Financial Sector Reforms and Currency Crisis: The Indonesian Experience

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The theory of exchange rate determination clearly links a depreciating currency to a deteriorating trade balance, interest differential and related economic fundamentals. Empirical testing carried out routinely confirms these relationships in "normal" times as currencies constantly align themselves to find their places in the global marketplace. When depreciation reaches crisis proportions, they are not always caused by a proportional deterioration in economic fundamentals. Random activities like speculative attacks are prompted by perceived problems in the banking sector as well as the contagion effect, leading to a currency crisis. Using pre crisis data and focusing on the Indonesian rupiah, this view is confirmed in the research.

Keywords: Currency Crisis, Indonesia, Exchange Rate

JEL Classifications : F31, F41

INTRODUCTION

The joint occurrence of currency and banking crisis were dubbed as the 'twin crises' by Kaminsky and Reinhart (1999). Following the spate of currency and banking crises in the 1990s, the literature on currency turmoil has extended beyond merely identifying the causes of such crises, to outlining the linkages between the two types of crises, especially where they occurred jointly. Many of these studies concentrate in designing an early-warning system characterising the behaviour of likely leading indicators of currency crises for groups of nations (e.g., Frankel and Rose 1996; Kaminsky, Lizondo and Reinhart 1998; Kaminsky and Reinhart 1999; and Ozkan 2005). Methodology used in these studies typically involves graphically mapping out and comparing the levels of the indicators in the period of 'tranquil times' to the period prior to the incidence of the currency crisis (however it has been defined) and generalising from that. Countries are lumped together, masking the unique characteristics of each country's

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experience. In this research we move away from designing an early-warning system for detecting an impending crisis in a group of countries. Instead we seek to quantify the relationship between the exchange value of the domestic currency and banking sector developments for Indonesia, the country that experienced the most severe currency depreciation during the Asian crisis of 1997-98.

So what is a currency crisis and what events led to such crisis in Indonesia? Whereas there is no universally accepted definition of a currency crisis, a sharp and continuous depreciation of the domestic currency is always an underlying characteristic. Frankel and Rose (1996) provide some quantitative dimension by suggesting a threshold of at least 25% annual nominal depreciation that is also at least a 10% increase in the rate of depreciation from the previous year. Others have used broader measures and look beyond the value of the currency to define a currency crisis. For example, Sachs, Tornell and Velasco (1996) employ a 'crisis index', calculated as a weighted average of the rate of depreciation and the percentage change in foreign reserves. The extent of rupiah's depreciation and loss of foreign reserves would leave no doubt that Indonesia's currency was, indeed, in crisis. From 1979 to the first half of 1997, Indonesia's exchange rate policy was that of a managed float supported by an intervention band. The nominal exchange rate was recorded at 2400 rupiah to the US dollar during the first quarter of 1997. In July 1997, when Thailand floated the baht, Bank Indonesia widened the rupiah trading band from 8 percent to 12 percent, but the attack on the currency became relentless. Since the rupiah was freely floated on August 14, 1997, its exchange rate with the US dollar jumped to over 10,000 to in less than six months (at its lowest point in January 1998, rupiah to dollar conversion rate reached 17,000).

Questions can be asked about possible overvaluation of the rupiah and macroeconomic fundamentals of the Indonesian economy immediately prior to the currency crisis in 1997. Saxena (2002) estimated the equilibrium rupiah exchange rate by using three approaches: co-integration, unobserved component model and structural vector autoregression. At no point in the entire sample period used (1980-97) did the extent of rupiah overvaluation exceed 2% in her study so that overvaluation was ruled out as the cause for the massive depreciation. In terms of macroeconomic fundamentals, Indonesia also seemed far from crisis as late as in June 1997. Unlike Thailand, the "fire-starter" in the Asian currency crisis, Indonesia had low inflation and a trade surplus of more than 900 million dollars. Shakur (2001, p.6) reports that in 1996, Indonesia's current account deficit relative to GDP at 3.41% fared much better than Korea (4.89%), Philippines (5.86%), Malaysia (5.99%) or Thailand (9.18%). And yet Indonesian rupiah suffered the worst consequences during the Asian crisis. This prompted us look at other weaknesses that led to the crisis, and the poor state of Indonesian banking system was an obvious candidate. At the onset of the crisis, Indonesia had too many banks that were also too small, fragmented and carried a very weak balance sheet. Subsequent consolidation of the banking sector meant the number of banks declined steadily in all years since the crisis (see Table 1). A particular contribution of the paper is that it adds the number of banks to a list of more conventional determinants of a currency crisis for Indonesia which improves performance of the applied model.

