Paul Krugman

January 1999

BALANCE SHEETS, THE TRANSFER PROBLEM, AND FINANCIAL CRISES

(This is a preliminary draft, prepared for the festschrift volume in honor of Robert Flood)

For the founding fathers of currency-crisis theory - a fraternity among whom Bob Flood holds a place of high honor - the emerging market crises of 1997-? inspire both a sense of vindication and a sense of humility. On one side, the number and severity of these crises has demonstrated in a devastatingly thorough way the importance of the subject; in a world of high capital mobility, it is now clear, the threat of speculative attack becomes a central issue - indeed, for some countries *the* central issue - of macroeconomic policy. On the other side, even a casual look at recent events reveals the inadequacy of existing crisis models. True, the Asian crisis has settled some disputes - as I will argue below, it decisively resolves the argument between "fundamentalist" and "self-fulfilling" crisis stories. (I was wrong; Maury Obstfeld was right). But it has also raised new questions.

One way to describe the problem is to think in terms of Barry Eichengreen's celebrated distinction between "first-generation" and "second-generation" crisis models. First-generation models, exemplified by Krugman (1979) and the much cleaner paper by Flood and Garber (1984), in effect explain crises as the product of budget deficits: it is the ultimately uncontrollable need of the government for seignorage to cover its deficit that ensures the eventual collapse of a fixed exchange rate, and the efforts of investors to avoid suffering capital losses (or to achieve capital

1

gains) when that collapse occurs provoke a speculative attack when foreign exchange reserves fall below a critical level. Second-generation models, exemplified by Obstfeld (1994), instead explain crises as the result of a conflict between a fixed exchange rate and the desire to pursue a more expansionary monetary policy; when investors begin to suspect that the government will choose to let the parity go, the resulting pressure on interest rates can itself push the government over the edge. Both first- and second-generation models have considerable relevance to particular crises in the 1990s - for example, the Russian crisis of 1998 was evidently driven in the first instance by the (correct) perception that the weak government was about to be forced to finance itself via the printing press, while the sterling crisis of 1992 was equally evidently driven by the perception that the UK government would under pressure choose domestic employment over exchange stability.

In the major crisis countries of Asia, however, neither of these stories seems to have much relevance. By conventional fiscal measures the governments of the afflicted economies were in quite good shape at the beginning of 1997; while growth had slowed and some signs of excess capacity appeared in 1996, none of them faced the kind of clear tradeoff between employment and exchange stability that Britain had faced 5 years earlier (and if depreciation was intended to allow expansionary policies, it rather conspicuously failed!) Clearly something else was at work; we badly need a "third-generation" crisis model both to make sense of the recent crises and to help warn of crises to come.

But what should a third-generation model look like? Most of the recent attempts to produce such a model have argued that the core of the problem lies in the banking system. McKinnon (199?) and others, myself included (Krugman 1998), have suggested that moral-hazard-driven lending could have provided a sort of hidden subsidy to investment, which collapsed when visible

losses led governments to withdraw their implicit guarantees; this line of thought has been taken to considerable lengths in the influential papers of Corsetti, Pesenti, and Roubini (1998a, 1998b). Meanwhile, an alternative line of work, followed in particular by Chang and Velasco (1998a, b) attempts to explain currency crises as the byproduct of a bank run, modeled a la Diamond and Dybvig (1983) as a self-fulfilling loss of confidence that forces financial intermediaries to liquidate their investments prematurely.

But is a bank-centered view of the crisis really right? Certainly in most cases the financial crisis did involve troubles for banks as well as for currencies. But it also involved other difficulties, most notably an epidemic of financial distress that cannot be resolved simply by fixing the banks. As evidence about the Asian crisis has accumulated, I have found myself increasingly skeptical about whether either a moral-hazard or a Diamond-Dybvig story can really get at the essential nature of what went wrong.

In any case, this paper sketches out yet another candidate for third-generation crisis modeling, one that emphasizes two factors that have been omitted from formal models to date: the role of companies' balance sheets in determining their ability to invest, and that of capital flows in affecting the real exchange rate. The model is at this point quite raw, with several loose ends hanging. However, it seems to me to tell a story with a more realistic "feel" than earlier efforts, my own included. It also sheds some light on the policy dilemmas faced by the IMF and its clients in the last two years.

