

Fundamental determinants of the Asian crisis: the role of financial fragility and external imbalances*

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1 Introduction

Episodes of speculative attacks on currencies in the 1990s (such as the 1992-93 crisis in the European Monetary System, the 1994 Mexican peso collapse, and especially the Asian turmoil of 1997-98) have generated a considerable — and finely balanced — debate on whether currency and financial instability should be attributed to arbitrary shifts in market expectations and confidence, rather than to weaknesses in the state of economic fundamentals.¹ Yet, advocates of both the ‘fundamentalist’ and the ‘non-fundamentalist’ views agree in principle that a deteriorating macroeconomic outlook increases the degree to which an economy is vulnerable to a crisis.

The problematic economic and financial conditions in Southeast Asia in the years preceding the crisis have been documented in a number of recent studies (including our own contribution in Corsetti, Pesenti and Roubini (1999b)).² A widespread view holds that, whether or not the plunges in asset prices after the eruption of the crisis were driven by a self-fulfilling expectations and a panic, weak economic fundamentals were a crucial element in the genesis of the crisis, as well as in its spread across countries. In support of this thesis, in this paper we present some preliminary formal evidence on the links between indicators of currency instability in 1997 and a number of indicators of real and financial fragility at the onset of the crisis. The proposed tests do not aim at discriminating among alternative explanations — rather, the goal here is to provide a set of baseline results to complement and integrate previous analyses pointing at the fragile state of the Southeast Asian economies before the eruption of the crisis.

One of the interesting pieces of evidence that corroborates a fundamental interpretation of the crisis is that well-performing Asian countries were spared

¹Among recent studies focusing on the large-scale speculative episodes in the 1990s before the Asian crisis, see Eichengreen and Wyplosz (1993) and Buiter, Corsetti and Pesenti (1998a, b) on the European Monetary System crisis of 1992-93, and Sachs, Tornell and Velasco (1996) on the Mexican peso crisis of 1994. A number of recent contributions on financial and balance of payments crises provide a discussion of the issues introduced in this paper — among others see Dornbusch, Goldfajn and Valdes (1995), Milesi-Ferretti and Razin (1996), Mishkin (1996), Kaminsky, Lizondo and Reinhart (1998) and Roubini and Wachtel (1998).

²A partial list of analyses of the Asian crisis includes Dornbusch (1998), Feldstein (1998), Goldstein (1998), IMF (1998), and Radelet and Sachs (1998). A large number of contributions on the crisis are available online on Nouriel Roubini’s Asian Crisis Homepage at www.stern.nyu.edu/~nroubini/asia/AsiaHomepage.html.

its most pervasive consequences. Taiwan, Singapore, and Hong Kong were, relatively speaking, less affected by the regional turmoil. The Hong Kong currency parity was maintained despite strong speculative attacks. Taiwan and Singapore decided to let their currency float rather than lose reserves by attempting to stabilize the exchange rate; however, the depreciation rates of their currencies were modest, and, most importantly, these countries did not experience drastic reversals in market sentiment, financial panic, and large-scale debt crises.

The three countries that were only mildly affected by the turmoil shared a number of characteristics: first, their trade and current account balances were in surplus in the 1990s and their foreign debt was low (Taiwan was a net foreign creditor towards BIS banks); second, they had a relatively large stock of foreign exchange reserves compared to the crisis countries; third, their financial and banking systems did not suffer from the same structural weaknesses and fragility observed in the crisis countries; finally, they were perhaps less exposed to forms of so-called ‘crony capitalism’, that is, from the system of intermingled interests among financial institutions, political leaders and corporate elites that was characteristic of Korea, Indonesia, Malaysia and Thailand.³ China also falls in the category of countries that were not subject to disruptive speculative pressure — the Chinese currency did not depreciate in 1997. However, the presence of constraints on capital mobility make it difficult to compare the performance of this country with the others.

Conversely, as a group, the countries that came under attack in 1997 had the largest current account deficits throughout the 1990s. While the degree of real appreciation over the 1990s differed widely across Asian countries, with the important exception of Korea all the currencies that crashed in 1997 had experienced a real appreciation.

The literature has pointed out several factors that contributed to the deterioration of fundamentals in East Asia. The region experienced significant negative terms of trade shocks in 1996, with the fall in price of semi-conductors and other goods. For most countries hit by the crisis, the long stagnation of the Japanese economy had led to a significant slowdown of export growth. Close to the onset of the crisis, the abortive Japanese re-

³Note that the crisis of the Philippines, a country with better fundamentals and a less fragile financial system than other countries in the region, was also relatively contained. Even though the exchange rate plunged and the stock market dropped by over 30% in 1997, this country did not experience the extent of the turmoil and financial panic that hit Korea, Thailand, Indonesia and Malaysia.

covery of 1996 was overshadowed by a decline in activity in 1997. Last but not least, the increasing weight of China in total exports from the region enhanced competitive pressures over the period.

On the financial side, there is a large body of evidence showing that the corporate, banking and financial systems of the crisis countries were very fragile — poorly supervised, poorly regulated, and already in shaky conditions before the onset of the crisis.⁴ The evidence suggests a sustained lending boom in the Philippines, Thailand and Malaysia — strikingly, these were also the first countries to be hit by currency speculation in 1997. It also suggests a severe mismatch between foreign liabilities and foreign assets of Asian banks and non-bank firms. Domestic banks borrowed heavily from foreign banks but lent mostly to domestic investors.⁵

By the end of 1996, a share of short-term foreign liabilities above 50% was the norm in the region. At the same time, the ratio between M2 and foreign reserves in most Asian countries was dangerously high: in the event of a liquidity crisis — with BIS banks no longer willing to roll-over short-term loans — foreign reserves in Korea, Indonesia and Thailand were insufficient to cover short-term liabilities, let alone to service interest payments and to repay the principal on long-term debt coming to maturity in the period. One could certainly hold the view that the creditors' 'panic' in Korea and Indonesia purely resulted from a standard 'collective action' problem faced by a large number of creditors in their decisions whether to roll-over existing credits or call in their loans.⁶ It should also be recognized that market reactions took place under conditions of extreme political uncertainty, low credibility of the existing governments, and skepticism about the direction of, and the commitment to, structural reforms.

Although Asian countries were characterized by very high savings rates throughout the 1990s, the deficiencies of their financial sector posed a severe burden on the fiscal balances of the affected countries. Such costs represented an implicit fiscal liability not reflected by data on public deficits until the eruption of the crisis but large enough to affect the sustainability of the pre-crisis current account imbalances. The size of this liability contributed to generate expectations of drastic, but uncertain, policy changes (a fiscal reform required to finance the costs of financial bailouts) and currency de-

⁴See for instance IMF (1998), Ito (1998), OECD (1998), Pomerleano (1998).

⁵On the role of moral hazard in generating such 'overborrowing' syndrome, see McKinnon and Pill (1996), Krugman (1998) and Corsetti, Pesenti and Roubini (1999a).

⁶See *e.g.* Chang and Velasco (1998a,b).

valuations (as a result of higher recourse to seigniorage revenues).⁷

This paper reports and discusses a number of tests of the empirical relevance of the set of macroeconomic factors recalled above. In our tests we compare the performance of all the Asian countries subject to pressures in 1997 with the performance of other emerging economies, for a total sample of 24 countries whose selection has been determined by data availability.⁸

The paper is organized as follows. In section 2, we present a summary of the analytical model that is the basis of the empirical tests in the paper. In section 3, we present the results of our empirical analysis. Next, in section 4 we elaborate on the role played by the banking sector weaknesses and the financial distress of over-leveraged firms in explaining the financial crisis in Asia in the late 1990s. Section 5 concludes.

2 A model of the Asian crisis

After the outburst of the currency and financial crises in Southeast Asia in the summer of 1997, many observers noted that the traditional conceptual and interpretive schemes⁹ did not appear, *prima facie*, to fit the data well and fell short in a number of dimensions.

A first reason is the role of fiscal imbalances. At the core of ‘first generation’ (or ‘exogenous-policy’) models of speculative attacks á-la-Krugman (1979) and Flood and Garber (1984), the key factor that explains the loss of reserves leading to a crisis is the acceleration in domestic credit expansion related to the monetization of fiscal deficits. In the case of Southeast Asia, the pre-crisis budget balances of the countries suffering from speculative attacks were either in surplus or limited deficit.