The rest of the paper is organised as follows. Section 2 deals with the incidence of banking crises in the last 15 years and traces their links to currency crises with detailed references to

Indonesia. Section 3 outlines the methodology and sources of the data used. Section 4 gives the model specification and reports the analytical results. The discussion of the regression results is done in Section 5 while section 6 concludes the paper.

INCIDENCE OF CURRENCY AND BANKING CRISES

There have been quite a few currency crises during the past 20 years. The important ones are the Mexican peso devaluation (the tequila crisis) in 1994, the currency mayhem in Europe during 1992-93 that brought down the Exchange Rate Mechanism (ERM) and forced the UK and Italy out of the system, and the Russian rouble crisis in 1998 and the Asian crisis of 1997-98 that may be considered the most significant. Relative to the US dollar, the values of most Asian currencies fell drastically. Between July 1997 and January 1998, the Thai baht fell by 55%, the Indonesian rupiah by 84%, the Korean won by 49%, the Malaysian ringgit by 45%, the Philippine peso by 39% and the Singapore dollar by 19% (Montes, 1998). Our research concentrates on Indonesian rupiah, the currency that depreciated the most.

Montes (1998) likens the cause of the Asian currency crisis to weaknesses in the financial systems that were then magnified by international contagion effects traceable to incomplete information. According to Kaminsky and Reinhart (1999, p. 495), "At the roots of the meltdown of the Thai baht, Korean won, and Indonesian rupiah lay systemic banking problems". Even developed countries like Finland, Norway and Sweden experienced contemporaneous currency crisis and a full-fledged domestic banking crisis in the late 1980's and early 1990's. Berg and Pattillo (1999) describe the Asian crisis as largely a "bank-run" phenomenon that witnessed panic attacks against otherwise viable exchange rate regimes. They suggest that the crisis could not be predicted by the fundamental variables emphasised in most empirical literature. Many others have argued that the Asian crisis was led by structural and microeconomic problems, such as inadequate banking supervision and poor corporate governance, at a time when economic fundamentals were reasonably strong.[1] Shakur (2001) draws comparisons between the worst affected countries in East Asia and relatively unscathed countries in South Asia to conclude a sound banking system coupled with tight control on interest rates and receipt of funds from abroad were the reasons behind the latter's immunity from the crisis. Three years after the Asian currency crisis, Turkey faced its worst post-war currency crisis in February 2001 when the Turkish lira collapsed. Two papers by Ozkan (2005) and Ozatay and Sak (2002) link weaknesses in the banking sector as a major triggering mechanism for the crisis in Turkey.

In the case of Indonesia, the weakening of the banking sector can be traced from the 1980s when worldwide recession of the early 1980s impacted on its economy. Falling commodity prices meant Indonesia's current account deficit increased from US$0.5 billion in 1981 to US$5.5 billion in 1982. Concomitantly, the growth rate fell from 10% in 1980 to just over 2% in 1982. The Indonesian government responded by undertaking economy-wide reforms to reverse the slowdown in economic growth. With respect to the reforms in the banking sector, the first measures of the Package of Banking Deregulation (PAKJUN, 1983) removed the ceiling on bank credit, allowed state-owned banks to freely determine interest rates, and abolished the restrictions on domestic banks from accepting funds from abroad. Subsequently, PAKTO 1988 saw the lifting of entry restrictions on new private banks (including rural banks) and the reduction of the reserve requirement on bank liabilities from 15% to 2%.

