

Paper tigers? A model of the Asian crisis*

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Abstract

This paper develops an interpretation of the Asian meltdown focused on moral hazard as the common source of overinvestment, excessive external borrowing, and current account deficits. To the extent that foreign creditors are willing to lend to domestic agents against future bail-out revenue from the government, unprofitable projects and cash shortfalls are re-financed through external borrowing. 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. Expectations of inflationary financing thus cause a collapse of the currency and anticipate the event of a financial crisis.

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paper tiger: *a Chinese expression first used by Chairman Mao, a person, country, etc., that appears outwardly powerful or important but is actually weak or ineffective* (Oxford English Dictionary, 2nd edition).

1 Introduction

With the goal of providing an interpretive scheme of the events in Southeast Asia since the summer of 1997, this paper develops a model of financial and currency crises focused on moral hazard as the common source of overinvestment, excessive external borrowing, and current account deficits in an economy with a poorly supervised and regulated financial sector.

In our model, private agents act under the presumption that there exists 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 anticipates the event of a financial crisis.

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 into high shares of non-performing loans. The final section of the paper applies our interpretive framework to the recent events in the Asian region, and discusses the thesis that the combination of the structural factors above was at the core of the Asian collapse.

The paper is organized as follows. Section 2 highlights the links between our model and the current literature on currency and financial crises. Section 3 introduces the structure of our model, Section 4 analyzes the implications

of moral hazard in the unfolding of a financial crisis, and Section 5 studies the relation between currency and financial crises. Building on these results, Section 6 presents a general discussion of the moral hazard problem and the structural imbalances in Southeast Asia on the eve of the crisis, and outlines policy implications and potential extensions of our framework. Section 7 answers the question in the title and concludes.

2 Towards a new theoretical framework in the currency crisis literature

After the outburst of the currency and financial crises in Southeast Asia in the summer of 1997, many observers have noted that the traditional conceptual and interpretive schemes¹ do not appear, *prima facie*, to fit the data well and fall short in a number of dimensions.²

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 in the presence of multiple equilibria,³ provided that the fundamentals are

¹See Buiter, Corsetti and Pesenti (1998a), Calvo (1998), Calvo and Vegh (1998), Cavallari and Corsetti (1996) and Flood and Marion (1998) for recent surveys.

²A partial list of recent studies providing empirical evidence on the Asian crisis includes Alba *et al.* (1998), Corsetti, Pesenti and Roubini (1998), 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.

³See among others Obstfeld (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

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 the following pages we suggest 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 analyze financial and currency crises as interrelated phenomena, focusing on moral hazard as the common factor underlying the ‘twin’ crises.⁴

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,⁵ 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

in a self-fulfilling way. Note that multiple equilibria can arise even in ‘first-generation’ models (see for instance Obstfeld (1986)). Somewhat confusingly, the literature occasionally identifies ‘first-generation’ models with unique equilibria, and ‘second-generation’ models with multiple equilibria. A classification of the models based on exogenous versus endogenous policies provides a more accurate taxonomy.

⁴Among recent contributions to the literature on the ‘twin’ crises see *e.g.* Velasco (1987), Kaminsky and Reinhart (1997), Goldfajn and Valdes (1997), Kumhof (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).

⁵As pointed out in Section 6, the mid-1990s macroeconomic shocks of particular relevance for the unraveling of the Asian crisis were the prolonged slump in Japan, the strong appreciation of the dollar, negative terms of trade fluctuations, and a regional productivity slowdown.

be understood as a consequence of the anticipated fiscal costs of financial restructuring, that generate expectations of a partial monetization of future fiscal deficits and a fall in economic activity induced by the required structural adjustment.⁶

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 believable.”⁷

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-Alejandro⁸ — “*which a misguided minister of finance or central bank president may occasionally utter in a moment of dogmatic exaltation*”. In what follows we suggest a simple model of financial crisis that builds upon the above remarks.⁹

⁶In order to maintain both focus and tractability, the model in this contribution necessarily abstracts from a number of factors that are relevant in a comprehensive reading of the Asian crisis. Namely, we do not explicitly model the role of real exchange rate fluctuations in determining the domestic burden of external debt. By the same token, we do not address contagion and issues related to the systemic dimension of the Asian crisis. For an overview of systemic models of currency crises and competitive real depreciations see Eichengreen, Rose and Wyplosz (1996), Buitier, Corsetti and Pesenti (1998a,b) and Corsetti, Pesenti, Roubini and Tille (1998).

⁷Díaz-Alejandro (1985), p.374.

⁸*Ib.*, p.379.

⁹The literature also identifies a related type of moral hazard problem, raised by the possibility that domestic agents divert part of the borrowed funds away from domestic investment project, and increase either their consumption or their holding of assets abroad

3 The structure of the model

3.1 The private sector: technology, preferences, market structure and budget constraints

Consider a small open economy specialized in the production of a traded good Y . The aggregate production function is

$$Y_t = \tilde{A}_t K_t^\alpha L^{1-\alpha} \quad (1)$$

where K is physical capital, L is labor and \tilde{A} is a technology parameter. Labor is inelastically supplied, and normalized to 1.¹⁰ The production technology is stochastic, say

$$\tilde{A}_t = \begin{cases} A + \sigma & \text{with probability } 1/2 \\ A - \sigma & \text{with probability } 1/2. \end{cases} \quad A > \sigma > 0$$

The country's asset market is assumed to be incomplete and segmented: a fraction β of domestic agents — the country *élite* (*ELI*) — benefit from full access to capital markets, while the remaining $1 - \beta$ agents, the *rest of the country* (*ROC*), do not hold assets.¹¹ There is no segmentation in the market for labor, assumed to be competitive for both *ROC* and *ELI* agents. All agents are risk neutral.

The *élite* agents hold the entire stock of domestic real money balances, which provide liquidity services. Formally, we parameterize the expected

(see the analysis in Gertler and Rogoff (1990)). When the lender can observe the behavior of the borrower only imperfectly, this problem leads to domestic underinvestment and rationing in the international financial markets: international creditors discourage hidden consumption or capital flight from the borrowing countries by rationing funds so as to keep the domestic marginal product of capital high. Note the different implications of this model of moral hazard relative to the model discussed in the text. The former is associated with credit rationing and underinvestment, the latter with excessive borrowing and overinvestment.

¹⁰As regards the timing of the variables, K_t , the level of capital in place at time t , is determined at time $t - 1$, before the shock \tilde{A}_t is realized and observed.

¹¹Note that the asymmetric characterization of private agents in our setup stems exclusively from market segmentation, and need not reflect social or political stratification. The latter aspect is somewhat emphasized in Krugman (1998), who in a similar context refers to the country *élite* as the class of *minister's nephews*. The political economy of the crisis is a promising direction of research that is not pursued in this paper.

utility of the elite agents as:

$$E_t \sum_{s=t}^{\infty} \frac{1}{(1+\delta)^{s-t}} \left[C_s^{ELI} + \chi \ln(M_s/P_s) \right] \quad (2)$$

where δ is the rate of time preference, C^{ELI} is the elite's consumption, M is nominal money holdings, and P is the domestic price level.