The remainder of this paper is in five parts. The first discusses in general terms some features of the financial crises of 1997-8, and the failure (in my view) of our models so far to reproduce some key stylized facts. The second part lays out a rough model intended to capture what I now

believe to be two essential pieces of the puzzle: the role of balance sheet difficulties in constraining investment by entrepreneurs, and the impact of the real exchange rate on those balance sheets. The third part shows how these effects produce a feedback loop that can cause a potentially healthy economy to experience a self-fulfilling financial crisis. The fourth part offers a crude interpretation of the "IMF strategy" of limiting currency depreciation in order to protect against this balance-sheet effect, and shows how this strategy may simply replace one destructive feedback loop with another. A final section offers some tentative policy conclusions.

1. *Recent crises: stylized facts and models*

The Asian crisis arrived with little warning. By normal criteria, government budgets were in good shape; current account deficits were large in Thailand and Malaysia, but relatively moderate in Korea and Indonesia; despite some slowdown in growth in 1996, there was not a strong case that any of the countries needed a devaluation for competitive or macroeconomic reasons. Indeed, right up to the summer of 1997 many observers echoed the conclusion of the now-notorious World Bank report, *The East Asian Miracle* (1993), that good macroeconomic and exchange-rate management was a key ingredient in the Asian recipe for success. And as Stiglitz (1998) has emphasized, even after the fact it is very difficult to come up with any set of conventional indicators that picks out the Asian countries as particularly at risk of financial crisis, or identifies 1997-8 as a time of unusual risk.

So what went wrong? As already suggested, there are two major views in the post-crisis theoretical literature.

The first is that underneath the apparent soundness of macroeconomic policy was a large, hidden subsidy to investment via implicit government guarantees to banks, cronies of politicians, etc.. The "over-borrowing syndrome" was modeled in advance of the crisis by McKinnon and Pill (1996), and for a time became the reigning orthodoxy after my own brief exposition (Krugman 1998); Corsetti, Pesenti, and Roubini (1998a, b) have emphasized that to the extent that implicit guarantees led banks to engage in moral-hazard lending, it represented a hidden government budget deficit, and the unfunded liabilities of these banks represented a hidden government debt. According to this view, then, the apparent soundness of budgetary and macroeconomic policy was an illusion: under the surface, the governments were actually engaged in reckless and unsustainable spending.

The alternative view, strongly expressed by Radelet and Sachs (1998), is that the countries were not doing anything wrong; their investments were basically sound. At most they can be said to have suffered from some kind of "financial fragility" that made them vulnerable to self-fulfilling pessimism on the part of international lenders. Chang and Velasco (1998a, b) have made the most thoroughly worked-out attempt to model this financial fragility, relying on a version of the Diamond-Dybvig (1983) model of bank runs. In this model, investors face a choice between short-term investments with a low rate of return and long-run investments with a higher rate of return; unfortunately, the long-run investments yield relatively little if they must be liquidated prematurely, and investors are assumed to be unsure ex ante about when they will want to consume. Financial intermediaries can resolve this dilemma by pooling the resources of many investors and relying on the law of large numbers to avoid holding more short-term assets than necessary. However, such intermediaries then become vulnerable to self-fulfilling panics, in which

5

fear of losses leads depositors to demand immediate payment, forcing destructive liquidation of long-run assets that validates these fears. In a closed economy the central bank can protect against such panics by acting as a lender of last resort; Chang and Velasco argue that in an open economy with a fixed exchange rate, the limited size of the central bank's reserves may prevent it from playing the same role.

There is no question that both of these views capture some aspects of what happened to Asia. On one side, "crony capitalism" was certainly a reality: the excesses of Thai financial companies, of members of the Suharto family, of megalomaniac *chaebol* are undeniable. On the other side, bank runs played an important role in the unfolding of the crisis, particularly in Indonesia, and a freezing up of the credit system played at least some role in deepening the recession after the crisis hit.

Yet as evidence about the crisis has accumulated, both explanations have come to seem inadequate to the task of explaining the severity of the event.