In ‘second generation’ (or ‘endogenous-policy’) models of currency crisis governments rationally choose — on the basis of their assessment of costs and benefits in terms of social welfare — whether or not to maintain a fixed rate regime. A crisis can be driven by a worsening of domestic economic fundamentals, or can be the result of self-validating shifts in expectations

⁷See Corsetti, Pesenti and Roubini (1998a) and Burnside, Eichenbaum and Rebelo (1998).

⁸The countries are Argentina, Brazil, Chile, China, Colombia, Czech Republic, Hong Kong, Hungary, India, Indonesia, Jordan, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Singapore, Sri Lanka, Taiwan, Thailand, Turkey and Venezuela.

⁹See Buiter, Corsetti and Pesenti (1998a), Calvo (1998), Calvo and Vegh (1999), Cavallari and Corsetti (1996) and Flood and Marion (1998) for recent surveys.

in the presence of multiple equilibria,¹⁰ provided that the fundamentals are weak enough to push the economy in the region of parameters where self-validating shifts in market expectations can occur as rational events. The indicators of weak macroeconomic performance typically considered in the literature focus on output growth, employment, and inflation. In the Asian economies prior to the 1997 crisis, however, GDP growth rates were very high and unemployment and inflation rates quite low.

In Corsetti, Pesenti and Roubini (1999a) we have suggested a formal interpretive scheme that, while revisiting the classical models, brings forward new elements of particular relevance for the analysis of the 1997-98 events. Specifically, we have analyzed financial and currency crises as interrelated phenomena, focusing on moral hazard as the common factor underlying the ‘twin’ crises.¹¹

At the core of our model is the consideration that, counting on future bailout interventions, weakly regulated private institutions have a strong incentive to engage in excessively risky investment. A bailout intervention can take different forms, but ultimately has a fiscal nature and directly affects the distribution of income and wealth between financial intermediaries and taxpayers: an implicit system of financial insurance is equivalent to a stock of contingent public liabilities that are not reflected by debt and deficit figures until the crisis occurs.

These liabilities may be manageable in the presence of firm-specific, or even mild sector-specific shocks. They become a concern in the presence of cumulative sizable macroeconomic shocks, which fully reveal the financial fragility associated with excessive investment and risktaking. While fiscal deficits before a crisis are low, the bailouts represent a serious burden on the *future* fiscal balances. The ‘currency’ side of a ‘financial’ crisis can therefore be understood as a consequence of the anticipated fiscal costs of financial restructuring, that generate expectations of a partial monetization of future

¹⁰See among others Obstfeld (1986,1994), Cole and Kehoe (1996) and Sachs, Tornell and Velasco (1996). If investors conjecture that a country’s government will eventually devalue its currency, their speculative behavior raises the opportunity cost of defending the fixed parity (for instance, by forcing a rise in short-term interest rates), thus triggering a crisis in a self-fulfilling way.

¹¹Among the contributions to the literature on the ‘twin’ crises see *e.g.* Velasco (1987), Kaminsky and Reinhart (1997), Goldfajn and Valdes (1997), Chang and Velasco (1998a,b). The role of moral hazard in the onset of the Asian crisis has been discussed by a number of authors. See *e.g.* Krugman (1998), Greenspan (1998), Fischer (1998).

fiscal deficits.

It is important to stress that the ‘financial side’ of the crisis likely results in a severe fall in economic activity induced by the required structural adjustment. This is because implicit guarantees on investment projects lead the private sector to undertake projects that are not profitable. In the tradables sector, the scale and type of technology adopted is not optimal. In the non-traded sector, the profitability of investment suffers from changes in the real exchange rate accompanying the devaluation — changes that do not necessarily depend on the presence of nominal rigidities. Even in the absence of a self-fulfilling panic at the root of the crisis, the adjustment to the existing fundamental imbalance may take more than a correction in the level of the real exchange rate. The economy must pay the cumulative bill from distorted investment decisions in the past.

In addition, political uncertainty about the distribution of the costs from the crisis, and their effect on the political stability of the leadership, may dramatically increase the risk premium charged by international and domestic investors — Indonesia being a striking example. A deterioration of the financial conditions may therefore deepen and prolong the recession accompanying the crisis. These considerations are important in assessing the relative merits of fundamentalist and non-fundamentalists views of the South-East Asian events. The first view is not necessarily associated with a quick recovery after a devaluation, since the correction of fundamental imbalances due to moral hazard takes more than a relative price change.

In assessing the role of moral hazard in a financial crisis we should note that investment-distorting expectations of a future bailout need not be based on an explicit promise or policy by the government. Bailouts can be rationally anticipated by both domestic and foreign agents even when no public insurance scheme is in place and the government explicitly disavows future interventions and guarantees in favor of the corporate and banking sectors. In his celebrated analysis of currency and financial crises of the early 1980s, Carlos Díaz-Alejandro stresses the time-consistency problem inherent in moral hazard:

“Whether or not deposits are explicitly insured, the public expects governments to intervene to save most depositors from losses when financial intermediaries run into trouble. Warnings that intervention will not be forthcoming appear to be simply not be-

lievable.”¹²

This is because no *ex-ante* announcement by policy-makers can convince the public that, *ex-post* (that is, in the midst of a generalized financial turmoil) the government will cross its arms and let the financial system proceed towards its debacle. Agents will therefore expect a bailout regardless of “*laissez-faire commitments*” — in the words of Díaz-Alejandro¹³ — “*which a misguided minister of finance or central bank president may occasionally utter in a moment of dogmatic exaltation*”.

To summarize, in our model private agents act under the presumption that there exist public guarantees on corporate and financial investment, so that the return on domestic assets is perceived as implicitly insured against adverse circumstances. To the extent that foreign creditors are willing to lend against future bailout revenue, unprofitable projects and cash shortfalls are re-financed through external borrowing. Such a process translates into an unsustainable path of current account deficits.

While public deficits need not be high before a crisis, the eventual refusal of foreign creditors to refinance the country’s cumulative losses forces the government to step in and guarantee the outstanding stock of external liabilities. To satisfy solvency, the government must then undertake appropriate domestic fiscal reforms, possibly involving recourse to seigniorage revenues through money creation. Speculation in the foreign exchange market, driven by expectations of inflationary financing, causes a collapse of the currency and brings the event of a financial crisis forward in time.

Financial and currency crises thus become indissolubly interwoven in an emerging economy characterized by weak cyclical performances, low foreign exchange reserves, and financial deficiencies eventually resulting in high shares of non-performing loans. Our empirical exercise below is cast within this conceptual framework. Adopting the methodology suggested in previous studies,¹⁴ in the next sections we first construct a ‘crisis index’ as a measure of speculative pressure on a country’s currency. Then, we compute a set of indexes of financial fragility, external imbalances, official reserves adequacy and fundamental performance. Finally we report the results of the regressions of the crisis index on the above indexes.¹⁵

¹²Díaz-Alejandro (1985), p.374.

¹³Ib., p.379.

¹⁴See *e.g.* Eichengreen, Rose and Wyplosz (1996), Sachs, Tornell and Velasco (1996), and Kaminsky, Lizondo and Reinhart (1998).

¹⁵Recent empirical studies of the causes of the Asian crisis include Berg and Pattillo

3 A preliminary empirical assessment

3.1 The crisis index

Our crisis index (IND) is a weighted average of the percentage rate of exchange rate depreciation relative to the US dollar — if such depreciation can be deemed as abnormal, as explained below — and the percentage rate of change in foreign reserves between the end of December 1996 and the end of December 1997.¹⁶ The logic underlying the index IND is quite simple. A speculative attack against a currency is signaled either by a sharp depreciation of the exchange rate or by a contraction in foreign reserves which prevents a devaluation.¹⁷ We present the values for IND in Table 1: a large negative value for IND corresponds to a high devaluation rate and/or a large fall in foreign reserves, *i.e.* a more severe currency crisis.¹⁸

In evaluating the crisis index we need to control for the fact that, in some countries, a high rate of depreciation in 1997 may reflect a past trend rather than severe speculative pressures. For example, the fact that the Turkish currency depreciated by over 50% in 1997 should not be interpreted as a signal of ‘crisis,’ as chronically high inflation rates in Turkey over the 1990s have been associated with ‘normally’ high depreciation rates.¹⁹

There is no obvious way to purge the sample of the effects of trend depreciations not associated with a crisis. In this study, we take the following approach: if a currency in 1997 has fallen in value by less than its average depreciation rate in the 1994-1996 period, we consider this as being part

(1999) and Alba *et al.* (1999).