The elite agents borrow funds from abroad, D , and lend capital K to the country's firms, that are owned by the elite itself. As a maintained hypothesis the capital stock of the nation at some initial date t_0 is assumed to be entirely financed through external borrowing. This assumption simplifies the exposition of the model without affecting the main results, and is consistent with empirical evidence on the insufficient capitalization of firms in the emerging economies of the Asian region.¹² The aggregate budget constraint of the elite is:

$$K_{t+1} - K_t - (D_{t+1} - D_t) \frac{\mathcal{E}_t}{P_t} = \beta W_t - \rho_t \frac{\mathcal{E}_t}{P_t} D_t - C_t^{ELI} - T_t^{ELI} - \frac{M_t - M_{t-1}}{P_t} \quad (3)$$

where D is gross foreign debt,¹³ ρ is the cost of borrowing in real terms, T^{ELI} are net taxes paid by the elite to the government, \mathcal{E} is the nominal exchange rate (domestic currency per unit of foreign currency), and W is before-tax labor income in real terms, of which a fraction β accrues to the elite. Competition in the labor market implies that

$$W_t = (1 - \alpha) Y_t. \quad (4)$$

For the agents in the rest of the country labor income is the only source of wealth, and there is no capital market where they can borrow against future incomes. The aggregate budget constraint of the *ROC* agents is therefore:

$$(1 - \beta)W_t = C_t^{ROC} + T_t^{ROC} \quad (5)$$

¹²Focusing for instance on the Korean case, by the end of 1996 — well before the onset of the crisis — the average debt-equity ratio for the top-30 chaebols was 333% (the comparable figure for the US being close to 100%). Those chaebols that went bankrupt or had severe financial problems in 1997 tended to have even larger debt-equity ratios. In 1996 some two-thirds of corporate debt in Korea were short-term, of which one quarter was foreign. For details, see Corsetti, Pesenti and Roubini (1998) and OECD (1998).

¹³The time-subscripts adopted here follow the notational conventions suggested by Obstfeld and Rogoff (1996): the elite enters period t with a stock of external debt equal to D_t and a stock of capital equal to K_t , but the stock of money holdings at the beginning of the period is denoted by M_{t-1} .

where C^{ROC} is consumption and T^{ROC} net taxes. Labor income of both *ELI* and *ROC* agents is taxed at some rate η_t , assumed to be bounded from above.

We conclude this subsection by defining a *financial crisis*. If the outstanding stock of liabilities of the elite is larger than the capital stock, the viability of the economy depends on the willingness of foreign creditors to roll over their loans and allow the domestic elite to borrow in excess of the domestic capital stock. A crisis will therefore occur if international creditors allow no borrowing in excess of the capital stock. Formally, a financial crisis can be defined as an event occurring at time t_c such that $\mathcal{E}_{t_c} D_{t_c} / P_{t_c} > K_{t_c}$, and $\mathcal{E}_{t_c+\tau} D_{t_c+\tau} / P_{t_c+\tau} = K_{t_c+\tau}$ for all $\tau \geq 1$.¹⁴ Note that at the time of the crisis t_c , with foreign creditors unwilling to provide further credit, the elite firms would be forced to declare insolvency unless the government intervenes by absorbing the difference between foreign private liabilities and domestic capital. In what follows, we will derive the timing t_c and the magnitude of a financial crisis as endogenous equilibrium outcomes, given a set of behavioral assumptions on both the government willingness to ‘save’ domestic firms and international creditors willingness to lend to them.

3.2 The public sector: preferences and budget constraints

In our model the government implements tax and transfer policies and manages the stock of official foreign reserves, under the maintained hypothesis that it never defaults on its liabilities, domestic or external. The domestic public sector can then borrow and lend in the international financial markets at the market rate r . As we analyze a small open economy, this rate is assumed to be constant and equal to the rate of time preference of the elite. The consolidated (government and central bank) public sector budget identity is therefore:

$$\frac{\mathcal{E}_t}{P_t} [(R_{t+1} - L_{t+1}) - (R_t - L_t)] = T_t^{ELI} + T_t^{ROC} + \frac{M_t - M_{t-1}}{P_t} + r \frac{\mathcal{E}_t}{P_t} (R_t - L_t) \quad (6)$$

where R denotes the assets, and L the liabilities of the government *vis-à-vis* the rest of the world. Both R and L are denominated in foreign currency.

¹⁴In other words, a financial crisis occurs when the ‘excessive’ borrowing that has taken place in the past is no longer permitted by foreign creditors.

Key to our analysis is that fiscal and monetary policies, i.e. the path of T^{ELI} , T^{ROC} , $R - L$ and M , are contingent on a financial crisis and differ *before* and *after* t_c . Consider first what government policies are implemented before a crisis, that is for $t_0 \leq t < t_c$. With reference to the stylized facts of the Asian crisis, the pre-crisis fiscal and monetary policy can be described as an *exchange rate peg with balanced budget*. As regards fiscal policy, we assume that the initial level of foreign reserves is positive, while the initial level of public debt and taxes on both corporate and labor income are set equal to zero. Accounting for international arbitrage in the goods market (so that purchasing power parity, PPP, holds and $P = \mathcal{E}$, where the foreign price level is assumed to be constant and normalized to one), the pre-crisis public budget constraint is therefore

$$R_{t+1} - R_t = \frac{M_t - M_{t-1}}{\mathcal{E}_t} + rR_t \quad t_0 \leq t < t_c.$$

As regards monetary policy, we assume that initially the government stands ready to exchange official reserves R_{t+1} for domestic money liabilities M_t at some fixed nominal exchange rate $\bar{\mathcal{E}}$, as long as this policy is not inconsistent with the government solvency constraint. Although in principle a speculative attack that triggers a currency devaluation could occur before t_c , we will show that, under our assumptions, this will never happen in equilibrium.

Consider now the post-crisis policy scenario. The logic of a financial crisis in our model hinges upon the assumption that government preferences conform the ‘Diaz-Alejandro’ paradigm discussed at the beginning of this section. When a financial crisis occurs, government welfare is assumed to fall to its minimum level if the government maintains a *laissez-faire* stance and does not intervene in favor of troubled private firms by bailing out corporate debt.¹⁵ Thus, agents *rationally* expect that, if a financial crisis materializes, the government chooses to step in and rescue the elite’s firms.

It should be clear that this hypothesis by no means implies that the government provides public guarantees to risky projects and excessive borrowing out of irrationality or myopia. Rather, the government is unable to commit credibly to *laissez-faire*, so that *ex-post* — in a time-consistent equilibrium

¹⁵Our definition of financial crisis highlights that bailouts concern only the component of corporate debt in excess of capital, that is, the cumulative value of firms losses up to time t_c .

— it has no choice but to intervene and validate agents' expectations of a bailout. To finance the transfers to the corporate sector representing the bailout costs, taxes on labor income are increased up to their bound. In developing our model, it is useful to resort to the simplifying assumption that a financial crisis-*cum*-bailout is a one-time event, that is not expected to occur again in the future.

Under the above assumptions, a bailout implies a discontinuous change in the level of public debt contingent on the occurrence of a financial crisis. *Before* a crisis, L is zero. *At the time of the crisis*, the right hand side of the budget constraint (6) falls by an amount equal to the bailout costs and the left hand side of the budget constraint now includes the stock of public liabilities emerging as a consequence of the rescue of insolvent private firms. Formally, under PPP we have:¹⁶

$$L_{t_c+1} = -\Delta T_{t_c}^{ELI} = D_{t_c} (1 + r) - (K_{t_c} + \alpha Y_{t_c}).$$

where Δ denotes a discrete change in the variable.

