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A model of the Asian crisis*

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First draft: June 1998
Revised: October 1998

*We thank two anonymous referees, Rudi Dornbusch, Linda Goldberg, Paul Krugman, Richard Portes, Roberto Rigobon, Andrew Scott, Harald Uhlig, Skander Van Den Heuvel, Jaume Ventura, seminar participants at Boston University, Dartmouth, IMF, MIT, Yale, and conference participants at the NBER-Bank of Portugal ISOM, the CEPR/ESRC/GEI Workshop on "World Capital Markets and Financial Crises," the NBER Summer Institute and the 1998 LACEA Conference for helpful comments. Michele Cavallo and Andrew Tiffin have provided excellent research assistance. Giancarlo Corsetti acknowledges financial support from MURST, while Paolo Pesenti thanks the University of Rome III for warm hospitality and support. The views expressed here are those of the authors, and do not necessarily reflect those of the Federal Reserve Bank of New York or any other institution with which the authors are affiliated. Correspondence: corsetti@econ.yale.edu, paolo.pesenti@ny.frb.org, and nroubini@stern.nyu.edu.

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.

J.E.L. classification F31, F34, G15, G18.

Keywords: moral hazard; balance of payment crisis; banking crisis; speculative attacks; Asia.

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 a poorly supervised and regulated economy.

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 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

It has been recently argued that a full understanding of the recent currency and financial crises in Southeast Asia requires a new theoretical paradigm, since the traditional conceptual and interpretive schemes[1] do not appear, *prima facie*, to fit well the data 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

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

[2] A 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.

[3] See 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.

[4] Among 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).

[5] As 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-Alejandro[8] — "*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 formal elaboration of the above remarks.[9]

[6] In 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), Buiter, Corsetti and Pesenti (1998a,b) and Corsetti, Pesenti, Roubini and Tille (1998).

[7] Díaz-Alejandro (1985), p.374.

[8] Ib., p.379.

[9] The 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

This section introduces the basic layout of the model. First, we describe tastes and technology of private agents, define the relevant constraints, and characterize the asset market structure of the economy. Second, we motivate moral hazard in terms of rational expectations of bailouts in a time-consistent equilibrium, given the preferences of the government.

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

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

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

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

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 financial market participation by the remaining $1-\beta$ agents, the *rest of the country* (ROC), is confined to holding

(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.

[10] As 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.

domestic real money balances.[11] There is, however, no segmentation in the market for labor, assumed to be competitive for both ROC and ELI agents. All agents are risk neutral.

The élite representative agent holds real money balances that provide liquidity services. Formally, we parameterize the expected utility of the élite agents as:

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

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

As a maintained hypothesis the initial capital stock of the nation 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] It follows that the specific economic role of élite agents is that of borrowing funds from abroad, denoted D, and lending capital K to the country's firms, that are owned by the élite itself.

Under our assumptions, the aggregate budget constraint of the élite is therefore:

$$\begin{aligned} & K_{t+1} - K_t - (D_{t+1} - D_t) \frac{\mathcal{E}_t}{P_t} \\ = \; & Y_t - W_t - \rho_t \frac{\mathcal{E}_t}{P_t} D_t - C_t^{ELI} - T_t^{ELI} - \frac{M_t^{ELI} - M_{t-1}^{ELI}}{P_t} \end{aligned} \tag{2}$$

where W are labor costs in real terms net of the remuneration of élite labor, T^{ELI} are net taxes paid by the élite to the government, ρ is the cost of bor-

[11] Note 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.

[12] Focusing 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).

rowing in real terms, and $\mathcal{E}$ is the nominal exchange rate (domestic currency per unit of foreign currency).[13]

For 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:

$$W_t = C_t^{ROC} + T_t^{ROC} + \frac{M_t^{ROC} - M_{t-1}^{ROC}}{P_t} \tag{3}$$

where C^{ROC} is consumption, T^{ROC} net taxes and $\left(M_t^{ROC} - M_{t-1}^{ROC}\right)/P_t$ the seigniorage tax.