¹⁶This section is based on Corsetti, Pesenti and Roubini (1999c). The weights assigned to exchange rate and reserves changes in IND are respectively 0.75/0.25. For the purpose of sensitivity analysis, we consider alternative crisis indexes with different weights, and find that the choice of the weight coefficients is not crucial to our results. Also, alternative tests with different samples of shorter size provide similar results. All tests are available upon request.

¹⁷While of course an increase in domestic interest rates may also signal a frustrated speculative attack, our crisis index excludes changes in interest rates. This is because an increase in interest rates in the presence of speculative pressures is highly correlated with non-sterilized foreign exchange intervention leading to a fall in reserves.

¹⁸In principle, IMF official loans should be subtracted from official reserves in computing the index IND . However, our results would not significantly change if we accounted for IMF disbursements in 1997.

¹⁹Note that Turkey exhibited a satisfactory economic performance in 1997, with GDP growing over 6% and its stock market being a leading performer among emerging countries.

of a trend depreciation and set the 1997 depreciation rate equal to zero in constructing the index.²⁰ In our sample, such screening procedure leads to a significant re-sizing of the crisis index for two high-depreciation countries: Turkey and Venezuela.

As Table 1 shows, in 1997 the countries that appear to have been hit by the most severe crises are, in order, Thailand, Malaysia, Korea, Indonesia, Philippines and the Czech Republic.²¹ Among Asian countries, the currencies of Singapore and Taiwan were also moderately devalued in 1997, but these two countries were not subject to such extensive and dramatic financial turmoils as the ones affecting other East Asian economies. Conversely, outside the Asian region the Czech Republic appears as a crisis country²² since its currency, which had been pegged since 1992, suffered a severe speculative attack in the spring of 1997 leading to a devaluation.²³

²⁰Other authors use a different approach to the same problem. For example, Sachs, Tornell and Velasco (1996) control for the variance of the exchange rate and reserves in the last 10 years.

²¹Latin American countries included in the sample were hit by crises in 1994-95. We refer the reader to the paper by Tornell in this volume for an analysis of the 1994-95 episode and a comparison with our results.

²²The Czech Republic shared many symptoms with the Asian crisis countries: a fixed exchange rate regime maintained for too long, a severe real appreciation, a dramatic worsening of the current account, and a weak banking system with large shares of non-performing loans.

²³Note that we limit our sample to devaluations in 1997, in the attempt to test whether the devaluations during that year can be explained by fundamentals. During 1998, a number of the crisis countries in Asia (namely Korea, Thailand and Indonesia) experienced in some degree a currency appreciation. However, such appreciations were the result of macroeconomic adjustment policies and the implementation of structural reforms. Also, while some currencies appreciated relative to their bottom values in early 1998, through 1999 they remained weak relative to their pre-crisis levels. Note also that some countries in the sample experienced currency and financial crises in 1998 and 1999, outside our sample period. Specifically, Brazil was eventually forced to devalue its currency in January 1999 while Pakistan experienced severe currency and banking distress in 1998. The case of Pakistan fits very well our model of the crisis: already in 1997 this country had a very fragile banking system with a large stock of non-performing loans and a large current account deficit. Brazil, instead, did not experience a banking crisis but had an overvalued currency and a large current account deficit, two factors that enter significantly in our empirical analysis. Also note that our sample does not include two countries, Russia and Ecuador, that were hit by currency and banking crises in 1998-99. Adding these two countries to an extended sample would have strengthened the results of our empirical analysis.

3.2 Indexes of financial fragility

Measures of banking system weakness are provided by the stock of non-performing loans as a share of total assets in 1996 (NPL)²⁴ and an index of ‘lending boom’ (LB), defined as the growth of commercial bank loans to the private sector (as percentage of GDP) in the period 1990-96. The latter is an indirect measure of financial fragility suggested by Sachs, Tornell and Velasco (1996).²⁵ Both variables (NPL and LB) are reported in Table 1.

We adopt two indicators of domestic financial fragility. The first one encompasses the information in both NPL (non-performing loans) and LB (lending boom) and is defined as follows: if the sign of the lending boom in the 1990s is positive, we assign to the new indicator $NPLB$ the original value of NPL ; if the lending boom in the 1990s is negative, we set $NPLB$ equal to zero:²⁶

$$NPLB = \begin{cases} NPL & \text{if } LB > 0 \\ 0 & \text{if } LB \leq 0 \end{cases}$$

As regards the second indicator, note that according to the theoretical model presented in Corsetti, Pesenti and Roubini (1999a) the vulnerability of a country to currency and financial crises increases with the implicit fiscal costs of financial bailouts. Under the maintained hypothesis that the time series of NPL provides information about the size of the overall bailout in the event of a crisis, we can obtain a statistical *proxy* for the associated fiscal costs by taking the ratio of non-performing loans to GDP in 1996. This series is denoted $NPLY$, and is defined as the product of NPL and commercial bank loans to the private sector as a share of GDP in 1996. This variable allows us to properly assess the performance of those countries with low ratios

²⁴In the Appendix we describe in detail our methodology to estimate the series NPL . As a caveat, NPL measures essentially banking sector non-performing loans, and may therefore fail to account appropriately for financial distress in countries where the heart of the problems in the initial stage of the crisis was non-performing loans among non-bank intermediaries (such as Thailand and Korea).

²⁵These authors argue that such a measure is a proxy for financial fragility as the quality of bank loans is likely to deteriorate significantly — and a large fraction is likely to become non-performing — when bank lending grows at a rapid pace in a relatively short period of time.

²⁶The logic of the $NPLB$ variable is straightforward: non-performing loans represent a source of severe tension only when observed in tandem with excessive bank lending that enhances the vulnerability of the country to a crisis.

of bank loans to GDP but relatively large non-performing loans as a share of banking assets (*e.g.* India and Pakistan). In those countries, the contingent fiscal liabilities related to bailout costs are smaller relative to countries with a similar *NPL*, but have a higher ratio of bank lending to GDP.

3.3 Indexes of current account imbalances

Table 1 reports the average current account balance as a share of GDP in the 1994-1996 period (*CA*) and the real exchange rate appreciation in the 1990s (*RER*). There is no simple way to assess when a current account balance is sustainable (*e.g.*, when it is driven by investment in sound projects) and when it is not (*e.g.*, when it reflects a structural loss of competitiveness), or to what extent a real appreciation is due to misalignment, as opposed to an appreciation of the fundamental equilibrium real exchange rate. However, the consensus in the empirical literature on crisis episodes is that the *combination* of a sizable current account deficit and a significant real appreciation represents a worrisome signal of external imbalance.

Consistent with this view, we construct an index of *current account imbalance*, *CAI*, defined as follows: if the rate of real exchange rate appreciation is above a given threshold T , *CAI* is equal to the current account balance (as a share of GDP); if the real appreciation is below the threshold (or there is a real depreciation), *CAI* is set equal to zero.²⁷

$$CAI = \begin{cases} CA & \text{if } RER \text{ appreciates by more than } T \\ & (T = 0, 10\%) \\ 0 & \text{otherwise} \end{cases}$$

3.4 Indexes of foreign reserves adequacy and fundamentals performance

Other things being equal, the vulnerability of a country to a currency crisis is higher when reserves are low relative to some measure of domestic liquid assets or short-term foreign debt. To assess the role played by reserves availability, we construct three different measures: the ratio of *M1* to foreign exchange reserves (*M1/RES*), the ratio of *M2* to foreign reserves (*M2/RES*),

²⁷In the tables, we present regression results for the 10% threshold, but similar results are obtained for the zero threshold.

and the ratio of the foreign debt service burden (i.e. short-term foreign debt plus interest payments on foreign debt) to foreign reserves (STD/RES). The values of these variables are reported in Table 1.

To test for the joint role of fundamentals and foreign reserves in determining a currency crisis, we classify the countries in our sample as being *strong* or *weak* with regards to these two dimensions using dummy variables. Regarding foreign reserves, we use a broad classification according to which a country is strong if the ratio of $M2$ to reserves is in the lowest quartile of the sample. The resulting dummy variable for low reserves, $D2^{LR}$, is defined as:

$$D2^{LR} = \begin{cases} 1 & \text{if } M2/RES \text{ above lowest sample quartile} \\ 0 & \text{otherwise} \end{cases}$$

Similar dummies are created by replacing $M2/RES$ with $M1/RES$ and STD/RES ; such dummy variables are labelled $D1^{LR}$ and $D3^{LR}$.