Integrating forward the identity (6) subject to the appropriate transversality condition, we obtain the intertemporal budget constraint conditional on the occurrence of a financial crisis:

$$L_{t_c+1} - R_{t_c+1} = E_{t_c+1} \sum_{s=t_c+1}^{\infty} \left(\frac{1}{1+r} \right)^{s-t_c} \left(\eta_s W_s + \frac{M_s - M_{s-1}}{P_s} \right) \quad (7)$$

This expression equates the outstanding stock of public liabilities net of reserves to the expected discounted value of the anticipated revenue flows from labor taxation ($T^{ROC} + T^{ELI} = \eta W$) and seigniorage. Two points are worth emphasizing. First, both the elite *and* the rest of the country ultimately carry the burden of financing the rescue of the elite firms. Second, monetary and exchange rate policy after t_c must be consistent with the constraint (7), so that the defense of the peg may no longer be feasible. We will return on the latter point shortly.

3.3 Optimality conditions

The aforementioned feature of government preferences (*á-la-Díaz-Alejandro*) sheds light on the essence of the moral hazard problem in lending. To the

¹⁶Note that if at time t_c the firms experience losses due to a negative output realization, these losses are included in the bailout.

extent that expectations of a bailout are rationally shared by both domestic and foreign agents and the bailout is not partial, foreign creditors will be willing to lend to both the private and public sectors at the international real interest rate r :

$$\rho_t = r = \delta.$$

From the vantage point of the elite agents, anticipation of a future corporate bailout — covering cumulative losses by the firms — implies that borrowing to increase the domestic capital stock by an additional unit entitles them to a stream of future contingent transfers. We can write such a stream as

$$-\partial \left[\sum_{s=0}^{\infty} T_{t+1+s}^{ELI} / (1+r)^s \right] / \partial K_{t+1} = \tilde{\theta}_{t+1}$$

where the non-negative transfer $\tilde{\theta}$ is contingent on the realization of \tilde{A} and determined as follows. If the productivity shock is negative ($\tilde{A} = A - \sigma$), at the margin agents expect additional transfers from the government, equal to the difference between the bad payoff and the cost of funds. If the realization of the shock is positive ($\tilde{A} = A + \sigma$), no additional transfer is expected to take place. The anticipation of such non-negative net transfers is the root of the moral hazard problem faced by the economy.

We have now all the elements to analyze the optimal behavior of the elite agents, who maximize (2) with respect to capital K and money holdings M , subject to (3). The optimal capital choice equates the expected marginal return on capital, adjusted to account for distortionary taxes and transfers, to the cost of funds:

$$E_t \frac{\partial Y_{t+1}}{\partial K_{t+1}} - E_t \frac{\partial \sum_{s=0}^{\infty} T_{t+1+s}^{ELI} / (1+r)^s}{\partial K_{t+1}} = r \quad (8)$$

In the above expression, the second term on the left hand side represents the effect of current investment decisions on the stream of net taxes T^{ELI} in future periods. If this term were identically equal to zero (as is the case with lump-sum taxes), the capital stock would be set at its efficient level K^* such that $rK^* = \alpha A (K^*)^\alpha$.¹⁷ However, insofar as agents rationally anticipate a bailout, when undertaking an investment project they expect, on average,

¹⁷This is the capital level that maximizes steady-state consumption in the country when the entire stock of capital is financed through net external borrowing.

to receive a positive net transfer from the government. In equilibrium, the perceived net transfer per unit of capital is equal to

$$\tilde{\theta}_{t+1} = \alpha \left(A + \sigma - \tilde{A}_{t+1} \right) K_{t+1}^{\alpha-1} = r - \frac{\alpha Y_{t+1}}{K_{t+1}}.$$

As long as elite agents act under the presumption that they will be ‘insured’ against adverse contingencies, they have no incentive to take a loss when facing a negative shock: they will instead re-finance shortfalls in earnings by borrowing from abroad. It is straightforward to show that under these circumstances the desired level of capital, denoted \hat{K} , is higher than the efficient level K^* defined above:

$$\hat{K} \equiv \left(\frac{\alpha(A + \sigma)}{r} \right)^{\frac{1}{1-\alpha}} > K^* \equiv \left(\frac{\alpha A}{r} \right)^{\frac{1}{1-\alpha}}$$

In Krugman (1998) terminology, such scenario corresponds to ‘overinvestment’ driven by ‘Pangloss values’.

The aggregate optimal demand for real balances by the elite is derived as:

$$\frac{M_t}{P_t} = \beta \chi \frac{1 + i_{t+1}}{i_{t+1}}. \quad (9)$$

In the previous expression, i_{t+1} denotes the domestic nominal interest rate, defined according to the uncovered interest parity relation:

$$1 + i_{t+1} = (1 + r) E_t \left(\frac{\mathcal{E}_{t+1}}{\mathcal{E}_t} \right) = (1 + r) E_t \left(\frac{P_{t+1}}{P_t} \right). \quad (10)$$

so that expected future exchange rate depreciation affects current real balances through a variation of the nominal interest rate and the elite agents are forward-looking.

Observe that under the assumptions that the initial capital stock is leveraged, the labor market is competitive, and the government is willing to bail out *corporate* (but not *personal*) debt, the present discounted value of consumption of risk-neutral elite agents is equal to the present discounted value of their after-tax labor incomes. Then, given that $\delta = r$ and agents are risk neutral (so that they are indifferent as regards the timing of consumption), without loss of generality we can posit

$$C_t^{ELI} = (1 - \eta_t) \beta W_t - \frac{M_t - M_{t-1}}{P_t} \quad (11)$$

To summarize, given $r = \rho_t = \delta$, $R_{t_0} > 0$, $L_{t_0} = 0$, $D_{t_0} = K_{t_0}$, M_{t_0-1} , the stochastic process \tilde{A}_t and the policies T_t^{ELI} , T_t^{ROC} and M_t , an equilibrium is a set of stochastic processes K_t , Y_t , W_t , C_t^{ELI} , C_t^{ROC} , D_t , $R_t - L_t$, $P_t = \mathcal{E}_t$ and i_{t+1} that for all $t \geq t_0$ solve equations (1), (3), (4), (5), (6), (8), (9), (10) and (11). We have already described the contingent policies that drive fiscal variables T^{ELI} and T^{ROC} over time. For a full characterization of the equilibrium in our economy, we now need to specify the behavior of the international financial markets and analyze in detail the interrelated conduct of fiscal and monetary policy. This is the goal of the section to follow.