Consider first the moral hazard argument. If one really takes that argument seriously, it implies not only that there should be over-investment and excessive risk-taking by entrepreneurs with access to guaranteed finance, but also that the availability of implicit guarantees should tend to crowd out "legitimate" investment that bears the full burden of risk. Yet as Radelet and Sachs point out, in the runup to the crisis all forms of investment in the emerging Asian economies were booming, including direct foreign purchases of equity and real estate, investments that clearly were *not* protected by any form of implicit guarantee. One might point to the severity of the problem of non-performing loans after the crisis as evidence that bad banking was a key problem in the crisis economies. But as many observers have noted, and as is documented in the recent

6

World Bank report *The Road to Recovery* (1998), the bulk of the bad loan problem is a *consequence* of the crisis - of the severe recessions and currency depreciations that followed the collapse of capital inflows. Since nobody expected a crisis of anything like this severity, the prevalence of bad loans we observe ex post does not mean that anything like the same amount of bad lending was taking place ex ante.

What about the financial fragility story? Here my main concern is not so much with Chang and Velasco as with Diamond-Dybvig - specifically, with the way that financial fragility and its real effects are modeled. In the Diamond-Dybvig model the costs of premature liquidation are *physical* - a bank run literally leads to investments being cannibalized before completion, with the output cost to the economy the result of a literal destruction of physical capital. There are a few real examples of this process in Asia - half-completed structures left to disintegrate for lack of funding, or dismantled for scrap metal. There are also some more complex stories that can be viewed metaphorically as examples of physical liquidation - for example, potentially profitable export opportunities not taken because working capital has been sold to pay off bank loans. But surely the main channels through which financial panic has turned good assets into bad involve not so much physical liquidation of unfinished projects as macroeconomic crisis: companies that looked solvent before the crisis have gone under because collapsing investment has produced a severe recession, or because capital flight has led to currency depreciation that makes their dollar debts balloon. Or to put it another way, Diamond and Dybvig used a physical metaphor for the costs of premature liquidation as a way to focus on the problem of multiple equilibria on the part of depositors; fair enough. But to make sense of the Asian crisis it is probably important to have a better metaphor, one that comes closer to matching the stylized facts of actual experience.

What are these stylized facts? Let me suggest three facts that a model should probably address - and which some or all of the existing models do not, as far as I can tell, seem to capture.

(i) *Contagion*: The most stunning aspect of the global financial crisis has been the way that events in small economies like Thailand or Russia have led more or less directly to crises in economies thousands of miles distant, with few direct trade or financial links.

From my point of view the power of contagion in the last two years settles a long-running dispute about currency crises in general: the dispute between "fundamentalists" and "self-fulfillers". In the original first-generation models, the suddenness of currency crises did not mean that their timing was arbitrary; on the contrary, such crises emerged when some set of fundamental factors (typically the level of reserves) fell below a critical level. Obstfeld (1994) argued that in second-generation models, by contrast, the timing of crisis was indeed arbitrary; in fact, a currency crisis could occur to a country whose fixed exchange rate might otherwise have survived indefinitely. I argued in reply (Krugman 1996) that this was a misleading point: the reason that the timing of crisis seemed determinate in first-generation models was not because of the difference in the mechanism of crisis, but because in those models there was assumed to be a secular deterioration in the fundamentals - a deterioration that ensured, through backward induction, that a speculative attack would always occur as soon as it could succeed. This point was, I still think, correct. However, I then went on to argue that we should view a predictable secular deterioration in fundamentals as the normal case, whatever the specifics of the model, and that spontaneous self-fulfilling crises would therefore be rare events.

I hereby capitulate. I cannot see any way to make sense of the contagion of 1997-8 without

supposing the existence of multiple equilibria, with countries vulnerable to self-validating collapses in confidence, collapses that could be set off by events in faraway economies that somehow served as a trigger for self-fulfilling pessimism. It follows that any useful model of the crisis must involve some mechanism that produces these multiple equilibria - a criterion met by the financial fragility models, but not by the moral hazard approach.

(ii) *The transfer problem*: If there is a single statistic that captures the violence of the shock to Asia most dramatically, it is the reversal in the current account: in the case of Thailand, for example, the country was forced by the reversal of capital flows to go from a deficit of some 10 percent of GDP in 1996 to a surplus of 8 percent in 1998. The need to effect such a huge change in the current account represents what may be history's most spectacular example of the classic "transfer problem" debated by Keynes and Ohlin in the 1920s. In practice this swing has been achieved partly through massive real depreciation, partly though severe recession that produces a compression of imports.