Seemingly, the reform packages worked well (until the crisis in 1997) and Indonesia's economy steamed ahead. The absence of a ceiling on interest rates meant these private banks could and actually did offer higher rates on deposits, luring customers away from the large and more stable state-owned banks. Between 1988 and 1996, the share of state-owned banks in total bank deposits fell from 77% to 32%, while that of private banks increased from 19% to 65%. Over the same period, the share of state-owned banks in outstanding credit dropped from 70% to 38%, while that of private banks increased from 28% to 60%.[2] The lifting of restrictions on domestic banks to accept funds from abroad saw foreign bank lending to Indonesia reach a total of US$55.5 billion by the end of 1996.[3]

Closer to the onset of the currency crisis, Indonesia's banking sector was very weak. 'Soft' licensing provisions and registration requirements meant that it became all too easy to start a new bank. The number of private banks of all varieties (domestic, foreign and joint venture) increased substantially from 208 in 1993 to 240 in 1995. It now would seem that this number was clearly excessive for Indonesia's market to sustain and the number of banks has been brought down in every year since the crisis, as can be seen in Table 1.

Table 1
Number of Banks in Indonesia by Ownership Category (1990-2005)

	1990	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2002*	*2004*	*2005*
State Owned Bank	7	7	7	7	7	5	5	5	5	5
Regional Government Bank	27	27	27	27	27	27	26	26	26	26
Private National Banks	99	166	165	144	130	92	81	77	74	70
Foreign & Joint Venture Banks	38	40	40	44	44	34	39	34	31	30
Total	171	240	239	222	208	158	151	142	136	131

Source: Bank Indonesia.

However, the 'twin liberalisations'–that of the domestic financial system and that of opening up of the capital account–was not matched with effective prudential banking regulation and supervision. It was possible to substitute political connection for capital and management requirement. For example, Cole and Slade (1998) argue that during the lending boom of the 1990s, the government guarantee in the form of "Suharto connection" protected insolvent private banks and their questionable borrowers from prudent supervision by the Bank of Indonesia. Nasution (1999) reports that in 1995 nearly one-tenth of the banks had a capital adequacy ratio less than the 8% minimum requirement, and more than a quarter of the banks had exceeded the legal lending limit. Furthermore, from the Bank of Indonesia annual data, it was calculated that non-performing loans as a proportion of assets for all banks rose from less than 1% in 1990 to 3.5% in 1994 to 16.3% in 1998.

The question to raise at this point is whether the deteriorating state of the Indonesian banks reached crisis proportions? Kaminsky and Reinhart (1999) associate banking crises with two unwanted events in the banking system. The first of these events involves banking panics that are accompanied by closures, mergers or takeover by the public sector or other financial institutions. The popular press is replete with reports of bank runs especially in the second half of 1997 and the early parts of 1998. Officially the Indonesian government liquidated 16 banks in November 1997. On 27 January 1998 the Indonesian Bank Restructuring Agency (IBRA)

was established with the mandate to control and manage the restructuring of banks. The first job that the IBRA undertook was to shut down seven small private banks and transfer their operations to Bank Negara Indonesia, the largest state-owned bank (Johnson, 1998). Another 38 banks were liquidated later in April 1999. The second event that Kaminsky and Reinhart (1999) associate with banking crises is the need for large-scale bailout packages such as were offered by the Indonesian government as well as the International Monetary Fund (US$43 billion) to the crippled banking sector. We note, for our model formulation purposes later, that the main policy response to the Indonesian banking crisis invariably has been to rationalise the number of banks.

Further consideration of Indonesia's experience shows that in June 1997, foreign reserves stayed low while short-term debt stood at twice the size of those reserves. Interest rates moved in rapid succession from 14% in the second quarter of 1997 to 52% by the end of 1998 but failed to arrest the outflow from rupiah-denominated securities. The contagion effect from the depreciation of the Thai baht in July 1997 may have prompted the depreciation of the currencies in the entire region, but the rupiah fared the worst. Even now, after remarkable recovery, the rupiah remains farthest away from its pre-crisis level, compared to other currencies in the region.

DATA AND METHODOLOGY

To motivate an empirical model to quantify the relationship between the exchange value of the domestic currency and banking sector developments in Indonesia, we draw on the literature on the linkages between currency and banking crises and the literature on exchange rate determination/forecasting.