In regards to fundamentals, we focus on current account imbalances and financial fragility. Countries are classified as being *strong* or *weak* according to the scheme:

$$D^{WF} = \begin{cases} 1 & \text{if either } CAI \text{ in highest sample quartile} \\ & \text{or } NPLB \text{ in lowest sample quartile} \\ 0 & \text{otherwise} \end{cases}$$

A similar dummy can be obtained by replacing $NPLB$ with $NPLY$.²⁸

3.5 Testing for the role of fundamentals imbalances in the crisis

3.5.1 Financial fragility and external imbalances

The results of the regression of IND on CAI and $NPLB$ are shown in column (1) of Table 2. The coefficients of the two regressors have the expected sign and are statistically significant at the 5% level: both a large current account deficit associated with a real appreciation and a larger rate of non-performing

²⁸In this case, the dummy variable would be equal to zero for countries with our index of current account imbalance (CAI) in the highest quartile of the sample, or with a rate of non-performing loans as a share of GDP, i.e. $NPLY$, in the lowest quartile of the sample; it would be equal to one otherwise.

loans associated with a lending boom worsen the crisis index. In columns (2)-(4) we interact the two regressors with the dummies for low reserves. The coefficients β_2 and β_3 measure the effects of *CAI* and *NPLB* on the crisis index in countries with high reserves ($D^{LR} = 0$); conversely, the sums of the coefficients $\beta_2 + \beta_4$ and $\beta_3 + \beta_5$ measure the impact of fundamental imbalances on the crisis index in countries with low reserves ($D^{LR} = 1$).

Looking at the regression results shown in columns (2)-(4), the coefficients β_2 and β_3 are not significant on their own, but rather only when reserves are low. In fact, for the case in which we use the reserve dummy $D2^{LR}$, based on *M2* data, the Wald tests indicate that the hypotheses $\beta_2 + \beta_4 = 0$ and $\beta_3 + \beta_5 = 0$ can be rejected at the 1% and 10% significance levels.²⁹ Similar or stronger results are obtained when we use the other two low-reserves dummies, $D1^{LR}$ and $D3^{LR}$. As a whole, these results suggest that structural imbalances (current account deficits/currency appreciation and non-performing loans/lending boom) play a role in the onset of a crisis to the extent that there is insufficient availability of foreign reserves — that is, in the light of both fundamental and non-fundamental models of currency crises, low reserves enhance the vulnerability of the economy to speculative attacks.³⁰

In Table 3 we test whether the effects of current account imbalances *CAI* on the crisis index depend on weak fundamentals D^{WF} and low reserves $D2^{LR}$. Relative to column (2) of Table 2, in column (1) of Table 3 we consider an additional regressor, namely an interaction term equal to *CAI* times $D2^{LR}$ times D^{WF} . In this case, the sum of the coefficients $\beta_2 + \beta_4 + \beta_6$ captures the effects of current account imbalances on the crisis index in countries with low reserves and weak fundamentals. If $\beta_2 + \beta_4 + \beta_6$ is positive while $\beta_2 + \beta_4$ is not significantly different from zero, the crisis index worsens when a high-deficit country with an appreciated currency meets both ‘weak fundamentals’ and ‘low reserves’ criteria, but the crisis index does not respond to the reserves indicator if such a country is in the ‘strong fundamentals’ region. The results of the Wald tests show that $\beta_2 + \beta_4 + \beta_6$ is indeed significantly positive at the 1% significance level, while $\beta_2 + \beta_4$ is not significantly different from zero.³¹

²⁹Their *p-values* are 0.005 and 0.09 respectively.

³⁰As a caveat, even when coefficients have right signs and are statistically significant, the relatively low *R*-squared of the regressions seem to suggest that the residuals may be large for specific countries — that is, a crisis was predicted but did not materialize, or was not predicted but did occur, according to the sign of the residual.

³¹Note also that the coefficient on *NPLB* (β_3) is still significantly different from zero

Column (2) of Table 3 includes a similar test for the role of non-performing loans. Here we add an additional regressor to those of column (2) in Table 2, which is an interaction term equal to $NPLB$ times $D2^{LR}$ times D^{WF} . Thus, the sum of the coefficients $\beta_3 + \beta_5 + \beta_7$ captures the effects of non-performing loans on the crisis index in countries that meet both ‘low reserves’ and ‘weak fundamentals’ criteria. Our tests show that $\beta_3 + \beta_5 + \beta_7$ is negative at the 5% significance level while $\beta_3 + \beta_5$ is not significantly different from zero. The crisis index depends on non-performing loans in countries with weak fundamentals and weak reserves, but not in countries with strong fundamentals and weak reserves. The implication of these results is that a crisis need not be related to current account imbalances or bad loans *per se*: such imbalances represent a source of severe tension only when they are observed in parallel with fundamental *and* reserve weaknesses.³²

3.5.2 Fiscal implications of financial fragility

Next, in Tables 4 and 5 we perform regressions similar to those in Tables 2 and 3, but now we move our focus away from financial fragility and onto the role of the fiscal implications of financial fragility. We therefore substitute $NPLB$ — the non-performing loans ratio adjusted to account for the lending boom — with $NPLY$ — a more direct *proxy* for the implicit fiscal costs of banking sector bailouts.

The results are very similar and, if anything, even stronger than those obtained in Tables 2 and 3. First, as Table 4 column (1) shows, both $NPLY$ and CAI are statistically significant regressors of the crisis index (at the 5% level and 1% level respectively). Second, columns (2)-(4) of Table 4 confirm that the effects of current account deficits are more relevant when reserves are low.³³ The results of columns (2)-(3) in Table 4 are worth emphasizing. Note that the coefficient on $NPLY$, β_3 , maintains the predicted sign and is statistically significant on its own at the 5% level. This suggests that non-

in this regression.

³²In column (3) of Table 3, we consider interactions of both CAI and $NPLB$ with the dummies for weak fundamentals and low reserves. The results for $NPLB$ are similar to those in column (2). For the current account, instead, we fail to reject the hypothesis that both $\beta_2 + \beta_4 + \beta_6$ and $\beta_2 + \beta_4$ are equal to zero. Formal tests such as the variance inflation test suggest that this is due to multicollinearity between the two interaction terms: when they both appear in a regression, the effects of CAI are swamped by those of $NPLB$.

³³The *p-values* on the Wald tests for $\beta_2 + \beta_4 = 0$ are 0.001, 0.002 and 0.016 respectively in columns (2), (3) and (4), under the three different measures of low reserves.

performing loans as a share of GDP — that is, as a measure of the intrinsic fiscal burden — affect the crisis index regardless of whether reserves are low or high.

In Table 5 we present results of regressions equivalent to those in Table 3, again using *NPLY* instead of *NPLB*. Once again, current account deficits and non-performing loans matter if both reserves and fundamentals are weak.³⁴ However, observe that the coefficient on *NPLY* tends to maintain the expected sign and be statistically significant on its own, affecting the crisis index *regardless* of whether reserves are low or high, as well as *regardless* of whether fundamentals are weak or not.³⁵

3.5.3 Real and financial weaknesses

Finally, we attempt to test whether direct measures of capital productivity have explanatory power as regressors of the crisis index. Conventional wisdom holds in that borrowing from abroad is less ‘dangerous’ for external sustainability if it finances new investment (leading to increased productive capacity and to higher future export receipts) rather than consumption (which implies lower saving). For these reasons, a current account deficit that is accompanied by a fall in savings rates is regarded as more problematic than a deficit accompanied by rising investment rates.

Underlying such ‘conventional’ conclusions, however, is the implicit assumption that the return on investment is at least as high as the cost of the borrowed funds.³⁶ As evidence on the profitability of the investment projects

³⁴These are the implications of the Wald tests on $\beta_2 + \beta_4 + \beta_6 = 0$ in column (1) and $\beta_3 + \beta_5 + \beta_7 = 0$ in columns (2) and (3). The failure to reject $\beta_2 + \beta_4 + \beta_6 = 0$ in column (3) is again due to multicollinearity between ‘*CAI* times $D2^{LR}$ times D^{WF} ’, and ‘*NPLY* times $D2^{LR}$ times D^{WF} ’.

