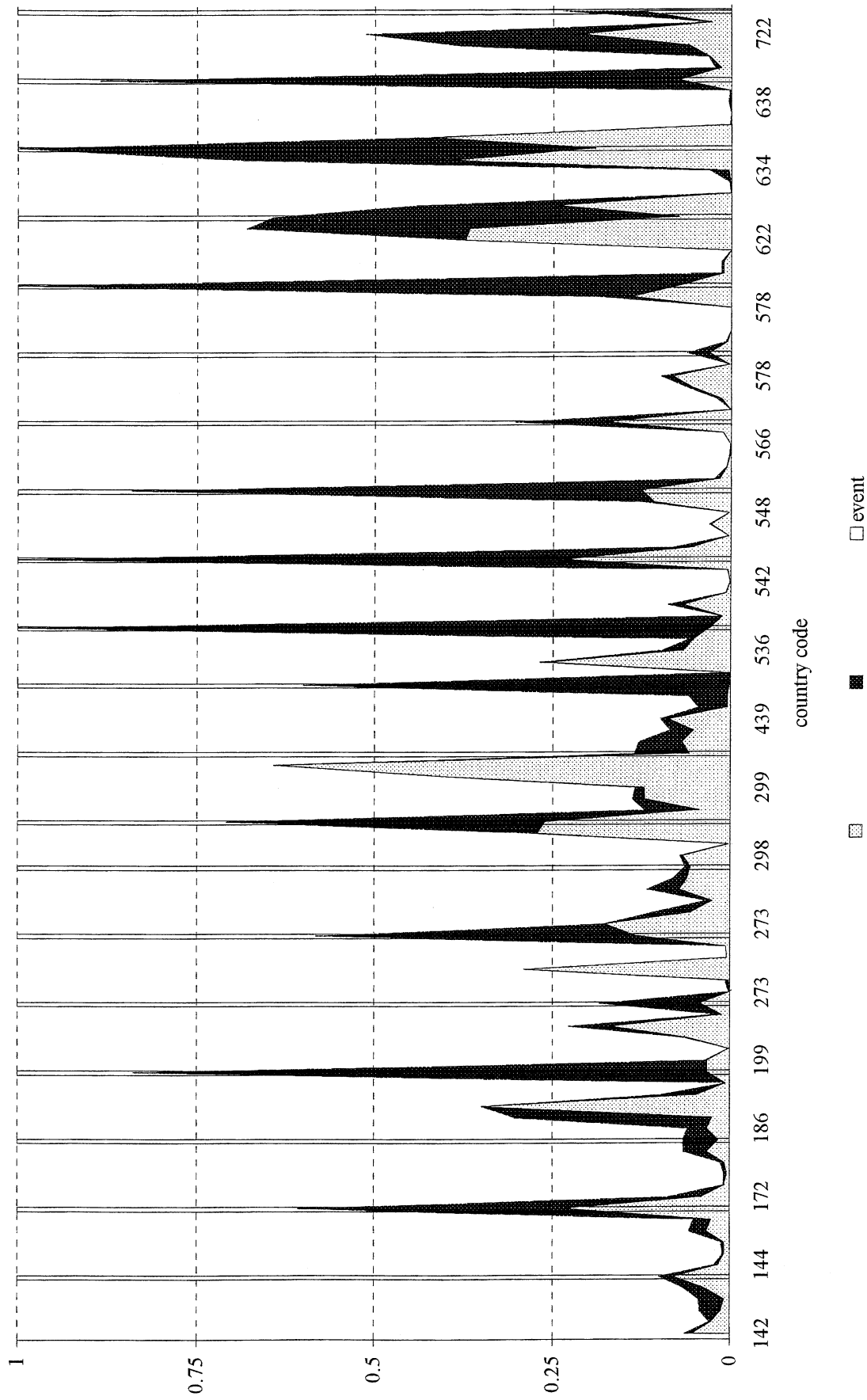

Figure 4. Estimated probabilities for y4, cases of banking system crisis

Certain of these tendencies seem to have been especially pronounced in the recent Asian crises, which seem to have been relatively difficult to predict using traditional macroeconomic indicators. Instead, real appreciation followed by a very sharp depreciation, and the build-up followed by the collapse of banks' foreign borrowing seem characteristic of those episodes. These results are consistent with several accounts of the origins of these crises which stress the boom-bust cycle in asset prices and lending by banks and non-bank financial institutions to decreasingly profitable projects. Krugman (1998) for instance argues that competition among over-guaranteed and under-regulated banks leads bankers to base decisions not on a project's expected return but on its return in ideal circumstances, leading to excessive capital inflows, over-investment and asset price bubbles.

More generally, the results presented are a reminder of how diverse are the problems that come under the heading of banking system distress, and how country-specific circumstances need to be recognized in assessing the likelihood of such difficulties. The banking systems of the primary product exporting countries of Africa are vulnerable to a different range of disturbances than those of, say, the Nordic countries, and, as shown, the relevant leading indicators differ likewise.