Kaminsky and Reinhart (1999) review three varieties of theoretical models advanced to explain the linkages between currency and banking crises. One variety posits that the direction of causality runs from balance of payments or currency problems, to banking crises (e.g., Stocker, 1995; Mishkin, 1996). In a fixed parity regime, if the loss of international reserves resulting from a sudden increase in foreign interest rates is not sterilised, it might lead to a credit crunch, increased bankruptcies and a banking crisis. The second variety stresses the opposite direction of causality (e.g., Velasco, 1987; Miller, 1995). When central banks finance the rescue of ailing banks by printing money, the excessive money creation undermines the exchange value of the domestic currency, leading to a crisis. The third variety points out that the two crises have common causes (e.g., McKinnon and Pill, 1996; Reinhart and Vegh, 1996; and Kaminsky and Reinhart, 1999). If policy keeps domestic interest rates high relative to foreign interest rates (e.g., in an exchange-rate-based inflation stabilisation plan), the resulting capital inflows support a credit growth and a boom in economic activity and in imports. As the current account deficit continues to grow, investor confidence is eroded and the capital inflows turn into capital outflows and asset markets crash. If the bank foreign currency borrowing is unhedged, and moral hazard leads to excessively risky lending, the vulnerability of the financial sector increases. Illiquidity in the financial sector triggers bank runs that spark the financial and banking crises.

On the whole, even though theory does not offer an unequivocal explanation of the linkages between currency and banking crises, it does highlight the important economic variables (e.g.

international reserves, domestic and foreign interest rates, bank credit, imports, etc). We postulate that the nominal exchange rate of the Indonesian rupiah is a function of three broad determinants: economic fundamentals (EF), banking sector developments (BSD) and the exchange rate regime (ERR). That is,

NER = f (EF, BSD, ERR)

Several variables can be put under the rubric of economic fundamentals; a few of them are: real growth of the economy, level of international reserves, international trade deficit, fiscal deficit, credit growth and the differential between domestic and world interest rates. Similarly, the condition of the financial sector may be represented with a range of variables: non-performing or bad loans of the banks, foreign liabilities of banks and their maturity structure, the existence of too many banks leading to supervision and regulatory enforcement problems, and other key indicators of financial health of banks (e.g., capital ratios). Availability of consistent and dependable data on various variables of interest guided our choice of the final set of variables that were selected to maximise the frequency or periodicity of observations and length of the data series. This yielded a dataset of quarterly observations covering the period 1990 I to 1998 IV.[4]

The data were obtained from a variety of sources. For example, banking data relating to the number of private banks, bank assets and foreign liabilities, non-performing loans and their deposit/ lending rates were obtained from the Bank of Indonesia. Macroeconomic data on the rupiah exchange rate, the GDP, interest rates, official foreign reserves, balance of payments, and inflation rates were sourced from the Indonesian Financial Statistics published by the Indonesian Bureau of Statistics. Data on US T-bills and inflation rates were obtained from the *International Financial Statistics* published by the IMF.

Lack of consistent and dependable data on non-performing loans meant that the empirical model could not incorporate that theoretically important determinant. The rate of growth of the economy and various bank capital ratios utilised in the preliminary stages of the construction of the model either turned out to be insignificant, wrongly signed or strongly correlated with other explanatory variables. The nominal interest rate differential as an explanatory variable took the counter-intuitive negative sign and its presence in the model also forced some other variables to take the wrong signs. Unsurprisingly, the domestic-foreign real interest rate differential gave a better fit. This implies that sentiments in the Indonesian foreign exchange market had more to do with expected inflation differential than relative liquidity positions. Resolution of all the aforementioned problems led to the choice of the following explanatory variables in a single-equation econometric model of the form:

EXCHVALU = f (RESERVES, TDEFGDP, RINTGAP, FORLIABS, BANKS, DVFLOAT)

RESERVES   = reserves in billions of constant US dollars;

TDEFGDP   = ratio of trade deficit to real GDP;

FORLIABS   = foreign liabilities of Indonesian banks in trillions of rupiah;

BANKS   = number of banks;

RINTGAP   = Indonesian real interest rate minus real interest rate on US T-bills as a proxy
              for world interest rate; and

DVFLOAT   = dummy variable representing the period when the pegged exchange rate system was abandoned (starting August 1997 to end of sample period).