Yet despite the evident centrality of the transfer problem to what actually happened to Asia, this issue has been remarkably absent from formal models. Perhaps because the modelers have been mainly concerned with the behavior of investors rather than with the real economy per se, all of the major models so far have been one-good models in which domestic goods can be freely converted into foreign and vice versa without any movement in the terms of trade or the real exchange rate.

Is this an acceptable strategic simplification? Perhaps not: in the model I develop below, the difficulty of effecting a transfer, the need to achieve the current account counterpart of a reversal

of capital flows either via real depreciation or via recession, turns out to be the heart of the story.

(iii) *Balance sheet problems*: Finally, descriptive accounts both of the problems of the crisis countries and of the policy discussions that led the crisis to be handled in the way it was place extensive emphasis on the problems of firms' balance sheets. On one side, the deterioration of these balance sheets played a key role in the crisis itself - notably, the explosion in the domestic currency value of dollar debt had a disastrous effect on Indonesian firms, and fear of corresponding balance sheet effects was a main reason why the IMF was concerned to avoid massive depreciation of its clients' currencies. On the other side, the prospects for recovery are now, by all accounts, especially difficult because of the weakened financial condition of firms, whose capital has in many cases been wiped out by the combination of declining sales, high interest rates, and a depreciated currency. Notice that while these balance sheet problems are in turn a cause of the problem of non-performing loans at the banks, they are not a banking problem per se; even a recapitalization of the banks would still leave the problem of financially weakened companies untouched.

The role of balance-sheet problems in constraining firms has been the subject of some recent work in the macroeconomics literature, notably tk and tk (199tk). So far, however, despite the attention given to balance sheets in practical discussions, the issue has been neglected in the currency crisis literature.

What I will do in the remainder of this paper, then, is to try to develop a model informed by these observations. As in the Diamond-Dybvig approach, this is a model potentially characterized

10

by multiple equilibria, in which a loss of confidence can produce a financial collapse that validates investor pessimism. However, the mechanism of that collapse is different: instead of creating losses via the premature liquidation of physical assets, a loss of confidence leads to a transfer problem. That is, in order to achieve the required reversal of its current account, the country must experience a large real depreciation; this depreciation, in turn, worsens the balance sheets of domestic firms, validating the loss of confidence. A policy that attempts to limit the real depreciation implies a decline in output instead - and this, too, can validate the collapse of confidence.

Moreover, once the crisis occurs it can have a sustained impact on the economy, because of that impact on balance sheets; as one Thai economist recently put it, the crisis leads to the "decapitation of the entrepreneurial class", and the economy cannot return to normal until it manages either to repair the balance sheets of its existing entrepreneurs or grows a new set.

It seems to me that this story - in which, incidentally, banks do not necessarily play a key role, although they could presumably also be introduced - comes closer than any of the previous models to having the right "feel" for making sense of recent events. But in any case, let us now proceed to the statement and analysis of the model.

2. *The model*

I consider an open economy that produces a single good each period using capital and labor; for simplicity the production function is assumed Cobb-Douglas:

$$y_t \; ' \; G(K_t, \, L_t) \; ' \; K_t^a L_t^{1\&a} \tag{1}$$

Capital is created through investment; I will assume, again for simplicity, that capital lasts only one period, so that this period's capital is equal to last period's investment. (This assumption also puts to one side Diamond-Dybvig-type concerns over maturity mismatch).

The residents of this economy are divided into two distinct classes. Workers play a passive role - they lack access to the capital market, and therefore must spend all their income within each period. Capital is both created and owned by a class of entrepreneurs, who are assumed to be single-mindedly engaged in accumulation at this point, saving and investing (either at home or abroad) all their income. Only these entrepreneurs have the ability to undertake domestic investment, which as we will soon see plays a crucial role in the story.

The good produced by this country is *not* a perfect substitute for traded goods produced elsewhere. Indeed, I will assume (yet another simplification) that there is a unitary elasticity of substitution, with a share μ of both consumption and investment spending on imports, 1-μ on domestic goods. The rest of the world is assumed to be much larger than the domestic economy, and to spend a negligible fraction of its income on domestic goods. (The disparity between the domestic and foreign marginal propensities to spend on domestic goods - 1-μ in the case of domestic spending, 0 for foreign spending - gives rise to the transfer problem that is crucial to this approach). If the foreign elasticity of substitution is also 1, the value of domestic exports in terms of foreign goods is fixed, say at *X*, and the value in terms of domestic goods is therefore *pX*, where *p* is the relative price of foreign goods (a.k.a real exchange rate).