4 Moral hazard and international lending

4.1 Anticipated bailouts, overinvestment and current account imbalances

A key implication of moral hazard is excessive private foreign borrowing, for two reasons. First, as shown above, moral hazard translates into overinvestment. Since the entire capital stock is leveraged, the elite must increase its external liabilities to finance a stock of capital \hat{K} which is larger than the optimal one. Second, as a negative shock to profitability (a bad realization of \tilde{A}) is not offset by a contemporaneous government transfer, in the aggregate elite agents cover their losses and cash shortfalls through the recourse to further foreign borrowing — a process that in jargon is referred to as *evergreening*.¹⁸

Formally, define the following variable F :

$$F_t = \sum_{s=t_0}^{t-1} \left[\alpha \left(A + \sigma - \tilde{A}_s \right) \hat{K}^\alpha \right] (1+r)^{t-s} \quad (12)$$

The interpretation of F is straightforward. Between the initial date t_0 and the time of a financial crisis, F is the cumulative level of corporate losses financed through evergreening (so that $D = F + K$). At the time of the crisis, F measures the stock of public liabilities emerging as a result of the bailouts, that is, $L_{t_c+1} = F_{t_c+1}$. This stresses the point made earlier, that firms' debt in excess of domestic capital is a contingent public liability.

¹⁸See *e.g.* Kumhof (1997).

The above equation shows that, other things being equal, F will be higher the worse is the history of ‘bad’ shocks, and the higher is the ‘excessive’ capital level \hat{K} . At any point in time, the expression in square bracket on the right hand side of (12) has a simple interpretation: it is the trade deficit associated with the refinancing of an adverse shock to production. Note that such a deficit is non-negative in all states of nature, so that the recourse to evergreening can cause persistent current account imbalances, and increase the stock of foreign liabilities even when the government budget is balanced.¹⁹

4.2 Willingness to lend, government solvency and expected monetization of future deficits

Equation (12) shows that F increases at a rate that is on average larger than the international interest rate r , reflecting the addition of new borrowing to the interest bill on existing liabilities. It should be clear, then, that evergreening cannot be practiced without limits. For instance, if the dynamics of F led to a persistent current account deficit, the stock of external liabilities of the country would grow faster than the cost of debt, ultimately violating the solvency constraint. If this were the case, rational international investors would not be willing to lend to the country at the market rate r , as the élite would be playing a Ponzi game at their expense!

More realistically, it is possible that foreign creditors’ willingness to lend vanishes even before the country becomes technically insolvent, reflecting an element of confidence that drives the behavior of international financial markets.²⁰ In our analysis, this element of confidence is parameterized in terms of the following maintained hypothesis: foreign creditors are willing

¹⁹The overall framework of analysis is by no means confined to the Asian case. For instance, it is instructive to quote once again Díaz-Alejandro (1985) on the Chilean case: “the massive use of central bank credit to ‘bail out’ private agents raises doubts about the validity of pre-1982 analyses of the fiscal position and debt of the Chilean public sector. The recorded public-sector budget deficit was nonexistent or minuscule for several years through 1981, and moderate during 1982. The declining importance of ostensible public debt in the national balance sheet was celebrated by some observers; [...] *ex-post* it turned out that the public sector, including the central bank, had been accumulating an explosive amount of contingent liabilities to both foreign and domestic agents who held deposits in, or made loans to, the rickety domestic financial sector. This hidden public debt could be turned into cash as the financial system threatened to collapse” (p.372).

²⁰See *e.g.* Milesi-Ferretti and Razin (1996). For a theoretical analysis of confidence, see Morris and Shin (1998).

to re-finance domestic firms against expected public guarantees only insofar as the country's liquid collateral, i.e. the stock of foreign official reserves, remains above some minimum threshold expressed as a fraction γ of the implicit government liabilities F .

When R reaches the threshold γF , foreign creditors not only refuse to finance new losses: they also refuse to roll-over the outstanding stock of debt, unless the country comes up with enough resources to service its cumulated external liabilities fully and permanently. We will refer to this condition, self-explanatorily, as the *show me the money* constraint.²¹ A binding 'show me the money' constraint clearly triggers a financial crisis: as the outstanding stock of liabilities D is larger than the capital stock K (due to evergreening), and no borrowing is further allowed, the timing of the financial crisis, t_c , coincides with the first period in which

$$R_{t_c+1} \leq \gamma F_{t_c+1} \quad 0 < \gamma < 1 \quad (13)$$

At t_c , consistent with the moral hazard argument, the élite agents 'present the bill' to the government, which steps in and bails them out. The distinction between private and public debt withers, private liabilities become *de jure* or *de facto* public or publicly guaranteed, corresponding to an appropriate flow of transfers from the public to the élite, and from the élite to international creditors.²²

To the extent that the crisis leads to the reduction of implicit public guarantees on investment, capital stock and output fall — so that a crisis corresponds to a contraction in the level of economic activity, a fall in investment, and a sharp adjustment of the current account. In the case in which,

²¹The 'show me the money' constraint could also be derived by setting an arbitrary upper limit to the level of *net* external debt (in the spirit of the 'unpleasant monetarist arithmetic'). This limit would take the form $D - K - R \leq \Omega$, where Ω is some positive parameter. Using the definition of F , we could then write:

$$F_{t_c+1} \frac{R_{t_c+1}}{R_{t_c+1} + \Omega} \equiv F_{t_c+1} \gamma_{t_c+1} \leq R_{t_c+1}$$

²²Typically, a government bail-out consists in guaranteeing all bank deposits, including interbank cross-border liabilities — as was the case in Korea, Thailand and Indonesia. This implies that the government is assuming responsibility for the gap created by the bad loans on the asset side of the banks' balance sheet. In the case of an explicit bank recapitalization, the government takes over the bad loans of the banking system in exchange for safe government bonds (loans for bond swap). The fiscal cost is the interest payment on these bonds.

once a crisis occurs, the élite no longer expects future government bailouts and no distortions affect the return on new financial investment in the country — as assumed in our setup — the post-crisis permanent level of capital stock, denoted \bar{K} , will be set equal to the level K^* as defined above.²³

It should be stressed that, at the time of a crisis, the country is not necessarily forced to repay F at once — rather, the government is expected to implement a credible plan generating enough resources to service the country's external debt.²⁴ To see what this entails, use (13) taken as equality to rewrite the post-crisis intertemporal budget constraint of the government (7) as

$$(1 - \gamma) F_{t_c+1} - \left[\frac{\bar{\eta}}{r} (1 - \alpha) A \bar{K}^\alpha \right] = E_{t_c+1} \sum_{s=t_c+1}^{\infty} \left(\frac{1}{1+r} \right)^{s-t_c} \left(\frac{M_s - M_{s-1}}{P_s} \right) \quad (14)$$

On the left hand side, $(1 - \gamma) F$ is the stock of net liabilities of the government at the time of the crisis, while the expression in square brackets is the present discounted value of tax revenues, where $\bar{\eta}$ is the average post-crisis tax rate (which is bounded from above).

If the government is able to implement a credible, permanent fiscal reform such that perspective tax revenues are sufficiently high to back the stock of net liabilities, then the left hand side of the previous expression is zero and there is no need for seigniorage financing. However, if the maximum feasible tax rate is low relatively to the financing need of the government, the left hand side of the previous expression is positive: thus, expectations of seigniorage financing are *residually* determined as a function of the gap between current liabilities and present discounted value of tax revenues.

Formally, define the post-crisis average growth rate of money as the constant $\mu > 0$, such that the money growth process

$$M_{t+1} = (1 + \mu) M_t \quad t \geq t_c$$

solves equation (14) contingent on the left hand side being positive. From

²³However, if the crisis itself magnifies the adverse effects of other types of distortions in the financial markets, \bar{K} will be lower than K^* . For instance, drawing on the Asian experience, the crisis may result in a credit crunch due to the rapid deterioration of the banks balance sheet, or in debt overhang. On the other hand, if expectations of future bailouts persist even after the crisis, \bar{K} can be larger than K^* .