³⁵To test for the robustness of our results we perform a number of other tests. First, we use two other indicators of crisis that give more weight to reserve losses relative to exchange rate depreciation; our qualitative results remain the same. As reported in Tables 2-5, the results are also robust to the use of three alternative definitions of low reserves. Next, we test whether the significance of *CAI* is sensitive to the threshold for the real exchange rate appreciation; instead of a 10% trigger we use a 0 trigger and obtain the same qualitative results. The significance of the two non-performing loans measures *NPLB* and *NPLY* is also invariant with respect to modification of the definitions of these variables. All these results are available upon request.

³⁶Also implicit is the assumption that high investment rates contribute to the enhancement of productive capacity in the traded sector. If the investment boom is confined to the non-traded sector (commercial and residential construction, as well as inward-oriented

one can employ a standard measure of investment efficiency, the *ICOR* or ‘incremental capital output ratio’ defined as the ratio between the investment rate and the output growth rate. In Corsetti, Pesenti and Roubini (1999b), we document that, for all the Asian countries except Indonesia and the Philippines, the *ICOR* had increased sharply in the 1993-96 period relative to the previous three years 1987-1992. This evidence suggests that the efficiency of investments in South East Asia was already falling in the four years prior to the 1997 crisis.

In Corsetti, Pesenti and Roubini (1999c) we derive a measure of the *ICOR* for all the countries in our sample in the period 1993-1996. We then test for its significance in our basic regression model. We find that the *ICOR* variable is generally not significant; however, a simple transformation of the *ICOR* is significant in some regressions. We then define a new variable, which is equal to the original *ICOR* when the lending boom variable is positive, and is equal to zero when the lending boom is negative.³⁷ When we regress the crisis index on the modified *ICOR* variable and *NPLY* we find that both variables have the expected sign and are statistically significant.³⁸

4 Financial weaknesses and emerging market crises

4.1 Banking and currency crises in the 1990s

Our interpretation of the Asian crisis focuses on the role played by weaknesses in the financial and banking system in triggering the currency crisis in 1997-98. It is worth stressing that other episodes of currency crises in the 1990s have been associated with banking crises. In the case of Mexico, for instance, recent work shows that the financial system was fragile well

services), in terms of sustainability analysis the contribution of such investment projects to future trade surpluses — thus to the ability of the country to repay its external debt obligations — is limited to their indirect impact on the productivity of the traded sector. The two ‘implicit’ assumptions above need not hold in the Asian case.

³⁷The idea here is that low capital profitability is not problematic in itself if the corporate and financial sectors are able to properly assess the characteristics of the investment projects, but may significantly contribute to the build-up of tensions in the financial markets if there is a lending boom and excessive credit growth — perhaps driven by moral hazard and implicit guarantees on investment by the public sector.

³⁸See Corsetti, Pesenti and Roubini (1999c).

before the peso crisis of 1994 (see Krueger and Tornell (1999)). Weak regulation and supervision, as well as an inadequate deposit safety net, were all elements leading to moral hazard in the banking system and to a surge in non-performing loans well before the end of 1994. The weakness of the financial system was exacerbated by a poorly designed privatization program in the early 1990s. This evidence casts doubts on the thesis that the severe Mexican banking crisis emerging after the peso collapse was simply the *result* of the double shock of devaluation and high real interest rates in 1995 on the balance sheets of financial and corporate firms. The 1994 crisis was perhaps just the last straw for an already weakened banking system, leading to a meltdown that is estimated to cost about 14-20% of GDP.

Currency depreciation was also associated with banking problems in the case of Europe in 1992-93. This is clearly visible in Scandinavian countries such as Sweden and Finland, where a severe banking crisis was emerging since the early 1990s. It is also apparent in Italy, where a fiscal retrenchment and the discontinuation of regional public investment projects made the banking system in the South vulnerable to the consequences of changes in the relative price of non-traded goods due to the lira depreciation in 1992 and 1993 (the Italian traded good sector being comparatively smaller in the South relative to the North).

Some authors such as Radelet and Sachs (1998) and Chang and Velasco (1998a,b) have interpreted recent emerging market crisis episodes as being caused by international ‘runs’, the international equivalent of Diamond-Dybvig (1983) bank runs. Such runs are not caused by fundamentals, but rather triggered by self-fulfilling panics that turn liquidity problems into solvency problems. In support of such interpretation, it is commonly observed that the Asian countries did not suffer from the usual symptoms of fundamental imbalances (high budget deficits, domestic credit expansion, high unemployment etc.) preceding the currency crises.

In Corsetti, Pesenti and Roubini (1999a,b,c), we have argued that, along with their many strong economic fundamentals, East Asian crisis countries also featured severe structural distortions and institutional weaknesses. The financial and banking systems in Korea, Thailand, Indonesia and Malaysia were already in distress before the devaluation in 1997-98. The same can be said for the episodes of currency crises in Ecuador, Pakistan and Russia following the ones in Asia. While it is likely that these crises were exacerbated by speculative capital flights, it is difficult to argue that such flights hit otherwise healthy economies.

Prior to the crisis in Asia, speculative purchases of assets in fixed supply fed a strong and sustained growth in asset prices. Many observers believe that equity and real estate prices rose well beyond the levels warranted by fundamentals, inflating the value of collateral of households and firms. Moral hazard arose from implicit or explicit government bailout guarantees of financial institutions. Banking regulation and supervision were notably weak. In addition, poor corporate governance and what has now come to be called ‘crony capitalism’ — widespread corrupt credit practices, as loans were often politically directed to favored firms and sectors — enhanced these distortions and contributed to a lending boom, leading to overinvestment in projects and sectors that were excessively risky and/or of low profitability, such as real estate and other non-traded sectors. In the traded good sectors, these elements led to accumulation of excessive capacity.

Domestic and international capital liberalization may have aggravated the existing distortions by allowing banks and firms to borrow larger funds at lower rates in international capital markets. In Thailand, for instance, liberalization of capital account regulations (e.g. the establishment of the Bangkok International Banking Facility) provided an incentive for Thai banks and firms to borrow heavily in international financial markets in foreign currency and at very short maturities. Moreover, regulations limiting entry into the banking system led to the growth of unregulated, non-bank finance companies, fueling boom in the real estate sector. Fifty-six of these finance companies were distressed well before the Thai baht crisis and were eventually closed down after the onset of the crisis.

In Korea, excessive investment was concentrated among the chaebols, the large conglomerates dominating the economy. Counting on their control of financial institutions, as well as on government policies of directed lending to favored sectors, Korean chaebols undertook large investment in low-profitability sectors such as automobiles, steel, shipbuilding and semi-conductors. By early 1997, seven out of the thirty largest chaebols were effectively bankrupt and the Korean economy was mired in a deep recession. Corporate leverage was already high before the crisis. In 1996, the average debt-to-equity ratio of the top thirty chaebols was over 300%. It then increased dramatically with the devaluation, as this raised the burden of foreign debt.

In Indonesia, a large share of bank credit consisted of directed credit, channeled to politically favored firms and sectors. Although Indonesia had already suffered a banking crisis in the early 1990s, these practices remained

prevalent. In this country, however, a significant fraction of foreign banks' lending was directed to the corporate sector, rather than being intermediated through the domestic banking system. Most of the loans were denominated in foreign currency.

An interpretation of the Asian crisis in terms of a pure international bank run must confront the evidence about the shaky financial conditions in the crisis countries *preceding* the large outflows of capital of the second half of 1997. A large body of literature (see Dziobek and Pazarbasioglu (1997), Honohan (1997), Goldstein and Turner (1996), Demirgüç-Kunt and Detragiache (1997), Caprio (1998)) supports the view that banking crises are not due to random runs and panics by depositors, but are the outcome of weaknesses rooted in excessive lending, distorted incentives, connected and directed lending, a weak macroeconomic environment, poorly designed deposit insurance, and poorly managed liberalization processes. Quite simply, thinking that systemic banking crises occur because of sudden and unjustified depositors' panic appears to be naive.

Moreover, interpretations of banking crises based on multiple equilibria models are somewhat incomplete, as nothing in those models explains what makes investors shift expectations from a good to a bad equilibrium. Some models rely on exogenous 'sunspots' to nail down the probability of a run — this is just a gimmick with little economic or empirical content. Drawing on the evidence on bank runs, it is weak banks that tend to be attacked, not solid and healthy banks. It is therefore plausible that the probability of ending up in the bad equilibrium depends on the state of fundamentals; if fundamentals are weak, the probability that agents attack is higher. If one takes this analogy to a country level, the message is clear. The countries that come under attack are countries that, in some dimension or the other, have weak fundamentals.³⁹

4.2 The 1998 recession in Asia: the role of financial distress and the need for systemic corporate and bank restructuring

By the summer of 1998, the combination of sustained high interest rates and illiquidity led to harsh economic contraction and a vast overhang of bad debt

³⁹See for instance recent work by Morris and Shin (1998) and Corsetti, Morris, and Shin (1999).

throughout Asia. Many corporations were frozen in their production decisions as they had little access to working capital and were severely burdened by a massive stock of debt.