Bearing in mind that a share 1-a of domestic income accrues to workers who must spend it,

and defining *I* and *C* as investment and consumption expenditures in terms of domestic goods, we can determine the real exchange rate as follows. Market clearing for domestic goods requires that

$$y \ ' \ (1\&\mu)I \ \% \ (1\&\mu)C \ \% \ pX \ ' \ (1\&\mu)I \ \% \ (1\&a)(1\&\mu)y \ \% \ pX \tag{2}$$

which implies

$$p_t \ ' \ \frac{y_t[1\&(1\&a)(1\&\mu)] \ \& \ (1\&\mu)I_t}{X} \tag{3}$$

We can immediately notice that the higher is investment, the lower the real exchange rate.

The next step is to describe the determination of investment. The central idea here is that the ability of entrepreneurs to invest may be limited by their wealth. Specifically, following tk and tk (199tk) I assume that lenders impose a limit on leverage: entrepreneurs can borrow at most ? times their initial wealth.

$$I_t \ \# \ (1\%?)W_t \tag{4}$$

Underlying this limitation on borrowing, presumably, are some kind of microeconomic motives, probably involving asymmetric information. For the purposes of this paper, however, I simply assume the existence of the constraint and take ? as a given.

This constraint need not be binding; although entrepreneurs are assumed to save all of their income, they may choose not to borrow up to the limit. In particular, they will not borrow beyond the point at which the real return on domestic investment equals that on foreign investment. One way to determine this limit is to compare the foreign real interest rate, r^*, with the return achieved by converting foreign goods into domestic, then converting the next-period return back into

foreign goods. Because a share μ of investment falls on foreign goods, the price index for investment relative to that of domestic output is $p^{-\mu}$; the return on investment in terms of domestic goods is therefore

$$1 + r_t \; ' \; G_k(I_{t-1}p^{-\mu}, \; L) \tag{5}$$

But a unit of foreign goods can be converted into p_t units of domestic goods this period, the return converted into $1/p_{t+1}$ units next period; so the statement that the return on domestic investment must be at least as large as that on foreign bonds may be written

$$(1 + r_t)(p_t/p_{t+1}) \; \$ \; 1 + r^* \tag{6}$$

Finally, investment cannot be negative:

$$I_t \; \$ \; 0 \tag{7}$$

As we will see, depending on circumstances (4), (6), or (7) may be the binding constraint.

The last element in the statement of the model is the definition of entrepreneurs' wealth. Domestic entrepreneurs own all domestic capital; they may also own other claims on foreigners, and/or have debts to foreigners. I assume that some claims are denominated in terms of the domestic good, others in terms of the foreign good; meanwhile, since capital lasts only one period, the value of domestic capital is simply the income accruing to capital within the current period. Let D, F be the net debts of domestic entrepreneurs indexed to domestic and foreign goods respectively; I will sloppily refer to these as "domestic currency" and "foreign currency"

debt respectively, although they are really denominated in goods rather than moneys. Then the wealth of entrepreneurs in period t is

$$W_t \text{ ' } ay \text{ \& } D \text{ \& } pF \tag{8}$$

Obviously a full model should try to endogenize the "currency composition" (again, actually goods composition, since the model is not explicitly monetary) of debt; again, however, I simply take it as a given.

We now have a rough but workable model that can be used to examine one way in which a financial crisis can occur in an open economy.

3. *The transfer problem and financial crisis*

According to our model, the amount that domestic entrepreneurs can borrow from foreigners to finance investment depends on their wealth. At the same time, however, the wealth of each individual entrepreneur itself depends on the level of such borrowing in the economy as a whole, because the volume of capital inflow affects the terms of trade and hence the valuation of foreign-currency-denominated debt. We can therefore immediately see the outlines of a story about financial crisis: a decline in capital inflows can adversely affect the balance sheets of domestic entrepreneurs, reducing their ability to borrow and hence further reducing capital inflows. But we need to be a bit more precise.