²⁴For example, if bad loans amount to 20% of GDP, the nominal interest rate is 15% and the real interest rate is 5%, the fiscal cost of servicing the debt is 3% of GDP per year in nominal terms, and only 1% of GDP in real terms.

$t_c + 1$ on, it is straightforward to show that both the price level and the exchange rate also grow at the rate μ , so that the nominal interest rate is equal to $1 + i = (1 + r)(1 + \mu)$ and the aggregate money demand is constant at the level

$$\left(\frac{M}{P}\right)_t = \chi\beta \frac{1+r}{1+r-\frac{1}{1+\mu}} \quad t \geq t_c + 1$$

For given γ , \bar{K} and $\bar{\eta}$, the rate of growth μ is a function of F_{t_c+1} , in itself a function of t_c .

As considered in the next section, when agents anticipate a positive growth rate of money supply their expectation of inflationary financing brings about the collapse of the exchange rate peg. Thus, in the spirit of the ‘first generation’ model of currency crises the switch from a peg to a more flexible regime is not modelled as a deliberate policy action; rather, it results from the monetary authorities being forced to abandon the peg by a crisis that exposes the overall fiscal weakness of the public sector.²⁵

4.3 Financial liberalization makes a country more vulnerable to a crisis...

Before delving into the analysis of the eruption of a crisis and the endogenous determination of t_c , it is worth stressing an important corollary of our analysis. In the presence of distortions related to moral hazard, a process of financial liberalization is a key factor in magnifying the adverse implication of moral hazard on macroeconomic stability.

The simplest way to illustrate this point is to model capital controls as a tax on foreign borrowing, say ϕ , such that the cost of borrowing is equal to $r(1 + \phi)$. Then, with a perfectly elastic supply of international funds, the élite would equate the *cum-tax* cost of borrowing to the (perceived) return on capital:

$$r(1 + \phi) = \alpha(A + \sigma)K^{\alpha-1}$$

²⁵It is worth stressing an important distinctive feature of our model. In our construction, as seen below, both the timing of the crisis and the post-attack level of net public debt are endogenous. But so is the average seigniorage required to satisfy the intertemporal budget constraint of the public sector. Thus, while most contributions in the literature on speculative attacks fix the rate of money growth exogenously and derive the timing of the attack, in our case these are jointly determined in equilibrium.

corresponding to a lower investment rate relative to \hat{K} . In this sense, capital liberalization (the removal of ϕ) aggravates the moral hazard problem and enhances overinvestment and evergreening.²⁶

4.4 ... and early fiscal reforms can make a country less fragile

We have seen that, as a consequence of moral hazard, F grows at a rate higher than r . Another corollary of our model is that neither the solvency nor the ‘show me the money’ constraints would ever be violated if R also grew at least as fast as F . Since international reserves do not yield an interest rate higher than r , the only way in which R could grow as fast as F is an early fiscal reform ($\eta_t > 0$ for $t < t_c$) raising tax rates on either sectors of the economy, and/or raising seigniorage revenues in equation (6).²⁷ In this scenario, moral hazard alters the distribution of gains and losses among domestic agents in the society but does not translate into an increase in *net* external liabilities $D - R$. Thus, there are no structural current account deficits, and no external crisis needs to materialize: while private investors take on too much risk, at the aggregate level excessive risktaking is compensated by policies that raise taxes against firms’ losses.²⁸ The picture changes radically when the stock of reserves does not grow as fast as F , as assumed hereinafter in our analysis.

5 The dynamics of the crisis

5.1 Financial crises *vs.* currency crises

This section is devoted to the analysis of the timing and the dynamics of a crisis. We will show that there exists an important link between a *financial crisis* as defined above and a speculative run on the official reserves of the

²⁶Similar considerations hold as regards the implications of political distortions on excessive fiscal deficits and external debt accumulation (see Corsetti and Roubini (1997)).

²⁷Note that, under a fixed exchange rate regime (with $P_t = \bar{\mathcal{E}}$ and $i_{t+1} = r$) seigniorage revenues are zero. This implies that under a peg the early recourse to seigniorage revenues as a way to finance the accumulation of foreign reserves is no longer a feasible option for a government. From this vantage point, *ceteris paribus* a fixed exchange rate regime can contribute to enhance the vulnerability of the country to a financial crisis.

²⁸In other words, government asset are always at least as high as the difference between debt and capital of the corporate sector.

country, that is, a *currency crisis*. We will then determine t_c endogenously in equilibrium.

Given the forward-looking nature of money demand by the elite agents, the logic of speculative attacks in our model is the same as in the Krugman (1979) model of balance of payments crisis. First, recalling that the government is willing to defend the peg only insofar as this policy is not inconsistent with the solvency constraint, the amount of reserves that the government can commit to the defense of the peg is bounded from below. In fact, as soon as reserves hit the threshold that triggers a financial crisis, the government needs to mobilize resources to finance its bailout plans.

Denote by ΔR^c the maximum size of exchange rate intervention, that is, the maximum amount of reserves that the government is able to ‘sacrifice’ to defend the peg in any period.²⁹ Using the ‘show-me-the-money’ constraint together with the solvency constraint of the government sector, we obtain the difference between the level of reserves at the beginning of the period (before the attack) and at the end of the period (after the attack).³⁰

$$\Delta R_{t+1}^c = R_t - \gamma F_{t+1} \quad (15)$$

This establishes a link between fiscal and monetary policy that will be at the core of the analysis of joint financial and currency crises.

Second, since the government exchanges reserves against money holdings of the elite, a crisis will emerge as soon as the elite agents optimally undertake a stock-shift reshuffle of their portfolios demanding the entire amount of reserves that the government can commit to the defense of the peg. In other words, a speculative attack leading to a currency crisis will occur the first period t_a such that

$$\Delta R_{t_a+1}^c = \frac{\Delta M_{t_a}}{\bar{\mathcal{E}}} = \beta\chi\Delta \left(\frac{1 + i_{t_a+1}}{i_{t_a+1}} \right).$$

A speculative attack occurs when, in equilibrium, money demand by the elite falls by the amount of reserves ΔR^c . But this can only happen if at time t_a

²⁹Once again, Δ denotes a discrete change.

³⁰Note that, at time t , the level of reserves R_t is predetermined and the stock of contingent liabilities F_{t+1} is obtained as a function of F_t (a predetermined variable) as well as the exogenous realization of the shock \tilde{A}_t . In principle, it is possible for a government to raise tax revenues in order to commit more resources to defending the peg. In our setup, the maximum amount of committed reserves in equation (15) would increase by the amount $\max\{0, [F_{t+1} - (\bar{\eta}/r)(1 - \alpha)A\bar{K}^\alpha]\}$. However, one could rule out this possibility by assuming that a low tax regime is *ceteris paribus* preferred to a high tax regime.

there is a sudden change — by the appropriate size — in the *expected rate of exchange rate depreciation* and therefore in the nominal interest rate.