By early 1998, large parts of the banking systems in Korea, Thailand and Indonesia were effectively bankrupt as the result of high interest rates, a large and increasing amount of non-performing loans and the attempts to rapidly recapitalize. The net worth of a large part of the banking system in these countries was negative. Apart from a few domestic banks somehow spared by the crisis, the only viable banks were foreign banks operating in the region. It is also worth mentioning that the actual amount of foreign financing disbursed has been significantly less than the headline amounts announced.

Being under extreme stress, banks essentially stopped making new loans. Because of the combined effect of a liquidity squeeze and the risks of corporate bankruptcies, banks went as far as denying loans for trade credits and working capital. This was an important factor in causing many corporations that would have been solvent under normal credit conditions, to go bankrupt. In support of this view, we stress the fact that, by mid-1998, exports of the crisis countries had not significantly increased in spite of massive real depreciation. Firms had so little access to working capital and trade credit that they could not import the intermediate inputs required for producing export goods.

Because of the severe liquidity crunch, for many corporations liquidity problems were turning into solvency problems. While some firms might have been bankrupt before the crisis, the net worth of many other firms *became* negative per effect of the liquidity crunch; a combination of real depreciation, high real interest rates, collapsing aggregate demand and liquidity squeeze was leading them to bankruptcy. For these reasons, the net worth turned negative for a large part of the corporate sector. With little alternative source of financing (other than banks), the credit crunch afflicting the crisis economies was giving way to a vicious cycle: retrenchment in credit - further economic downturn - higher non performing loans and credit risk - more retrenchment in credit. Contractions in trade credit were particularly painful, directly affecting the ability of these economies to acquire foreign currency through exports.

The credit crunch for corporate firms was particularly devastating because in East Asia bank loans were the prevailing source of financing for firms. With banks and other financial institutions in severe financial distress, both short-term lending (for working capital purposes) and long-term lending by

banks and non-bank financial institutions were drastically reduced.

While a banking crisis was also experienced in Mexico in 1995 following the collapse of the peso, this crisis was different from the Asian one in one important respect. Relative to the case of East Asia, corporate bankruptcies in Mexico were much less important in triggering the financial distress of the financial sector. In Mexico, the lending boom preceding the crisis was concentrated in the household sector. Households borrowed heavily from banks (often in foreign currency) to finance their consumption of durable goods and household services. Thus, the peso fell and the ensuing economic recession mainly caused financial distress among heavily leveraged households. The inability of households to service their debt was what led to the collapse of financial institutions.

Over the summer of 1998, interest rates in Asia had significantly fallen relative to the peaks of the crisis, and in Korea they returned to pre-crisis levels. In spite of this, a credit crunch was still severe in most countries: while the price of credit had been falling, banks that were effectively bankrupt or experiencing financial distress were unwilling to lend to corporations suffering from debt overhang. As loans were still drastically rationed, capital controls leading to lower interest rates would have done little to ease the credit crunch. Moreover, it is far from clear whether they would have helped to remove structural impediments to recovery.

While the need for a more decisive expansionary policy was widely recognized, several observers emphasized the need for an accelerated debt restructuring process as the only effective way to help the Asian countries to start producing and exporting again. Such process consists of the following steps: recapitalize banks, reduce corporate debt overhang, and provide firms with debt moratoria and new priority financing of working capital and trade.

Suggestions for a comprehensive approach to bank and corporate restructuring, including a more active role of governments, were widely debated. An accelerated restructuring of the banking system could be accomplished in a number of alternative ways. Banks that were undercapitalized but still solvent had to be recapitalized, either with capital injections from domestic and/or foreign investors or through capital injections by the government. In the case of institutions that were clearly insolvent or borderline insolvent, the governments had to intervene directly, eventually deciding among possible alternative actions: recapitalize them in order to sell them to (domestic and/or international) private investors, merge them with stronger institutions, or close them down and sell their assets.

Korea, Indonesia, Thailand and Malaysia tried out different approaches to bank capitalization, each with a different mix of private and public participation including recapitalization (mostly via foreign injections of new equity), closure, and mergers with other financial institutions. Accelerated disposal of bad loans, proper loan classification, and provisioning for bad loans were all elements of an accelerated bank restructuring strategy.

In these countries the approach to bank and corporate restructuring was modeled on a variant of the ‘London approach’ used by the United Kingdom to achieve out-of-court restructuring. This approach is mostly voluntary, case-by-case and market based. Some suggested that the systemic nature of the corporate and bank financial distress in South-East Asia required a more aggressive approach with coercive elements and greater government involvement. As a matter of fact, the restructuring process has been relatively slow, especially in the corporate area. While the recapitalization of the banking system picked up speed in the second half of 1998, progress on corporate restructuring remained slow through 1999.

4.3 The role of foreign ownership of domestic banks in preventing emerging market crises

One key issue raised by recent crises in emerging markets is whether significant ownership of the domestic financial system by foreign banks could help prevent currency and financial crises, and/or help reduce the impact of a crisis on the economy. In the case of East Asia, BIS country banks provided most international lending to Asian local banks, which in turn lent to domestic corporations. Also in the case of Indonesia, where international banks tended to lend directly to corporations, international lending was mostly offshore. It has been argued that direct ownership of a fraction of the domestic financial system by foreign banks may have positive stabilizing effects. The case of Argentina (together with some other Latin American countries) is often mentioned in this respect.

In addition to enhancing competition, efficiency, and to bringing new managerial skills and banking knowledge, international banks may provide specific benefits in periods of crisis. First, if a foreign bank only lends to an emerging market bank, it does not have any stake in the corporate projects financed by the local bank. In anticipation of a crisis it may be rational for a foreign bank not to roll over its loans to the domestic bank, even if, by forcing

the domestic bank to call in loans in turn, such decision causes financial distress at corporate level. If, instead, a foreign bank operates locally, it would be more concerned with the health of domestic corporations. It would be less likely to call in loans abruptly, and repatriate liabilities, adding to the risk of a crisis, since this would harm the foreign bank directly.

Second, the presence of foreign banks could mitigate some of the problems that emerges with weak domestic supervision and regulation (an emerging market regulator's ability to properly supervise and regulate domestic banks is often limited for a variety of reasons, and cannot be trusted). International banks may be inclined to follow an arms-length approach, rather than relationship banking; and they may be less exposed to political pressure to provide direct lending. Also, a strict regulation of the foreign bank in its home-country (say US) may indirectly affect the activities of the bank's branches in the emerging market economies. Third, foreign ownership of banks operating domestically may reduce the need for central banks in emerging market to provide a safety net, by performing as lenders of last resort. This is because the foreign owned local banks can rely on the foreign owners to provide funds in the presence of sudden and rapid deposit withdrawals, observed during episodes of panic.

On the basis of these arguments, some have claimed that a fraction of emerging markets banking system should indeed be controlled by foreign banks as a way to ensure competition, efficiency and stability. In favor of such a view, the examples of Hong Kong and Singapore (where a large fraction of the banking system is foreign owned) are often mentioned.

What are the main objections to such a view? One is, of course, a question of sovereignty. But why should countries care about who owns their banks more than they care about who owns their factories? The reason is that banks have traditionally been used for political purposes through direct lending, and as a source of revenue via financial repression. This is why governments are wary of letting go of domestic banks. Note that these elements provide a positive explanation of why governments do not want a foreign ownership of domestic banks; they do not provide, however, a strong normative argument against foreign ownership.

A second objection casts doubts on the presumption that foreign-owned banks would behave properly and avoid excessive risk taking. In the case of Chile in the early 1980s, for instance, the Chilean subsidiaries of foreign banks gambled on very risky projects, and engaged in excessive credit creation. A third objection is against the presumption that a financial system owned by a

small number of foreign banks would reduce the need for the domestic central bank to intervene in the banking system, acting as lender of last resort. It is far from obvious that these banks would not count on the local central bank as provider of funds, when economic shocks or poor lending decisions lead to financial distress in the banking system. Large foreign banks may have the power to impose ex-post liquidity provision, and other forms of support, such as a government bail-out of their bad loans.