Imagine a game in which lenders decide, in random order, how much credit to offer to successive domestic entrepreneurs. The offer of credit depends on what the lenders *think* will be

15

the value of the borrower's collateral. But because some debt is denominated in foreign goods, this value depends on the real exchange rate, and hence on the actual level of borrowing that takes place. A rational-expectations equilibrium of this game will be a set of self-confirming guesses - that is, the expected level of investment implicit in the credit offers must match the actual level of investment that takes place given those offers.

As a first step, let us derive the relationship between investment and the wealth of entrepreneurs. From (8), we know that wealth depends, other things being the same, on the real exchange rate p; from (3) we know that p depends on I. We therefore have that

$$\frac{dW}{dI} \cdot \frac{(1\&\mu)F}{X} \tag{9}$$

Let us define I_f as the "financeable" level of investment - that is, the level of investment that would occur if the leverage constraint (4) were binding. Since the ability of entrepreneurs to borrow depends on their wealth, we have

$$\frac{dI_f}{dI} \cdot \frac{(1\%?)(1\&\mu)F}{X} \tag{10}$$

If dI_f/dI is less than 1, the behavior of this model is relatively uninteresting: an economy with a high rate of return on investment may find that adjustment in its capital stock is delayed by financing constraints, but there will be nothing resembling an Asian-style financial crisis. But suppose that $dI_f/dI > 1$. Then there can indeed be multiple equilibria, with the possibility that a loss of lender confidence will be validated by financial collapse.

The picture would look like Figure 1[1]. On the horizontal axis is the expected level of investment, which determines via its effect on the real exchange rate, and hence on balance sheets, how much credit is extended to domestic firms. On the vertical axis is the actual level of investment that results. (The picture could alternatively be drawn in terms of the expected and actual levels of p). At high levels of expected I the financing constraint (4) is not binding; instead, investment is determined by the rate-of-return constraint (6). At low levels of expected I firms are bankrupt, and cannot invest at all - that is, they are hard against the non-negativity constraint (7). In an intermediate range I is constrained by financing, and the schedule is therefore steeper than the 45-degree line.

There are clearly three equilibria in this picture. The intermediate, internal equilibrium may be dismissed as likely to be unstable under any plausible mechanism of expectation formation. This leaves us with two possible outcomes: a high-level outcome H in which investment takes place up to the point where domestic and foreign rates of return are equal; and a low-level outcome L in which lenders do not believe that domestic entrepreneurs have any collateral, their failure to provide funds means a depreciated real exchange rate, and that unfavorable real exchange rate means that entrepreneurs are in fact bankrupt, validating lenders' poor opinion.

And we therefore now have our extremely stylized version of the Asian financial crisis: something - it does not matter what - caused lenders to become suddenly pessimistic, and the result was a collapse from H to L. The collapse does not indicate that the previous investments

---

[1]Strictly speaking, there are two other possibilities even if $dI_f/dI > 1$. If domestic-currency debt is very high, entrepreneurs may be unable to borrow even with a favorable exchange rate; if D is low, even a very unfavorable rate will not cause financial collapse. I neglect these cases for the sake of the main story.

were unsound; the problem is instead one of financial fragility.

The difference between this story of financial fragility and that told by Chang and Velasco can be highlighted by considering the conditions under which this fragility can occur - namely, when $dI_f/dI > 1$. By construction here, this criterion has nothing to do with the mismatch between short-term debt and long-term investments; nor does it appear to depend on foreign exchange reserves. Instead, as we see from (10), the factors that can make financial collapse possible are:

(i) High leverage

(ii) Low marginal propensity to import

(iii) Large foreign-currency debt relative to exports

These factors matter, of course, because they make the circular loop from investment to real exchange rate to balance sheets to investment more powerful.

We can now also offer a possible answer to the great mystery: Why Asia? Why now? If we ask what was special about Asian economies, something that may have made them peculiarly vulnerable to financial crisis, the answer is high leverage: all of the now afflicted countries had unusually high levels of ?. If we ask why now - given that high leverage, "crony capitalism", etc. have been characteristic of Asian economies for decades - the answer is that only after 1990 did these economies begin extensive borrowing denominated in foreign currencies, borrowing that placed them at risk of financial collapse if the real exchange rate depreciated.