5.2 Is a financial crisis necessarily accompanied by a currency crisis?

To the extent the average rate of growth of F is higher than the rate of growth of R , an economy that starts off at time t_0 with a large level of foreign reserves relative to the stock of foreign debt will sooner or later (at some finite time t_c) run into the ‘show me the money’ constraint. In analogy with the literature on currency crises, define the ‘natural collapse’ of the financial system a situation in which no speculative attack on the country’s currency occurs before a financial crisis. Denoting t_n the time of such ‘natural collapse’, we have $t_n = t_c < t_a$.

At the time of natural collapse, there are two possible scenarios. Either the present discounted value of expected labor income taxation in equation (7) is large enough to back the net liabilities $L - R$ without resorting to seigniorage, or it is not. In the first case, the financial crisis does *not* induce expectations of monetization of the deficit, and a financial crisis occurs without coinciding with increasing inflation and an exchange rate devaluation.³¹ Thus, in principle, if the stock of net public debt is ‘small’ enough relative to the government’s ability to extract fiscal revenues from the country, the ‘natural collapse’ of the financial system occurs without prejudice for the sustainability of the current peg. The competitive equilibrium will record a switch from private to public debt not accompanied by any speculative movements in the foreign exchange market.

5.3 The role and timing of speculative attacks on the currency

Focus now on the more interesting — and realistic — case in which, at the point of natural collapse, the size of the bailout in equation (14) is large enough to induce expectations of an increase in seigniorage and future money growth. We first establish that *a natural collapse cannot occur in a rational expectations equilibrium*. The reason is straightforward. Since future money

³¹Talvi (1997) considers a model of endogenous fiscal response to the announcement of an inconsistent exchange rate-based stabilization program.

growth translates into expectations of exchange rate depreciation, at t_n the domestic nominal interest rate must jump upward, driving down money demand. But at t_n the path of domestic credit is determined by seigniorage needs and the stock of reserves is already at its floor γF : the central bank cannot accommodate the discrete change in money demand by selling reserves.

To restore equilibrium in the market for money, the exchange rate must therefore jump above the current parity. But, clearly, no *anticipated* jump in the exchange rate is consistent with a rational expectations equilibrium. As forward-looking agents foresee the jump in the exchange rate occurring at the time of natural collapse, at some time $t_a < t_n$ there will be an increase in the expected rate of exchange rate depreciation and in the interest rate, triggering a currency crisis. Thus, the peg will collapse before the economy reaches t_n .

The key to understanding the dynamics of a crisis is that the speculative attack occurring at time t_a leads to a sudden reserve depletion and makes the ‘show me the money constraint’ immediately binding. It follows that the only rational expectation equilibrium is such that $t_a = t_c < t_n$: the currency and financial crises occur simultaneously, and there is no ‘natural collapse’.

The core implication of the above analysis is that a currency crisis ‘causes’ a financial crisis by bringing R/F down to its lower limit γ . At the same time, a currency crisis ‘is caused’ by the anticipation of seigniorage financing of the government bailouts. The attack will take place as soon as the fundamentals are weak enough (that is, when the stock of external debt no longer refinanced by foreign creditors and now backed by the government is sufficiently high) to induce expectations of a sustained permanent monetary expansion.³² A crisis thus takes the form of a ‘twin run’ on the monetary balances (as in the traditional stock-shift reshuffle of money and foreign reserves) and on the foreign liabilities of the financial and corporate sector (the international creditors withdraw the loans triggering a financial crisis).

Our analysis has a final important implication for the post-crisis dynamics of money demand, investment and output. At the time of a ‘twin crisis’, the money demand from the elite falls due to the increase in the interest rate, reflecting expectations of exchange rate depreciation. However, economic

³²Rational agents will never find it optimal to attack the currency ‘too soon’, when the stock of outstanding liabilities is still too small relative to the country’s future tax revenue: in this case, the need for seigniorage revenue is contained, and the anticipated rate of post-attack money growth is correspondingly negligible.

activity is still high, as it depends on the existing moral hazard-induced high level of capital and output \hat{K} . It is only in the following period ($t_c + 1$) that external debt, capital, and output all drop. Such scenario in which economic performance and fiscal imbalances worsen over time following the initial currency plunge captures in a highly stylized yet coherent way the events that have characterized the onset and aftermath of the 1997-98 crisis in several Asian economies.

6 Moral hazard and the Asian crisis: discussion, implications and extensions

Our theoretical construction suggests an interpretation of the Asian events according to which moral hazard magnified the vulnerability of the region during the process of financial market liberalization, and exposed its fragility *vis-à-vis* the macroeconomic and financial shocks that occurred in the period 1995-1997.

In interpreting the Asian meltdown, one should consider three different, yet strictly interrelated dimensions of the moral hazard problem at the corporate, financial, and international level. At the *corporate* level, political pressures to maintain high rates of economic growth had led to a long tradition of public guarantees to private projects, some of which were effectively undertaken under government control, directly subsidized, or supported by policies of directed credit to favored firms and/or industries.³³ In light of the record of past government intervention, the production plans and strategies of the corporate sector largely overlooked costs and riskiness of the underlying investment projects.³⁴ With financial and industrial policy enmeshed within a widespread business sector network of personal and political favoritism, and with governments that appeared willing to intervene in favor of troubled firms, markets operated under the impression that the return on investment was somewhat ‘insured’ against adverse shocks.

Such pressures and beliefs accompanied a sustained process of capital accumulation, resulting into persistent and sizable current account deficits. While common wisdom holds that borrowing from abroad to finance domestic

³³See IMF (1997).

³⁴See Pomerleano (1998) for a thorough assessment of the corporate roots of the financial crisis in Asia.

investment should not raise concerns about external solvency — it could actually be the optimal course of action for undercapitalized economies with good investment opportunities — the evidence for the Asian countries in the mid-1990s highlights that the profitability of new investment projects was low.³⁵

Investment rates and capital inflows in Asia remained high even after the negative signals sent by the indicators of profitability.³⁶ Consistent with the *financial* side of the moral hazard problem in Asia, the crucial factor underlying the sustained investment rates was excessive borrowing by national banks abroad, corresponding to high and excessive investment at home. Financial intermediation played a key role in channeling funds toward projects that were marginal if not outright unprofitable.³⁷

The adverse consequences of these distortions were crucially magnified by the rapid process of capital account liberalization and financial market deregulation in the region during the 1990s, which increased the supply-elasticity of funds from abroad.³⁸ The extensive liberalization of capital markets was consistent with the policy goal of providing a large supply of low-cost funds to national financial institutions and the domestic corporate sector. The same goal motivated exchange rate policies aimed at reducing the volatility of the domestic currency in terms of the US dollar, thus lowering the risk premium on dollar-denominated debt.

The *international* dimension of the moral hazard problem hinged upon the behavior of international banks, which over the period leading to the

³⁵For instance, in Korea, 20 of the largest 30 conglomerates displayed in 1996 a rate of return on invested capital below the cost of capital. In 1997, before the crisis, as many as 7 of the 30 largest conglomerates could be considered effectively bankrupt. OECD (1988) stresses that Korean Chaebols were performing poorly since the second half of the 1980s.

³⁶In part, this may have occurred because the interest rate fall in industrial countries (especially in Japan) lowered the cost of capital for firms and motivated large financial flows into the Asian countries.