3.2 The public sector: preferences and budget constraints

A key assumption underlying our analysis is that government preferences conform the 'Diaz-Alejandro' paradigm discussed at the beginning of this section. In detail: define a financial crisis as an event occurring at time t_c such that the outstanding stock of liabilities of the élite is larger than the capital stock ($\mathcal{E}_{t_c} D_{t_c}/P_{t_c} > K_{t_c}$) *and* financial markets allow no private borrowing in excess of the capital stock ($\mathcal{E}_{t_c+1} D_{t_c+1}/P_{t_c+1} = K_{t_c+1}$).[14] Inspection of the élite budget constraint shows that at time t_c, with foreign creditors unwilling to provide further credit, the élite would be forced to declare insolvency *unless* the government intervened by absorbing the difference between foreign private liabilities and domestic capital. We postulate that government preferences are such that, when a financial crisis occurs, the level of government welfare is at a minimum if the government maintains a *laissez-faire* stance and does not rescue troubled private firms. Therefore, contingent on a financial crisis the government is willing to bailout corporate debt corresponding to past and present real investment.

The above pattern of government preferences *á-la-Diaz-Alejandro* sheds light on the essence of the moral hazard problem in lending. Agents *rationally*

[13] The time-subscripts adopted here follow the notational conventions suggested by Obstfeld and Rogoff (1996): the élite 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}^{ELI}. This convention regarding the time-subscript of the money stock is maintained throughout the paper.

[14] In other words, a financial crisis occurs when the 'excessive' borrowing $\mathcal{E}_{t_c} D_{t_c}/P_{t_c} > K_{t_c}$ that has taken place in the past is no longer allowed by foreign creditors.

expect that, once a financial crisis materializes, the government steps in in favor of the élite's firms. It should be clear that this hypothesis by no means implies that the government provides public guarantees to risky projects 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 — it has no choice but to intervene and validate agents' expectations of a bailout.

There are two important features of the model implied by this assumption. First, expectations of a bailout are rationally shared by both domestic and foreign agents. Thus, to the extent that the bailout is not partial, foreign creditors will be willing to lend to both the domestic private and public sectors at the international real interest rate, assumed to be constant at some level r. This implies that:

$$\rho_t = r.$$

Second, a bailout implies a discontinuous change in the level of public debt contingent on the occurrence of a financial crisis. For simplicity, focus on a government that only implements tax and transfer policies and starts off without domestic or foreign debt. We denote as R the assets of the government *vis-à-vis* the rest of the world, and as L the liabilities of the government *vis-à-vis* the rest of the world. Both R and L are denominated in foreign currency. The consolidated (government and central bank) public sector budget identity is

$$\frac{\mathcal{E}_t}{P_t}\left[(R_{t+1} - L_{t+1}) - (R_t - L_t)\right] = T^{ELI} + T_t^{ROC} + \frac{M_t - M_{t-1}}{P_t} + r\frac{\mathcal{E}_t}{P_t}\left(R_t - L_t\right) \tag{4}$$

where M is money supply. Note that R yields the international interest rate r.

Before a crisis, L is zero. *At the time of the crisis*, the right hand side of the budget constraint 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 government bailout of insolvent private firms. Formally,[15]

$$\left(\mathcal{E}_{t_c+1}/P_{t_c+1}\right) L_{t_c+1} = -\Delta T_{t_c}^{ELI} = D_{t_c}\left(1+r\right) - \left(K_{t_c} + \alpha Y_{t_c}\right).$$

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

Accounting for international arbitrage in the goods market (so that purchasing power parity holds and $P_t = \mathcal{E}_t$, where the foreign price level is assumed to be constant and normalized to one), and integrating forward the identity (4) subject to the appropriate transversality condition, we obtain the intertemporal budget constraint conditional on the occurrence of a financial crisis:

$$L_{t_{c+1}} - R_{t_{c+1}} = E_{t_c+1} \sum_{s=t_c+1}^{\infty} \left(\frac{1}{1+r}\right)^{s-t_c} \left(T_s^{ROC} + T_s^{ELI} + \frac{M_s - M_{s-1}}{P_s}\right) \quad (5)$$