The dependent variable is the natural logarithm of the nominal exchange rate expressed as the value of the Indonesian rupiah in terms of US dollars (ln EXCHVALU) so that an increase reflects appreciation and a decrease reflects depreciation of the Indonesian rupiah. Our 'a priori' expectation is that EXCHVALU should be positively related to RESERVES and RINTGAP, and negatively related to TDEFGDP, FORLIABS and BANKS. While it is popularly believed that Indonesia had too many banks during the financial crisis, this idea has not been empirically tested.[5] In November 1997, the Indonesian government in its first crisis support arrangement with the IMF agreed to close 16 small private banks that were in breach of various prudential regulations. According to Fane and McLeod (2002, p. 289) however, the apparent belief of the government and the IMF that fewer, bigger banks is better is not supported by Indonesia's recent experience as all of the large private banks were brought down by the crisis. Too many independent banks puts constraint to regulatory agencies and the perceived stability of fewer large banks may be important to currency speculators in a volatile economy. At the same time too few banks often lead to poor service and high cost of foreign exchange transactions. We put the issue as an empirical question and included BANKS as an explicit variable in our regression.

MODEL SPECIFICATION AND REGRESSION RESULTS

It is evident that the government has considerable control over the interest rate differential and the number of banks. Because of that, there was particular interest in how those two variables would enter the model. Concerning the specification of the relationship between the dependent variable and the explanatory variables, it is to be expected that the marginal impact of a change in BANKS on the exchange rate would not be constant but would depend on the number of banks. BANKS entering the model either in a reciprocal form or in quadratic form may capture this nonlinearity in BANKS. Additionally, there is sufficient reason to argue that the marginal impacts of some of the explanatory variables would not be independent of the values of some other regressor (s). That is, interactive effects between explanatory variables (especially between the interest rate differential and the others) may be significant enough to warrant the introduction of interaction terms. As Gujarati (1995 p. 517) notes, "... omitting a significant interaction term will lead to a specification bias."

In the model estimation process, a baseline log-lin regression model (linear in BANKS and without interaction terms) was estimated first. Subsequently, alternative models in which BANKS enters in reciprocal and quadratic forms were also estimated. Since government monetary policy could directly affect the domestic interest rate, it could be inferred that the government controlled RINTGAP somewhat. Theoretically, an increase in RINTGAP (from an increase in domestic interest rate) should lead to an appreciation of the rupiah under normal circumstances. However, given the much-publicised weaknesses in the economic fundamentals and financial vulnerability of Indonesia, the effect of any such policy change would greatly depend on perceptions of the strength of the economy. The hypothesis that the marginal effect of the interest rate differential (RINTGAP) depended on the levels of the other variables was tested for with the introduction of interaction terms constructed from the product of RINTGAP and

the other explanatory variables. The interaction term from RINTGAP and FORLIABS (named IGAPFORL) proved beneficial. The regression results for the various models are presented in Table 2.

Table 2
Regression Results

Variable	Model 1	Model 2	Model 3A	Model 3B
INTERCEPT	-6.3608	-8.3857	10.335	12.884
	(-24.25)	(-28.94)	(1.62)	(2.56)
RESERVES	0.01275	0.01296	0.01055	0.00720
	(2.67)	(2.76)	(2.37)	(2.37)
TDEFGDP	-0.01024	-0.01060	-0.01567	-0.01575
	(-1.76)	(-1.84)	(-2.75)	(-3.49)
RINTGAP	-0.01514	-0.01525	-0.01405	
	(-5.74)	(-5.88)	(-5.76)	
FORLIABS	-0.01423	-0.01423	-0.01362	-0.01207
	(-16.71)	(-17.03)	(-16.81)	(-24.73)
DVFLOAT	-0.15934	-0.15736	-0.12946	-0.12601
	(-3.02)	(-3.02)	(-2.62)	(-3.23)
BANKS	-0.00449	-0.15476	-0.18149	
	(-3.63)		(-2.69)	(-4.02)
BANKSQR			0.00034	0.00040
			(2.62)	(3.99)
BANKINVS		227.34		
		(3.77)		
IGAPFORL				-0.00014
				(-8.30)
R^2	0.9925	0.9926	0.9939	0.9962
Adjusted R^2	0.9909	0.9911	0.9924	0.9952
F-stat	636.123	651.251	656.115	1042.547
DW d-stat	2.7123	2.6780	2.1280	2.1865
SC	0.00401	0.00391	0.00356	0.00224
AIC	0.00295	0.00288	0.00250	0.00158

Figures in parentheses are t-ratios.