³⁷The literature has focused on a long list of structural distortions in the pre-crisis Asian financial and banking sectors: lax supervision and weak regulation; low capital adequacy ratios; lack of incentive-compatible deposit insurance schemes; insufficient expertise in the regulatory institutions; distorted incentives for project selection and monitoring; outright corrupt lending practices; non-market criteria of credit allocation, according to a model of *relationship banking* that emphasizes semi-monopolistic relations between banks and firms, somehow downplaying price signals. All these factors contributed to the build-up of severe weaknesses in the undercapitalized financial system, whose most visible manifestation was eventually a growing share of non-performing loans.

³⁸See *e.g.* McKinnon and Pill (1996).

crisis had lent large amounts of funds to the region's domestic intermediaries, with apparent neglect of the standards for sound risk assessment.³⁹ Underlying such overlending syndrome may have been the presumption that short-term interbank cross-border liabilities would be effectively guaranteed by either a direct government intervention in favor of the financial debtors, or by an indirect bailout through IMF support programs. A very large fraction of foreign debt accumulation was in the form of bank-related short-term, unhedged, foreign-currency denominated liabilities: by the end of 1996, a share of short-term liabilities in total liabilities above 50% was the norm in the region. Moreover, the ratio of short-term external liabilities to foreign reserves — a widely used indicator of financial fragility — was above 100% in Korea, Indonesia and Thailand.

The core implication of moral hazard is that an adverse shock to profitability does not induce financial intermediaries to be more cautious in lending, and to follow financial strategies reducing the overall riskiness of their portfolios. Quite the opposite, in the face of negative circumstances the anticipation of a future bailout provides a strong incentive to take on even more risk — that is, as Krugman (1998) writes, “to play a game of heads I win, tails the taxpayer loses.” In this respect, a number of country-specific and global shocks contributed to severely deteriorate the overall economic outlook in the Asian region, exacerbating the distortions already in place.

In particular, the long period of stagnation of the Japanese economy in the 1990s led to a significant export slowdown from the Asian countries; in the months preceding the eruption of the crisis, the hopes for a Japanese recovery were shattered by a sudden decline in economic activity in this country. Sector-specific shocks such as the fall in the demand for semi-conductors in 1996, and adverse terms of trade fluctuations also contributed to the worsening of the trade balances in the region between 1996 and 1997.

The sharp appreciation of the US dollar relative to the Japanese yen and the European currencies since the second half of 1995 led to deteriorating cost-competitiveness in most Asian countries whose currencies were effectively pegged to the dollar. Based on standard real exchange rate measures, many Asian currencies appreciated in the 1990s, although the degree of real appreciation was not as large as in previous episodes of currency collapses (such as Mexico in 1994). In general, competitive pressures were enhanced by the increasing weight of China in total export from the region.

³⁹See *e.g.* Stiglitz (1998).

As a result of the cumulative effects of the financial and real imbalances considered above, by 1997 the Asian countries appeared quite vulnerable to financial crises, either related to sudden switches in market confidence and sentiment, or driven by deteriorating expectations about the poor state of fundamentals. In 1997, the drop of the real estate and stock markets — where sustained speculative trends were in part fueled by foreign capital inflows — led to the emergence of wide losses and outright defaults in the corporate and financial sectors. Policy uncertainty stemming from the lack of commitment to structural reforms by the domestic authorities worsened the overall climate. From the summer of 1997 onward, rapid reversals of financial capital inflows led to the collapse of regional currencies amidst domestic and international investors' panic.

Krugman (1998) has pointed out that, provided the crisis coincides with the end of moral hazard and the early dismantling of the public guarantees on investment reduces the extent of overinvestment, financial speculation ends up forcing an economic system out of an inefficient equilibrium. Our interpretive scheme stresses that, even if this was the case, the real income of the rest of the country would fall at the new efficient level of investment, both because of a lower real wage and a higher tax rate. The crisis implies a sizeable redistribution of resources from the rest of the country to the élite.

In the general case, however, the crisis will coincide with the magnification of other severe distortions in the financial and real sectors of the economy. Liquidity problems and credit crunch, debt overhang and a persistent loss of confidence by international financial markets reduce output, employment and investment in the crisis countries. As a promising and important extension of our analysis, some of these mechanisms can be modeled within the theoretical framework outlined in the previous sections.

The key role played by the fiscal dimension of the crisis in our model is consistent with the view that structural, or long-run, primary balances should be improved *vis-à-vis* the fiscal burden of the bailouts. In many of the Asian countries, the magnitude of required public bailouts of financial institutions is estimated to be as high as 20%-30% of GDP. On a yearly basis, the fiscal costs of the bailouts only consist in financing the interest payment on the additional public liabilities. Under reasonable assumptions about interest rates, the yearly costs will amount to 2-4 percentage points of GDP. Solvency thus requires an equivalent permanent adjustment in the primary surplus of the public sector. This in part reflects the recommendations by the International Monetary Fund in the summer and the fall of 1997. However,

it should be stressed that the model makes a theoretical case for the need to adjust the *structural* (or long-run) primary balance, as a strategy to finance the reform of the financial system and to strengthen the external value of the currency. A mechanical extension of these prescriptions to the short-run, overlooking cyclical arguments in economies hit by sharp recessions, is unwarranted.

7 Conclusions

Many decades of economic growth and development in the region make it clear that there were no *paper tigers* among the East Asian countries. Yet, our analysis of the dramatic break-down of currencies and economic activity in 1997-98 suggests that severe structural weaknesses in the financial and corporate sectors had been masked by strategies of overinvestment. Eventually, the Asian tigers collapsed under the excessive weight of the paper liabilities which had financed projects of doubtful profitability, covered losses, and led to unsustainable external imbalances.

Further research is needed to shed light on the many issues left open for a thorough understanding of the causes of the crisis, its international propagation, and its welfare implications. A partial list of questions includes: the analysis of real depreciations and their effects on the real burden of foreign debt, through the disruptive increase of short-term foreign liabilities by domestic firms and banks; the assessment of self-fulfilling liquidity crises, under scenarios in which sudden shifts in market confidence lead to large-scale reversals of short-term capital flows; and the contagious elements of the crisis, including — but not limited to — the ‘beggar-thy-neighbor’ spiral of competitive devaluations and speculative attacks in the region.

Nonetheless, the analysis in this paper stresses that at the root of the Asian currency and economic crisis was a complex web of structural distortions and fundamental weaknesses. Because of moral hazard banks borrowed heavily in foreign currency, and their debt positions were often short-term and unhedged, as borrowers acted on the presumption that the exchange rates would remain stable, and they would be bailed-out if things went wrong. When indeed things went wrong and a series of domestic and external shocks revealed the low profitability of past investments, the shaky foundations of investment strategies in the region emerged, and currency and financial crises appeared inextricably intertwined.

Almost fifteen years ago, Diaz Alejandro interpreted the Chilean crisis in terms of the inconsistency between a policy of rapid liberalization of domestic and international capital flows, and the lax supervision of financial institutions. Our analysis suggests that, to a large extent as well as to a much larger scale, the Asian region witnessed in the 1990s a materialization of the same scenario: “good-bye financial repression, hello financial crash”.