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 and seigniorage.[16]

3.3 Optimality conditions and equilibrium

The élite agents maximize (1) with respect to capital K and money holdings M^{ELI}, subject to (2). Observe that under the assumption that the initial capital stock is leveraged, the labor market is competitive, and the government is not willing to bail out personal (as opposed to corporate) debt, the present discounted value of consumption of risk-neutral élite agents is equal to the present discounted value of their after-tax labor incomes. Thus, modelling net taxes as a fraction η of labor incomes — where η is assumed to be bounded from above —without loss of generality we can write

$$C_t^{ELI} = \beta\,(1-\alpha)\,(1-\eta_t)\,Y_t - \frac{M_t^{ELI} - M_{t-1}^{ELI}}{P_t} \quad (6)$$

To simplify our analysis, we assume that the rate of time preference δ is equal to the (constant) international rate r. The optimal capital choice then equates the expected marginal return on capital, adjusted to account for distortionary taxes and transfers, to the cost of funds:

$$E_t \frac{\partial Y_{t+1}}{\partial K_{t+1}} - E_t \frac{\partial \sum_{s=0}^{\infty} T_{t+1+s}^{ELI} / (1+r)^s}{\partial K_{t+1}} = r \quad (7)$$

[16] The key implication of the above intertemporal budget constraint is that, if at time t_c the net debt $L-R$ is large relative to the present discounted value of government revenues from explicit taxation, agents anticipate a positive growth rate of money supply at some point in the future. We will return on this point shortly.

In the above expression, the second term on the left hand side allows for the possibility that current investment decisions affect the stream of net taxes T^{ELI} in future periods. If this term is identically equal to zero (as is the case with lump-sum taxes), the capital stock is set at its efficient level K^* such that $rK^* = \alpha A (K^*)^{\alpha}$.[17] If agents expect to receive, on average, a net transfer from the government when they expand investment, the desired capital stock will be larger than K^*.

Maximizing (1) with respect to money, the aggregate optimal demand for real balances by the élite is derived as:

$$\frac{M_t^{ELI}}{P_t} = \beta\chi \frac{1 + i_{t+1}}{i_{t+1}}. \tag{8}$$

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

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

As opposed to the élite, agents in the rest of the country cannot engage in intertemporal asset trade. Their money demand function is interest-inelastic and determined as a cash-in-advance constraint:

$$M_{t-1}^{ROC} = P_t C_t^{ROC} \tag{9}$$

To obtain an expression for aggregate money demand — the sum of M^{ELI} and M^{ROC} — observe that with competitive labor markets the wage incomes of ROC agents are equal to

$$W_t = (1 - \beta) \partial Y_t / \partial L. \tag{10}$$

Recalling that net taxes on labor incomes are a fraction η of real wages, or $T_t^{ROC} = \eta_t W_t$, aggregate money demand can be written as the sum of the forward-looking component (8) (such that expected future exchange rate depreciation affects current real balances through a variation of the nominal interest rate), and a 'myopic' component proportional to current output:

$$\frac{M_t}{P_t} = \beta\chi \frac{1 + i_{t+1}}{i_{t+1}} + (1 - \beta)(1 - \alpha)(1 - \eta_t) \tilde{A}_t K_t^{\alpha}. \tag{11}$$

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

Given $r = \rho_t$, R_{t_0}, D_{t_0}, K_{t_0}, the stochastic processes for $\tilde{A}_t$, η_t, T_t^{ELI}, M_t, and a switching time t_c such that (a) $D_{t_c} > K_{t_c}$, (b) $L_t = 0$ for $t_0 \leq t \leq t_c$, (c) $L_{t_c+1} = D_{t_c}(1+r) - (K_{t_c} + \alpha Y_{t_c})$, and (d) $D_t = K_t$ for all $t > t_c$, an equilibrium is a set of stochastic processes C_t^{ELI}, C_t^{ROC}, K_t, D_t, $P_t = \mathcal{E}_t$, W_t, M_t^{ELI}, M_t^{ROC} and $R_t - L_t$ that for all $t \geq t_0$ solve equations (2), (3), (4), (6), (7), (10), (8), (9) and (11).