Variables:

RESERVES = reserves in billions of US dollars.

TDEFGDP   = ratio of trade deficit to the GDP.

RINTGAP   = Indonesian real interest rate minus real interest rate on US T-bills.

FORLIABS = foreign liabilities of Indonesian banks in trillions of rupiah.

BANKS   = number of banks.

BANKSQR   = the square of the number of banks.

BANKINVS = the reciprocal (or inverse) of the number of banks.

DVFLOAT   = dummy variable representing the period when the pegged exchange rate system was abandoned (starting August 1997 to end of sample period).

IGAPFORL = interactive variable equal to the product of RINTGAP and FORLIABS.

Summary measures:

SC   = Schwarz Criterion.

AIC   = Akaike Information Criterion

DISCUSSION OF REGRESSION RESULTS

The results for the baseline model appear under the column titled Model 1 in Table 2; those for the models in which BANKS enters in reciprocal form and in quadratic form, respectively, are reported in the columns captioned Model 2 and Model 3A. Model 3B reports the regression results after the incorporation of the interaction term IGAPFORL in Model 3A. The R-square and Adjusted R-square of all the models are quite high, indicating differential but acceptably good fit by all the models. In Models 2 and 3A when BANKS enter either in reciprocal or quadratic form, the results improve over the baseline log-lin model, especially for the quadratic Model 3A. Furthermore, the interaction term from the product of interest rate differential and foreign liabilities of banks (IGAPFORL) in Model 3B is highly significant. It will be observed that the introduction of IGAPFORL forces the stand-alone RINTGAP to drop out of the model. The detailed discussion of the empirical results will dwell on the results of Model 3B.

The regression results of Model 3B indicate that about 99.6% of the variation in the natural logarithm of the Indonesian rupiah exchange rate (hereafter the exchange rate) is explained by the variables selected in that model. The coefficient of RESERVES implies that an increase of US$10 billion in international reserves of the country leads to about 7.2% appreciation in the exchange rate, holding other things constant; this is significant, at least, at the 2.5% level.

The coefficient of TDEFGDP implies that an increase of one percentage point in the ratio of trade deficit to GDP of the country leads to about 1.6% depreciation in the exchange rate, holding other things constant. Conversely, when the ratio decreases by one percentage point the rupiah is expected to appreciate by 1.6%, other things kept the same.

The marginal effect of FORLIABS is given by the partial derivative:

$$\partial \ln \text{EXCHVALU} / \partial \text{ FORLIABS} = -0.01207 - 0.00014 \text{ (RINTGAP)}.$$

This implies that as the foreign liabilities of banks increase, the exchange rate depreciates and higher levels of interest rate differential reinforce the rate of depreciation. Conversely, as FORLIABS decreases, the exchange rate appreciates but high levels of interest rate differential mitigate the rate of appreciation. It seems that the expectation of a relatively high domestic rate of inflation was prevalent during the sample period. Economic agents must have doubted the ability and willingness of the central bank to continue maintaining the pegged exchange rate system and correctly anticipated the abandonment of the system which would lead to a precipitous fall in the value of the rupiah, massive capital losses and escalating inflation. The coefficient of DVFLOAT indicates that the period when the pegged exchange rate system was abandoned contributed an extra 11.8% (= antilog [-0.12601] – 1) or nearly 12 percentage points to the depreciation of the Indonesian rupiah.

The marginal effect of BANKS is given by the partial derivative:

$$\partial \ln \text{EXCHVALU} / \text{ " BANKS} = -0.18149 + 2(0.0004) \text{ BANKS}$$
$$= -0.18149 + 0.0008 \text{ BANKS}$$

This implies that as BANKS increases the exchange rate depreciates but the rate of depreciation gets continually smaller until, at a certain number of banks, an additional bank might lead to no effect on the exchange rate. However, increasing the number of banks beyond

that number is theoretically expected to lead to an appreciation of the exchange rate. That critical number may be found by equating the partial derivative to zero and solving for BANKS. The important thing to note here is not so much this solution value of BANKS and the implicit recommendation to reduce the number of banks to a figure below it, but the notion that if the banks are supervised and regulated properly, the system can beneficially accommodate a much larger number of banks than it has at present. This assumes, of course, that the banks are all well capitalised.