4. *The dilemma of stabilization*

Although standard models of currency crisis have not to date taken account of the problems

posed by foreign-currency debt, practitioners have been aware of this issue for decades. And the risks of financial trauma because of that debt were a major reason why the IMF advised its Asian clients to follow the much-criticized "IMF strategy" of defending their currencies with high interest rates rather than simply letting them decline.

This model does not allow a direct analysis of monetary policy. We can, however, take a very rough cut at the nature and consequences of the IMF strategy by imagining that the effect of that strategy is to hold the real exchange rate p constant even when the willingness of foreign lenders to finance investment declines. In that case, of course, something else must give; and the natural assumption is that output declines instead.

Indeed, if we hold p constant, output will be determined by a sort of quasi-Keynesian multiplier process; rearranging (2) we have

$$y \ ' \ \frac{pX \ \% \ (1\&\mu)I}{1 \ \& \ (1\&a)(1\&\mu)} \tag{11}$$

But given that a share a of output goes to profits, a decline in investment will reduce entrepreneurs' wealth:

$$\frac{dW}{dI} \ ' \ \frac{a(1\&\mu)}{1 \ \& \ (1\&a)(1\&\mu)} \tag{12}$$

and hence once again there will be a feedback from actual to financeable investment:

$$\frac{dI_f}{dI} \ ' \ \frac{(1\%?)a(1\&\mu)}{1 \ \& \ (1\&a)(1\&\mu)} \tag{13}$$

It is immediately clear that stabilizing the real exchange rate, while closing one channel for potential financial collapse, opens another: if leverage is high, the economy may stabilize its real

19

exchange rate only at the expense of a self-reinforcing decline in output that produces an equivalent decapitation of the entrepreneurial class.

5. *Policy implications*

One would ordinarily be somewhat diffident about drawing policy implications from so rough a framework. However, policy must be and is being made, by and large without any explicit analytical framework at all; so here are some conclusions inspired from the model. They pertain to three rather different questions. First is the question of prophylactic measures: what can we do to prevent such crises in the future? Second is the question of policy in the crisis: how can the crisis be halted or at least limited? Finally there is the question of what to do once the crisis has occurred: how does one rebuild the economy?

Prophylactic measures: In the aftermath of the Asian crisis, a broad consensus has emerged among responsible people that countries need to take much greater care with their banking systems - that they need "transparency", better capital standards, more careful regulation of risk-taking, an end to cronyism, etc.. Underlying such recommendations is the belief that the crisis was largely due either to moral hazard, Diamond-Dybvig-type problems, or both. And it is hard to disagree that such measures are a good thing. If I am right about the mechanism of crisis, however, even a very clean and prudent banking system may not be enough to protect open economies from the risk of self-reinforcing financial collapse.

A more controversial proposal is for the widespread imposition of Chilean-type restrictions on

short-term borrowing denominated in foreign currencies. The idea here is that by reducing short-term foreign-currency exposure, countries can reduce the risks of being forced into crisis by a loss of confidence.

I have been skeptical about this argument on the general grounds that as long as a country has free convertibility of capital, short-term foreign loans are only one of many different possible sources of capital flight. We cannot deal with the issue of maturity structure in this model, since such issues have been ruled out by assumption. But in the spirit of the model, consider the following situation: domestic firms are financed by a mixture of short-term debt denominated in domestic currency, and long-term debt denominated in foreign currency. Does the fact that the foreign currency debt is long-term protect the country from financial crisis? Surely not: if people expect a financial crisis, the holders of domestic short-term debt will refuse to roll it over, generating an exchange rate depreciation that bankrupts the firms even though the foreign-currency debt itself is long term.

So what is the appropriate prophylactic policy? The answer from this model, at any rate, seems to be to discourage firms from taking on foreign-currency-denominated debt of any maturity. Loosely speaking, there appears to be a sort of external diseconomy to borrowing in foreign currencies: because such borrowing magnifies the real-exchange-rate impact of adverse shocks, and because real depreciation interacts with capital-market imperfections to cause economic distress, the decision by an individual firm to borrow in dollars imposes costs on the rest of the economy.

Dealing with crisis: Much of the vituperative public debate over how to deal with crisis has

involved the question of whether to let the exchange rate go or stabilize it. The answer suggested by this model is that this is a real choice, but that both answers may be equally bad. Is there a third way?