4 Moral hazard and international lending

4.1 Anticipated bailouts, overinvestment and current account imbalances

As considered above, in our model the government is only willing to bailout corporate debt corresponding to past and present real investment. Thus, from the vantage point of the élite agents, anticipation of a future bailout implies that borrowing to increase the domestic capital stock by an additional unit entitles them to a stream of future contingent transfers. Rewrite such a stream as

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

We model moral hazard as a non-negative transfer $\tilde{\theta}$ 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. In equilibrium, then, the perceived bailout transfer per unit of capital is

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

As long as élite 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:

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

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

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 élite 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 élite 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:

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

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 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.

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 state 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, or in surplus.[19]

[18] See *e.g.* Kumhof (1997).

[19] The overall framework of analysis is by no means confined to the Asian case. For

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 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] so that the timing

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).

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

[21] The 'show me the money' constraint could also be derived by setting an arbitrary

of the financial crisis, t_c, coincides with the first period in which

$$R_{t_c+1} \leq \gamma F_{t_c+1} \qquad 0 < \gamma < 1 \tag{13}$$

A binding 'show me the money' constraint clearly triggers a financial crisis: conforming our definition, at t_c the outstanding stock of liabilities D is larger than the capital stock K (due to evergreening), and no borrowing is further allowed. Then, 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, after the crisis, the government can resort to some commitment technology that eliminates the moral hazard problem *and* no distortions affect the return on *new* financial investment in the country, the post-crisis permanent level of capital stock, denoted $\bar{K}$, will be set equal to the efficient level K^*.[23]

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:

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

[22] Typically, 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.

[23] However, 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^*.

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 (5) as

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

(details on the derivation of the above equation are provided in the Appendix). 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 $\bar{\eta}$ 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.

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

Before delving into the analysis of the eruption of a crisis, it is worth stressing that, 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

[24] For 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.

élite would equate the *cum-tax* cost of borrowing to the (perceived) return on capital:

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

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.[25]

4.4 ... and early fiscal reforms make a country less vulnerable to a crisis

We have seen that, as a consequence of moral hazard, F grows at a rate higher than r. A 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 raising tax rates on either sectors of the economy, and/or raising seigniorage revenues. 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.[26] 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

So far, we have focused exclusively on the *financial* side of a crisis, with no substantial role for exchange rates, prices or monetary aggregates. We can now delve into the analysis of a *currency* crisis, by introducing an explicit

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

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

characterization of the exchange rate regime and the monetary rules adopted by the government.

In addition to the hypotheses introduced in the previous sections, we assume that, from the initial date t_0 onward, the government stands ready to exchange official reserves R_{t+1} for domestic money liabilities M_t at some fixed nominal exchange rate $\overline{\mathcal{E}}$, *unless* such policy is inconsistent with the government solvency constraint.[27] In the spirit of 'first generation' model of currency crises, the choice to fix the exchange rate policy is not derived from an explicit social welfare function, but it is simply motivated as a descriptively realistic assumption. Consistently, the possible switch from a peg to a more flexible regime is not modelled as an optimal policy action, but results from the monetary authorities being forced to abandon the peg by a crisis that exposes the overall fiscal weakness of the public sector.[28]

Speculation in the foreign exchange market is driven by portfolio decisions of the élite agents: by reducing their holdings of domestic currency, these agents can lower the international reserves of the country to any level at any point in time.[29] A *currency crisis* is defined as a run on the reserves of the government R which forces the government to abandon the peg.