Overall, however, these objections do not appear to be strong enough to offset the arguments in favor of foreign ownership of domestic banks in emerging markets — especially in light of the track records of the countries where foreign banks own a large fraction of the domestic banking system. Yet, there are a number of issues that require additional analysis. Do foreign owned banks in emerging markets need a domestic safety net (lender of last resort and deposit insurance)? Will they expect it, require it and get it ex-post if they experience financial distress? Should the home country rather than the host country provide regulation and lender of last resort support? These are complex questions with no easy answers.

5 Conclusions

The results of our empirical analysis provide evidence in support of the thesis that crises are systematically related to the fundamental weaknesses in the real and financial sectors of the economy. The recent turmoil in Asia does not seem to represent an exception in this respect. External imbalances, as measured by the current account deficits associated with real exchange rate appreciation, are significantly correlated with the crisis index. So are measures of financial fragility (non-performing loans in the presence of a lending boom) and measures of the fiscal costs associated with financial bailouts (non-performing loans as a share of GDP). The effects of these variables on the crisis index are found to be stronger in countries with low reserves.

The empirical analysis presented in this paper is quite preliminary. Yet, it complements other analyses showing the extent of the deterioration of fundamentals in Asia in the years before the crisis. Per se, these results cannot discriminate across alternative explanations of currency crises based on self-fulfilling speculative attacks, as opposed to fundamental factors. They do, however, identify a set of variables that appear to enhance the vulnerability of an economy to a crisis.

The indicator that seems to be most robust in our analysis is the indirect measure of the implicit costs of bailouts in the presence of a financial crisis, *i.e.* non-performing loans before the crisis as a share of GDP. In related work (Corsetti, Pesenti and Roubini (1999a)) we have provided a consistent theory of the role that contingent public debt plays in generating ‘twin’ financial and currency crises. We interpret the empirical evidence presented in this paper as an indication that this is the right direction to pursue in a comprehensive research agenda on the Asian crisis.

The analysis in this paper highlights the role played by the financial distress of banks, other financial institutions and corporation in the Asian crisis. The fiscal costs of cleaning up the balance sheets of banks is bound to be very high, while the prospects for a rapid and sustained recovery of economic growth in Asia depend on an accelerated process of bank and corporate restructuring in the region. The recent recovery in economic activity in the region may experience a relapse unless bank and corporate restructuring is pursued more aggressively in the near future.

Appendix

In this appendix we describe in detail the construction of the variables used in the empirical analysis.

Crisis index (IND)

The index is a weighted average of the percentage rate of exchange rate depreciation relative to the US dollar and the percentage rate of change in foreign reserves between the end of December 1996 and the end of December 1997. A large negative value for *IND* corresponds to a high devaluation rate and/or a fall in foreign reserves, *i.e.* a more severe currency crisis. All data are from the International Financial Statistics of the International Monetary Fund (IFS-IMF).

Real exchange rate appreciation

This variable measures the percentage rate of change of the real exchange rate between the end of 1996 and an average over the 1988-1990 period. The real exchange rate measure is based on wholesale price indexes, using trade weights of OECD countries (excluding Mexico and Korea). For the three transition economies — Czech Republic, Hungary and Poland — whose real exchange rates exhibit large fluctuations in the early transition years, the appreciation is calculated between 1996 and 1992. For Argentina, whose real exchange rate experienced large swings in the hyperinflation period, the real exchange rate is computed between 1996 and the end of 1990.

Current account deficits and the CAI index

The current account deficit as a share of GDP is an average over the 1994-96 period. Data are from IFS-IMF. The index of current account imbalances *CAI* is computed as follows: for countries where the real exchange rate appreciated more than 10% over the period defined above, *CAI* takes the value of the average 1994-96 current account balance (as a share of GDP); for all other countries, *CAI* is set equal to zero.

Lending boom (LB)

This variable is the rate of growth between 1990 and 1996 of the ratio between the claims on the private sector of the deposit money banks (line 22d in IFS-IMF) and nominal GDP. All data are from IFS-IMF. In the case of transition economies whereas either data since 1990 are not available or the ratio is very unstable in the early transition years, we take 1992 (rather than 1990) as the starting date.

Non-performing loans as a share of total bank assets (NPL)

As there are no homogeneous series for non-performing loans, we need to

build our dataset relying on several sources. For most of the Asian countries in our sample (Korea, Indonesia, Hong Kong, Taiwan, Malaysia, Thailand) there are two available estimates of NPL in 1996; one from the 1997 BIS Annual Report, the other from Jardine Fleming. Both estimates are biased: the former underestimates non-performing loans before the onset of the crisis (for instance, the end-of-1996 figure for Korea is 0.8%); the latter is based on data from the third quarter of 1997, when non-performing loans are already reflecting the consequences of the currency crises on the financial conditions of banks and corporate firms (for instance, Korean non-performing loans are estimated to be 16%). We take the average of the two figures as a reasonable estimate of the non-performing loans before the onset of the crisis, *i.e.* end 1996-early 1997. For the remaining countries, we proceed as follows: for India, Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela we use the estimates for 1996 in the BIS 1997 Annual Report. For China, Singapore and the Philippines, we use estimates from Jardine Fleming. For the other countries in the sample, we rely on information derived from IMF country reports. It is worth emphasizing that our estimates do not appear to be systematically biased towards the countries that suffered a crisis in 1997. Note in fact that non-crisis countries such as Mexico, China, India and Pakistan all show a very large fraction of non-performing loans (over 10% of total loans).

Fiscal cost of the bailout of the banking system as a share of GDP (NPLY)

This variable is computed as follows. We take the estimate of the non-performing loans as a share of bank assets (NPL) derived above and we multiply it by the ratio of claims on the private sector by deposit money banks at the end of 1996 to GDP. The latter variable is computed from IFS-IMF data.

The NPLB index

In deriving $NPLB$, we interact the lending boom variable with the non-performing loans variable: for countries where the sign of the lending boom variable is positive, we set $NPLB$ equal to NPL ; for countries with a negative lending boom, we set $NPLB$ equal to zero.

Reserve adequacy ratios

We compute three ratios for reserve adequacy at the end of 1996. The first is the ratio of $M1$ to foreign exchange reserves ($M1/RES$); the second is the ratio of $M2$ to foreign reserves ($M2/RES$); the third is the ratio of the foreign debt service burden (*i.e.* short-term foreign debt plus interest payments on foreign debt) to foreign reserves (STD/RES). Foreign exchange reserve data are from the IFS-IMF (line 11.d). Data on short term debt and

interest payments on foreign debt are from Datastream.

Taiwan

Taiwan is not included in the IMF data base. Our data for Taiwan are from Datastream and rely on Taiwan national data sources.

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Table 1.*Percentage or percentage change*

<i>Country</i>	<i>Crisis Index (IND)</i>	<i>Real Appreciation (RER)</i>	<i>Current Account (CA)</i>	<i>Lending Boom (LB)</i>	<i>Non-Performing Loans (NPL)</i>	<i>Reserves Adequacy (M2/RES)</i>	<i>Reserves Adequacy (M1/RES)</i>	<i>Reserves Adequacy (STD/RES)</i>
Argentina	4.9	38.6	-1.9	16.5	9.4	351.0	108.2	147.8
Brazil	-0.5	75.8	-2.0	-26.3	5.8	345.9	66.8	78.3
Chile	-1.4	37.5	-1.7	24.1	1.0	188.2	41.9	53.3
China	7.6	4.9	0.8	6.9	14.0	828.9	334.0	26.7
Columbia	-9.1	26.6	-5.0	35.0	4.6	209.4	104.3	73.9
Czech	-19.5	50.7	-4.4	22.7	12.0	356.9	139.5	42.9
Hong Kong	5.7	31.8	-1.6	25.5	3.4	411.9	34.2	20.0
Hungary	-1.6	-38.8	-6.5	-56.5	3.2	167.1	83.3	52.3
India	5.7	-29.1	-1.2	-2.3	17.3	860.0	296.5	37.2
Indonesia	-38.3	17.5	-2.9	9.6	12.9	614.8	114.3	188.9
Jordan	9.8	6.1	-4.5	1.4	6.0	437.8	141.4	33.9
Korea	-38.6	11.1	-2.5	11.2	8.4	665.4	147.6	217.0
Malaysia	-38.8	19.9	-6.4	31.1	9.9	364.8	115.6	45.3
Mexico	10.9	8.9	-2.7	-10.9	12.5	444.8	129.3	142.9
Pakistan	11.4	-2.0	-5.3	-3.7	17.5	3369.9	1822.8	399.0
Peru	0.7	-20.4	-6.2	177.2	5.1	123.6	32.4	61.6
Philippines	-29.8	38.9	-4.6	150.8	14.0	465.6	91.8	849.3
Poland	3.5	30.0	0.9	38.5	6.0	262.3	95.9	14.2
Singapore	-15.7	4.7	16.5	16.7	4.0	103.5	25.0	20.0
Sri Lanka	-1.0	17.7	-5.7	28.4	5.0	236.4	72.9	26.8
Taiwan	-11.4	-7.0	2.9	43.4	3.9	575.1	141.0	22.8
Thailand	-47.8	20.0	-7.2	58.0	13.3	380.5	43.3	121.5
Turkey	4.3	-16.1	-0.1	43.2	0.8	302.6	48.9	76.0
Venezuela	4.9	2.2	6.8	-51.5	3.8	102.4	58.5	28.2