One possibility would be the provision of emergency lines of credit. However, in the context of this model it appears that these credit lines would have to do more than provide balance-of-payments financing, or even provide lender-of-last resort facilities to banks: they would have to make up the credit being lost by firms, so as to allow investment to continue. Thus the credit lines would have to be very large indeed, and also be accompanied by a mechanism that funnels the funds to troubled entrepreneurs. (This would be especially difficult politically, since in the midst of crisis there is widespread and often justified vilification of those same entrepreneurs, on the grounds that their excesses brought on the crisis in the first place). Of course if one takes the model seriously, a sufficiently large credit line would never actually have to be used, since its very existence would prevent the crisis from ever getting under way (but one has to be credibly willing to use it in order not to have to).

Another possibility is to rule out the possibility of a downward financial spiral by being ready to impose a curfew on capital flight. Again, there is substantial sympathy even among respectable opinion for standstill agreements on foreign-currency debt; but this may well not be sufficient, if capital-account convertibility means that other forms of capital flight are still possible. All of which raises the possibility that it might be necessary, and even in the interests of investors themselves, to impose emergency capital controls ... enough said.

After the fall: Finally, what we hope is the current question: once the crisis has happened, how

does one get the economy going again? To date most actual efforts have focused on bank restructuring and recapitalization; but if this model is on the right track, this will not be sufficient. The main problem at this point, the model (like many practitioners) suggests, is that the firms and entrepreneurs who drove investment and growth before the crisis are now effectively bankrupt and unable to raise capital.

If this is right, the key to resuming growth is either to rescue those entrepreneurs, through some kind of "private sector Brady Plan", or to grow a new set of entrepreneurs - or both. A likely source of new entrepreneurs is, of course, from abroad: a welcome mat for foreign direct investment might be just what the doctor ordered.

Again, all of this is based on a liberal interpretation of a very rough model. It seems to me, however, that this model does provide at least a different perspective on how to think about these issues.

As I said at the beginning of this paper, the Asian crisis inspires mixed emotions in those of us who, like Bob Flood, have shared a decades-long fascination with the issue of currency crises. Our obsession has been spectacularly and tragically vindicated; but the world seems to keep finding new ways to generate crises. Let us hope that the lessons of this "third-generation" crisis are learned, and that no future crises arise in the same way; but even if that hope is fulfilled, one can be sure that there are many more generations to come.
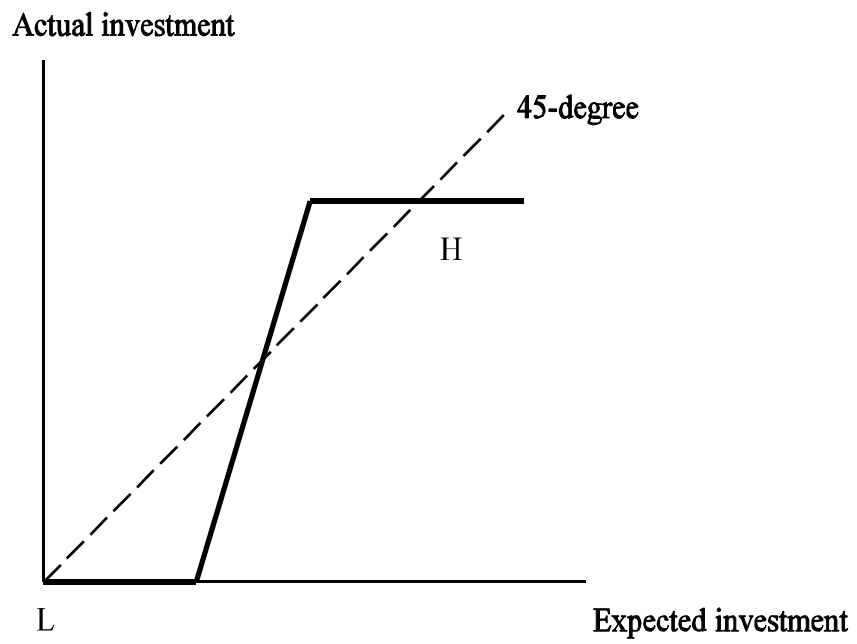
REFERENCES

(To be provided)

Actual investment

45-degree

H

L

Expected investment

Figure 1