The logic of a speculative attack in our setup is therefore the same as in a textbook model of balance of payments crisis. First, the amount of reserves that the government can commit to the defense of the peg is bounded from below. Using the 'show-me-the-money' constraint together with the solvency constraint of the government sector, the maximum amount of committed

[27] Note that, under a fixed exchange rate regime, seigniorage revenues are on average zero (as shown in the Appendix). 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.

[28] It is worth stressing an important distinctive feature of our model. In our construction, given γ, 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 attack fix the rate of money growth exogenously and derive the timing of the attack, in our case these are jointly determined in equilibrium.

[29] This assumption rules out coordination failures among élite agents in determining the timing of the attack.

reserves ΔR^c at some time t will be equal to[30]

$$\Delta R^c_{t+1} = R_t - \gamma F_{t+1} \tag{15}$$

This expression highlights that, as soon as a speculative attack on the peg forces the reserves to hit the threshold for a financial crisis, the government will mobilize all the resources available to finance its bailout plans.[31] Such a condition 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 élite, a crisis will emerge as soon as the élite 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. A speculative attack leading to a crisis will occur the first period t_a such that

$$\Delta R^c_{t_a+1} = \frac{\Delta M^{ELI}_{t_a}}{\overline{\mathcal{E}}} = \chi \Delta \left(\frac{1 + i_{t_a+1}}{i_{t_a+1}} \right).$$

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

[30] Note 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 $\tilde{A}_t$.

[31] In principle, it is possible for a government to raise tax revenues in order to commit more resources to defending the peg. In our set up, the maximum amount of committed reserves in equation (15) would increase by the amount $\max\left\{0, \left[F_{t+1} - (\bar{\eta}/r)(1-\alpha) A \bar{K}^{\alpha}\right]\right\}$. However, one can rule out this possibility by assuming that a low tax regime is *ceteris paribus* preferred to a high tax regime.

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 scenario. Either the present discounted value of expected labor income taxation in equation (14) is large enough to back the net liabilities $F - R$ without resorting to seigniorage, or it is not. In the former 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.[32] 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

Suppose now that, more interestingly, the size of the bailout in equation (14) is large enough to induce expectations of an increase in seigniorage and future money growth. To the extent that these translate into expectations of exchange rate depreciation, driving a sizeable wedge between the domestic and the international nominal interest rates, the currency will sharply depreciate at the natural collapse point. However, since such a jump is anticipated by economic agents who know the dynamics of debt and reserves, *the natural collapse will not be a rational expectation equilibrium,* and the peg will collapse before the economy reaches t_n.

To see this, recall that if the left hand side of equation (14) is positive, the average growth rate of money is expected to be positive as well. For simplicity, assume that the money supply grows at some constant rate $\mu(F_{t_n+1}) = \mu_{t_n} > 0$, determined as a function of the size of the public debt at the time of the natural collapse.

From the period t_n+1 on, it is straightforward to show that, for a constant

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

tax rate on labor income $\bar{\eta}$ and for a constant capital stock at its post-crisis level $\bar{K}$, both the price level and the exchange rate also grow at the rate μ_{t_n}, so that the nominal interest rate is equal to $\bar{\imath} = (1+r)\left(1+\mu_{t_n}\right)$, and aggregate money demand fluctuates around the constant level

$$E\left(\frac{M}{\mathcal{E}}\right) = \chi \frac{(1+r)}{(1+r) - \frac{1}{1+\mu_{t_n}}} + A\,(1-\alpha)\,(1-\beta)\,(1-\bar{\eta})\,\bar{K}^{\alpha},$$

At the time of the natural collapse, the expected rate of exchange rate depreciation must be even higher than the steady-state rate μ_{t_n}.[33] It follows that at t_n the nominal interest rate must jump upward (and money demand downward), triggering a speculative attack. But this is impossible, since at t_n the stock of reserves is already at its floor γF, and 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 this implies that, as forward-looking agents anticipate the jump in the exchange rate occurring at the time of natural collapse, at some time $t_a < t_n$ the increase in the interest rate will trigger a currency crisis. The key to understanding the dynamic 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.[34] A crisis thus takes the form of a 'twin run' on the monetary balances (as in

[33] This is because the nominal stock of money is expected to grow at the rate μ_{t_n} but agents anticipate a fall in the transaction component of money demand between t_n and $t_n + 1$ due to the fall in the level of capital stock from $\widehat{K}$ to $\bar{K}$.