References

- [1] Alba, Pedro, Amar Bhattacharya, Stijn Claessens, Swati Ghosh, and Leonardo Hernandez (1998). "Volatility and contagion in a financially-integrated world: lessons from East Asia's recent experience," paper presented at the PAFTAD 24 conference "Asia Pacific financial liberalization and reform," Chiangmai, Thailand, 20-22 May.
- [2] Buiters, Willem, Giancarlo Corsetti and Paolo Pesenti (1998 a). *Financial markets and European monetary cooperation. The lessons of the 1992-93 Exchange Rate Mechanism crisis*. Cambridge, UK: Cambridge University Press.
- [3] Buiters, Willem, Giancarlo Corsetti and Paolo Pesenti (1998 b). "Interpreting the ERM crisis: country-specific and systemic issues," *Princeton Studies in International Finance* No.84, March.
- [4] Calvo, Guillermo (1998). "Varieties of capital market crises," in G. Calvo and M. King (eds.) *The debt burden and its consequences for monetary policy*, London: Macmillan, forthcoming.
- [5] Calvo, Guillermo and Carlos Vegh (1998). "Inflation stabilization and balance of payments crises in developing countries," forthcoming in John Taylor and Michael Woodford (eds.), *Handbook of Macroeconomics*, Amsterdam: North-Holland.
- [6] Cavallari, Lilia and Giancarlo Corsetti (1996). "Policy-making and speculative attacks in models of exchange rate crises: a synthesis." Economic Growth Center Working Paper, Yale University.
- [7] Chang, Roberto and Andres Velasco (1998a). "Financial fragility and the exchange rate regime." National Bureau of Economic Research Working Paper No.6469, March.
- [8] Chang, Roberto and Andres Velasco (1998b). "Financial crises in emerging markets: a canonical model." National Bureau of Economic Research Working Paper No.6606, June.
- [9] Cole, Harold and Timothy Kehoe (1996). "A self-fulfilling model of Mexico's 1994-1995 debt crisis." *Journal of International Economics*, 41, 309-330.

- [10] Corsetti, Giancarlo, Paolo Pesenti and Nouriel Roubini (1998). “What caused the Asian currency and financial crisis?” National Bureau of Economic Research Working Papers No.6833-6834, December.
- [11] Corsetti, Giancarlo, Paolo Pesenti, Nouriel Roubini and Cedric Tille (1998). “Competitive devaluations: a welfare-based approach,” paper presented at the conference “Globalization, capital market crises and economic reform,” Duke University, December.
- [12] Corsetti, Giancarlo and Nouriel Roubini (1997). “Politically motivated fiscal deficits: policy issues in closed and open economies.” *Economics & Politics*, March, pp.27-55.
- [13] Díaz-Alejandro, Carlos F. (1985) “Good-bye financial repression, hello financial crash,” *Journal of Development Economics* 19, reprinted in A. Velasco (ed.), *Trade, development and the world economy : selected essays of Carlos Díaz-Alejandro*, Oxford, UK: Blackwell, 1988.
- [14] Dornbusch, Rudiger (1998). “Asian crisis themes,” mimeo, MIT, February.
- [15] Eichengreen, Barry, Andrew K. Rose and Charles Wyplosz (1996). “Contagious currency crises.” National Bureau of Economic Research Working Paper No.5681, July.
- [16] Feldstein, Martin (1998). “Refocusing the IMF.” *Foreign Affairs* 77 (2), March-April.
- [17] Fischer, Stanley (1998). “The IMF and the Asian crisis.” Forum Funds Lecture at UCLA, Los Angeles, March 20.
- [18] Flood, Robert and Peter Garber (1984). “Collapsing exchange-rate regimes: some linear examples.” *Journal of International Economics* 17: 1-13.
- [19] Flood, Robert and Nancy Marion (1998). “Perspectives on the recent currency crisis literature.” National Bureau of Economic Research Working Paper No.6380, January.
- [20] Gertler, Mark, and Kenneth Rogoff (1990). “North-South lending and endogenous capital-market inefficiencies.” *Journal of Monetary Economics* 26, pp.245-266.

- [21] Goldfajn, Ilan and Rodrigo O. Valdes (1997). “Capital flows and the twin crises: the role of liquidity.” International Monetary Fund Working Paper 97/87, July.
- [22] Goldstein, Morris (1998). “The Asian financial crisis: causes, cures, and systemic implications.” *Policy Analyses in International Economics* No.55, Washington, DC: Institute for International Economics.
- [23] Greenspan, Alan (1998). “Remarks before the 34th Annual Conference on Bank Structure and Competition,” Federal Reserve Bank of Chicago, May 7.
- [24] International Monetary Fund (1997). *World economic outlook. Interim assessment*. Washington, DC: International Monetary Fund, December.
- [25] International Monetary Fund (1998). *World economic outlook*. Washington, DC: International Monetary Fund, May.
- [26] Kaminsky, Graciela and Carmen M. Reinhart (1997). “The twin crises: the causes of banking and balance-of-payments problems,” mimeo, Federal Reserve Board.
- [27] Krugman, Paul (1979). “A model of balance of payments crises.” *Journal of Money, Credit, and Banking* 11: 311-325.
- [28] Krugman, Paul (1998) “What happened to Asia?,” mimeo, MIT, January.
- [29] Kumhof, Michael (1997). “Balance of payment crises: the role of short-term debt,” mimeo, University of Maryland.
- [30] McKinnon, Ronald and Huw Pill (1996). “Credible liberalization and international capital flows: the ‘overborrowing syndrome’,” in T. Ito and A.O. Kruger (editors), *Financial deregulation and integration in East Asia*, The University of Chicago Press.
- [31] Milesi Ferretti, Gian Maria and Assaf Razin (1996). “Current account sustainability.” *Princeton Studies in International Finance* No.81, October.

- [32] Morris, Stephen, and Hyung Song Shin (1998). "Unique equilibrium in a model of self-fulfilling currency attacks." *American Economic Review* 88 (3), pp.587-597.
- [33] Obstfeld, Maurice (1986). "Rational and self-fulfilling balance of payments crises." *American Economic Review* 76: 676-681.
- [34] Obstfeld, Maurice (1994). "The logic of currency crises." *Cahiers Economiques et Monetaires* 43:189-213.
- [35] Obstfeld, Maurice and Kenneth Rogoff (1996). *Foundations of international macroeconomics*. Cambridge, MA: MIT Press.
- [36] OECD (1988). *Economic Survey of Korea 1997-98*. Paris, OECD.
- [37] Pomerleano, Michael (1998). "The East Asia crisis and corporate finances — The untold micro story." *Emerging Markets Quarterly*, forthcoming.
- [38] Radelet, Steven and Jeffrey Sachs (1998). "The onset of the East Asian financial crisis," National Bureau of Economic Research Working Paper No.6680, August.
- [39] Sachs, Jeffrey, Aaron Tornell and Andres Velasco (1996). "Financial crises in emerging markets: the lessons of 1995." *Brookings Papers on Economic Activity* No.1, 147-217.
- [40] Stiglitz, Joseph (1998). "The role of international financial institutions in the current global economy," address to the Chicago Council on Foreign Relations. Chicago, February 27.
- [41] Talvi, Ernesto (1997). "Exchange rate-based stabilization with endogenous fiscal response." *Journal of Development Economics* 54, pp.59-75.
- [42] Velasco, Andres (1987). "Financial and balance of payments crises." *Journal of Development Economics* 27, 263-283.