The biggest potential problem with the approach taken in this research is the single-equation model that precludes reverse causality from exchange rate to any of the explanatory variables. It has been widely reported in the empirical literature that there is a 'vicious circle' between currency and banking crises. To fix the simultaneous-equation bias problem would ideally require a general equilibrium macroeconometric model that might demand more resources and data than are currently available to us. To our knowledge no exchange rate model has been determined for Indonesia incorporating banking sector variables and using data traversing the crisis period. The approach taken here can be seen as the first step towards integrating banking sector variables in any model that contains an exchange rate equation. Despite the methodological weakness of the single-equation, it has been discovered that the marginal impact of number of banks on the exchange rate is not monotonic.

SUMMARY AND CONCLUSION

During the Asian crisis of 1997-98, Indonesia suffered the most severe depreciation of its currency compared to its neighbours. Research lately is focussed on designing early-warning systems from the empirical regularities in world-wide experiences in banking-currency crises to avert future currency crises. Individual country experiences get masked and lessons learned may not be equally useful in country-specific policy recommendations. Prior to the onslaught of the crisis, Indonesia had a healthier macroeconomic fundamental compared to its Asian neighbours but a very weak banking structure. The linkages between banking and currency crises are complex and there is need to critically evaluate them. To quantify some aspects of the linkages, this paper set out to estimate a single-equation model for the nominal exchange rate for the Indonesian rupiah using quarterly data covering 1990 I and 1998 IV and traversing the banking-cum-currency crisis period. The literature on currency turbulence and banking crises and that on exchange rate determination were reviewed for that purpose. The novelty lay in incorporating a number of variables about the banking sector in an exchange rate model that would have otherwise utilised only 'economic fundamentals'.

A good measure of success was obtained with the model despite the potential simultaneous-equation bias. Weak economic fundamentals, like worsening trade deficit and loss of international reserves, do lead to depreciation of the currency. Increasing foreign liabilities of banks have a discernible deleterious effect on the exchange value of the rupiah. Further, because economic agents generally expected a relatively higher domestic inflation rate, interest rate increases at home simply weakened the rupiah. A combination of increasing foreign liabilities and increasing domestic interest rates *vis a vis* foreign interest rates is especially lethal. As an explanatory variable, 'number of banks' enters the model nonlinearly and improves performance of the model. The model then suggests some desirable range as to number of banks thereby lending

support to the popular but previously untested view that Indonesia had too many unregulated and inadequately supervised banks during its currency crisis of 1997-98.

NOTES

1. The inability of macroeconomic fundamentals to explain the Asian currency crisis and the role in the crisis of a poor banking sector and other structural problems is reflected in a series of NBER papers focusing on the crisis. For example, see Radelet and Sachs (1998), Corsetti, Pesenti and Roubini (1998a and 1998b).

2. These figures are obtained from various issues of the Indonesian Financial Statistics, published by the Bank of Indonesia. Private banks here include private domestic, foreign, as well as joint venture banks. A small percentage of deposits are held by the development banks.

3. Figures for foreign bank lending to Indonesia are taken from the Bank for International Settlements. Of this total, the major lenders were Japanese banks (US$22 billion), European banks (US$21 billion) and U.S. banks (US$5.3 billion).

4. Because the paper attempts to identify the causes leading up to the crisis in second half of 1997, and by most accounts the severity of the crisis lasted around 15 months, this particular data range was selected. Post-crisis evaluation is not within the scope of the paper.

5. The idea that Indonesia has too many banks is widely believed in financial circles even after massive mergers and rationalisation of Indonesian banking sectors reduced the number of banking institutions from 239 in 1996 to 131 in 2005. The International Herald Tribune (June 8, 2005 issue) quotes a fund manager saying "There are too many banks (in Indonesia). Indonesia needs three to four major banks." In 2004, Indonesia's central bank stated their ideal to have five banks with as much as 50 trillion rupiah in capital, and as many as 50 banks with capital of up to 10 trillion rupiah (as reported in Business Asia by Bloomberg. www.iht.com/articles/2005/06/07/Bloomberg/sxbank.php).

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