Table 2.^a

<i>Estimated coefficient and summary statistic</i>	<i>Independent variable</i>	<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>
			<i>Regression with M2/RES</i>	<i>Regression with M1/RES</i>	<i>Regression with STD2/RES</i>
β_1	constant	6.877 (3.755)	7.073 (4.094)	7.437 (3.956)	5.324 (3.552)
β_2	<i>CAI</i>	3.768 (1.254)	0.849 (2.869)	2.210 (3.677)	0.569 (1.971)
β_3	<i>NPLB</i>	-1.338 (0.605)	-2.888 (2.073)	-2.805 (1.946)	-0.476 (0.782)
β_4	<i>CAI</i> \times <i>D2</i> ^{LR}		3.613 (3.191)		
β_5	<i>NPLB</i> \times <i>D2</i> ^{LR}		1.761 (2.035)		
β_4	<i>CAI</i> \times <i>D1</i> ^{LR}			1.467 (3.982)	
β_5	<i>NPLB</i> \times <i>D1</i> ^{LR}			1.534 (1.929)	
β_4	<i>CAI</i> \times <i>D3</i> ^{LR}				3.571 (2.564)
β_5	<i>NPLB</i> \times <i>D3</i> ^{LR}				-0.864 (0.986)
<i>Summary statistic</i>					
\bar{R}^2		0.555	0.541	0.536	0.622
R^2		0.594	0.621	0.616	0.688
<i>Addendum:</i>					
<i>Wald tests</i>					
Null hypothesis		<i>p values</i>	<i>p values</i>	<i>p values</i>	<i>p values</i>
$\beta_2 + \beta_4 = 0$			0.005	0.018	0.023
$\beta_3 + \beta_5 = 0$			0.099	0.057	0.091

^a The dependent variable is the crisis index, *IND*. See Table 1 and Appendix for definition of variables. Standard errors are shown in parentheses.

Table 3.^a

<i>Estimated coefficient and summary statistic</i>	<i>Independent Variable</i>	(1)	(2)	(3)
β_1	constant	-2.861 (2.138)	5.535 (3.887)	5.602 (4.082)
β_2	<i>CAI</i>	0.841 (2.946)	0.762 (2.694)	0.766 (2.771)
β_3	<i>NPLB</i>	-1.338 (0.605)	-2.569 (1.954)	-2.583 (2.017)
β_4	<i>CAI</i> \times <i>D2^{LR}</i>	2.851 (6.650)	1.118 (3.274)	1.559 (6.293)
β_5	<i>NPLB</i> \times <i>D2^{LR}</i>	1.769 (2.091)	2.448 (1.945)	2.446 (2.000)
β_6	<i>CAI</i> \times <i>D2^{LR}</i> \times <i>D^{WF}</i>	0.834 (6.337)		-0.497 (6.004)
β_7	<i>NPLB</i> \times <i>D2^{LR}</i> \times <i>D^{WF}</i>		-2.120 (1.123)	-2.131 (1.164)
<i>Summary statistic</i>				
\bar{R}^2		0.516	0.596	0.572
R^2		0.621	0.684	0.683
<i>Addendum:</i>				
<i>Wald tests</i>				
Null hypothesis		<i>p values</i>	<i>p values</i>	<i>p values</i>
$\beta_2 + \beta_4 = 0$		0.547	0.337	0.688
$\beta_2 + \beta_4 + \beta_6 = 0$		0.009		0.388
$\beta_3 + \beta_5 = 0$		0.146	0.883	0.875
$\beta_3 + \beta_5 + \beta_7 = 0$			0.017	0.026

^a The dependent variable is the crisis index, *IND*. See Table 1 and Appendix for definition of variables. Standard errors are shown in parentheses.

Table 4.^a

<i>Estimated coefficient And summary Statistic</i>	<i>Independent variable</i>		(1) <i>Regression with M2/RES</i>	(2) <i>Regression with M1/RES</i>	(3) <i>Regression with STD2/RES</i>
β_1	constant	6.682 (3.699)	8.142 (3.951)	6.289 (3.789)	5.491 (3.492)
β_2	<i>CAI</i>	4.156 (1.158)	2.288 (2.394)	-1.402 (4.511)	0.845 (1.963)
β_3	<i>NPLY</i>	-1.630 (0.724)	-6.579 (3.263)	-4.817 (2.419)	-0.597 (0.874)
β_4	<i>CAI</i> \times <i>D2^{LR}</i>		2.594 (2.657)		
β_5	<i>NPLY</i> \times <i>D2^{LR}</i>		5.133 (3.170)		
β_4	<i>CAI</i> \times <i>D1^{LR}</i>			5.760 (4.660)	
β_5	<i>NPLY</i> \times <i>D1^{LR}</i>			3.481 (2.497)	
β_4	<i>CAI</i> \times <i>D3^{LR}</i>				3.487 (2.530)
β_5	<i>NPLY</i> \times <i>D3^{LR}</i>				-1.185 (1.248)
<i>Summary statistic</i>					
\bar{R}^2		0.558	0.578	0.634	0.618
R^2		0.596	0.651	0.557	0.684
<i>Addendum: Wald tests</i>					
Null hypothesis		<i>p values</i>	<i>p values</i>	<i>p values</i>	<i>p values</i>
$\beta_2 + \beta_4 = 0$			0.001	0.002	0.016
$\beta_3 + \beta_5 = 0$			0.074	0.105	0.107

^a The dependent variable is the crisis index, *IND*. See Table 1 and Appendix for definition of variables. Standard errors are shown in parentheses.

Table 5.^a

<i>Estimated coefficient and summary statistic</i>	<i>Independent variable</i>	(1)	(2)	(3)
β_1	constant	9.060 (4.233)	3.754 (2.731)	3.677 (3.026)
β_2	<i>CAI</i>	2.438 (2.439)	1.570 (1.577)	1.557 (1.633)
β_3	<i>NPLY</i>	-6.912 (3.347)	-4.985 (2.164)	-4.957 (2.263)
β_4	<i>CAI</i> \times <i>D2^{LR}</i>	-7.295 (14.900)	-2.753 (2.033)	-2.085 (9.972)
β_5	<i>NPLY</i> \times <i>D2^{LR}</i>	5.425 (3.246)	5.287 (2.081)	5.267 (2.160)
β_6	<i>CAI</i> \times <i>D2^{LR}</i> \times <i>D^{WF}</i>	9.905 (14.676)		-0.685 (10.005)
β_7	<i>NPLY</i> \times <i>D2^{LR}</i> \times <i>D^{WF}</i>		-5.420 (1.060)	-5.436 (1.117)
<i>Summary statistic</i>				
\bar{R}^2		0.566	0.818	0.808
R^2		0.660	0.858	0.858
<i>Addendum:</i>				
<i>Wald tests</i>				
Null hypothesis		<i>p values</i>	<i>p values</i>	<i>p values</i>
$\beta_2 + \beta_4 = 0$		0.741	0.424	0.957
$\beta_2 + \beta_4 + \beta_6 = 0$		0.001		0.633
$\beta_3 + \beta_5 = 0$		0.073	0.626	0.445
$\beta_3 + \beta_5 + \beta_7 = 0$			0.000	0.000

^a The dependent variable is the crisis index, *INDI*. See table 1 and Appendix for definition of variables. Standard errors are shown in parentheses.