[34] Rational 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 negligeable.

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 élite falls due to the increase in the interest rate i_{t_c+1}, reflecting expectations of exchange rate depreciation. However, demand for money from the rest of the country 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, output and ROC money demand all drop, triggering a further depreciation of the exchange rate besides the one induced by high money growth. 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.[35] In the light of the record of past government intervention, the production plans and strategies of the corporate sector largely overlooked costs and riskiness of

[35] See IMF (1997).

the underlying investment projects.[36] 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 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.[37]

Investment rates and capital inflows in Asia remained high even after the negative signals sent by the indicators of profitability.[38] 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 channelling funds toward projects that were marginal if not outright unprofitable.[39]

The adverse consequences of these distortions were crucially magnified by the rapid process of capital account liberalization and financial market

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

[37] For 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.

[38] In 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.

[39] The 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.

deregulation in the region during the 1990s, which increased the supply-elasticity of funds from abroad.[40] 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 crisis had lent large amounts of funds to the region's domestic intermediaries, with apparent neglect of the standards for sound risk assessment.[41] 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 a) 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-

[40] See *e.g.* McKinnon and Pill (1996).
[41] See *e.g.* Stiglitz (1998).

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.

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 with 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".

Appendix

This appendix derives the post-crisis budget constraint of the government. At time t_c, the budget constraint of the government is

$$0 = (1+r)\left(R_{t_c+1} - L_{t_c+1}\right) + E_{t_c+1}\sum_{s=t_c+1}^{\infty}\left(\frac{1}{1+r}\right)^{s-t_c-1}\left(T_s^{ELI} + T_s^{ROC} + \frac{M_s - M_{s-1}}{P_s}\right)$$

The level of reserves R_{t_c+1} is equal to γF_{t_c+1} by definition of t_c. The present discounted value of T_s^{ROC} is equal to

$$E_{t_c+1}\sum_{s=t_c+1}^{\infty}\left(\frac{T_s^{ROC}}{1+r}\right)^{s-t_c-1} = E_{t_c+1}\sum_{s=t_c+1}^{\infty}\left(\frac{\bar{\eta}W_s}{1+r}\right)^{s-t_c-1} = \frac{1+r}{r}\bar{\eta}\left(1-\alpha\right)\left(1-\beta\right)A\bar{K}$$

The present discounted value of T_s^{ELI} is equal to the present discounted value of taxes on élite labor incomes minus the current stock of contingent public liabilities, that is:

$$E_{t_c+1}\sum_{s=t_c+1}^{\infty}\left(\frac{1}{1+r}\right)^{s-t_c-1}T_s^{ELI} = \frac{1+r}{r}\bar{\eta}\left(1-\alpha\right)\beta A\bar{K} - F_{t_c+1}\left(1+r\right)$$

Rearranging, we obtain expression (14) in the main text.

Note also that, under the pre-crisis fixed exchange rate regime, $P_t = \overline{\mathcal{E}}$, $i_{t+1} = r$, $K = \hat{K}$, so that for a constant tax rate η, seigniorage revenues are, on average, zero:

$$\frac{M_t - M_{t-1}}{\overline{\mathcal{E}}} = \left(1-\alpha\right)\left(1-\beta\right)\left(1-\eta\right)\left(\tilde{A}_t - \tilde{A}_{t-1}\right)\hat{K}^{\alpha}.$$

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