Furthermore, it needs to be recognized that banking sector difficulties may be severe without reaching the level of a crisis. The paper contains evidence to suggest that severe banking problems are more domestic in origin and effect than full-blown crises. Certain external developments and constraints, such as heavy reliance on external funds, seem to magnify the impact of a negative shock to the financial system, and full-blown banking crises may contribute to foreign exchange market turbulence. In contrast, case of significant distress are often preceded by especially rapid credit expansion and growth in consumption, and are associated with rising domestic real interest rate.

Data Description

Table 4. Classification of countries by banking distress date

IFS code	Country	data availability		Banking distress date	Type of distress 1/
		First year	Last year		
122	Austria	1990	1995		0
128	Denmark	1985	1990	1990	1
132	France	1989	1994	1994	1
134	Germany	1990	1995		0
138	Netherlands	1990	1995		0
142	Norway	1986	1991	1991	2
144	Sweden	1987	1992	1992	2
146	Switzerland	1990	1995		0
156	Canada	1978	1983	1983	1
158	Japan	1987	1992	1992	1
172	Finland	1986	1991	1991	2
176	Iceland	1980	1985	1985	1
178	Ireland	1990	1995		0
181	Malta	1990	1995		0
182	Portugal	1990	1995		0
186	Turkey	1977	1982	1982	2
193	Australia	1990	1995		0
196	New Zealand	1984	1989	1989	1
199	South Africa	1980	1989	1985	2
				1989	1
233	Colombia	1979	1984	1984	1
238	Costa Rica	1989	1994	1994	1
243	Dominican Rep.	1987	1992	1992	1
248	Ecuador	1987	1992	1992	1
253	El Salvador	1990	1995	1995	1
273	Mexico	1977	1994	1982	2
				1994	2
288	Paraguay	1990	1995	1995	1
293	Peru	1978	1983	1983	1
298	Uruguay	1979	1982	1982	2
299	Venezuela	1989	1994	1994	2
343	Jamaica	1989	1994	1994	1
423	Cyprus	1990	1995		0
439	Jordan	1984	1989	1989	2
536	Indonesia	1987	1997	1992	1
				1997	2
542	Korea	1992	1997	1997	2
548	Malaysia	1980	1985	1985	2
566	Philippines	1976	1997	1981	2
				1997	1
576	Singapore	1990	1995		0
578	Thailand	1978	1997	1983	2
				1997	2
612	Algeria	1985	1990	1990	1
616	Botswana	1992	1995		0
622	Cameroon	1984	1989	1989	2
634	Congo	1989	1994	1994	2
638	Benin	1982	1987	1987	2
662	Cote d'Ivoire	1983	1988	1988	1
664	Kenya	1988	1993	1993	1
674	Madagascar	1983	1988	1988	1
678	Mali	1982	1987	1987	1
722	Senegal	1978	1983	1983	2
742	Togo	1984	1989	1989	1
819	Fiji	1990	1995		0

Source: Lindgren, Garcia and Saal (1996).

1/ A value of 0 indicates no significant banking sector problems during the sample period, a value of 1 indicates significant distress, and a value of 2 indicates a systemic crisis.

Table 5. Description of the explanatory variables and sources

Variable name	Definition	Source
D_	Difference operator	
L(n)_	n-th lag of the variable it preceeds	
GDP	Nominal gross domestic product, in logs	IFS, 99b
RGP	Real GDP, in logs	IFS, 99b.p
PCN	Private consumption, in logs	IFS, 96f
FCF	Gross fixed capital formation, in logs	IFS, 93e
ICOR	Incremental capital output ratio	exp(FCF)/Dexp(GDP)
PGP	GDP price deflator, in logs	GDP - RGP
RBDL	Real bank deposit liabilities relative to GDP, in logs	IFS, 24+25
RBCP	Real bank credit to private sector relative to GDP, in logs	IFS, 22d
RDIR	Deposit interest rate minus contemporaneous GDP price inflation	IFS, 60l
ERR	Real effective exchange rate, in logs	IFS, reu
RGFL	Bank gross foreign liabilities relative to GDP	IFS, 26c
RIMP	Imports in US dollars, deflated by the US CPI, in logs	IFS, 71 /111.64
TOT	Terms of trade (price of exports over price of imports), in logs	IFS, 76 / 76.x
RM	Reserve money relative to GDP, in logs	IFS, 14
CMA	Monetary authorities' credit to banks rel. to GDP, in logs	IFS, 12e
BR	Bank reserves relative to GDP, in logs	IFS, 20
NFA	Banks' net foreign assets relative to GDP	IFS, 21 - 26c
RES	Official foreign exchange reserves relative to imports	IFS, 1d.d
CAB	Current account balance relative to imports	IFS, 78ald
RPTD	Dummy variable for repeated crisis in a country	Lingren, Garcia and Saal (1996)

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