EXCHANGE-RATE REGIMES FOR EMERGING MARKETS: MORAL HAZARD AND INTERNATIONAL OVERBORROWING

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This paper investigates the role of the exchange-rate regime in a simple Fisherian model of the overborrowing syndrome. Where domestic banks are subject to moral hazard, the choice of exchange-rate regime may have important implications for the macroeconomic stability of the economy. Banks that enjoy government guarantees have an incentive to increase foreign borrowing and incur foreign-exchange risks that are underwritten by the deposit insurance system. In the absence of capital controls, this increases the magnitude of overborrowing and leaves the economy both more vulnerable to speculative attack and more exposed to the real economic consequences of such an attack. While 'bad' exchange-rate pegs will tend to exacerbate the problem of overborrowing in emerging markets, it is unclear that flexible exchange rate always dominates fixed exchange rates. A 'good fix'—one that is credible and close to purchasing power parity—may reduce the 'super risk premium' in domestic interest rates and thereby narrow the margin of temptation for banks to overborrow internationally. Contrary to the current consensus regarding the lessons that should be drawn from the Asian crisis, a good fix may better stabilize the domestic economy while limiting moral hazard in the banking system.

I. INTRODUCTION

The 1990s have been marked by successive financial crises. Following the financial turmoil in Mexico, East Asia, Russia, and most recently Brazil, commentators have begun to question whether 'globalization has gone too far' (Rodrik, 1998) or whether the global capital market is a 'benefactor or menace' (Obstfeld, 1998). Should the scope of international financial liberalization be more restricted by capital controls? How does the nature of the exchange-rate regime affect moral hazard in capital markets and the problem of international overborrowing, or, depending on your perspective,

overlending? These are the questions raised in this paper.

The problem is not new. For economies undertaking economic liberalizations, McKinnon (1973, 1993b) identified a phenomenon he labelled the 'over-borrowing syndrome'. Even if apparently well-designed macroeconomic, trade, and structural policies were being put in place, massive inflows of foreign capital often created severe macroeconomic imbalances in liberalizing economies that ultimately proved unsustainable, thereby jeopardizing the entire reform process. This led McKinnon to advocate a carefully structured sequencing of reforms—the 'order of economic liberalization'.

Taking a Fisherian approach to modelling inter-temporal saving and investment decisions, McKinnon and Pill (1996, 1997, 1998a) focused on moral hazard in the domestic banking system from deposit insurance or other government bail-out facilities as the root cause of international overborrowing. Because of asymmetric information and moral hazard, financial intermediation may misdirect real economic resources at the microeconomic level, leading to substantial macroeconomic imbalances. However, in these papers we took the world 'real' interest rate as given to the domestic economy, thereby abstracting from the complications introduced by monetary considerations, such as the exchange rate.

In our more recent work, (McKinnon and Pill, 1998b), currency risk was reintroduced into the model of overborrowing explicitly. The paper considered the implications of allowing borrowing abroad in either domestic or foreign currency, where foreign-exchange positions could be hedged or unhedged and when moral hazard in the banking sector might be present or absent. Nevertheless, the paper did not address the issue of exchange-rate regime, i.e. whether the choice of a fixed, managed peg or a freely floating exchange rate affects the propensity to overborrow internationally.

Building on our previous work, this paper analyses the choice of an exchange-rate regime and the possible use of exchange controls over capital flows from the perspective of limiting moral hazard in international financial markets. The current consensus in the academic literature, endorsed by the International Monetary Fund (IMF) and other international organizations, is that one of the main lessons of recent emerging market financial crises is the need for more flexible exchange-rate arrangements. Stanley Fischer, the Deputy Managing Director of the IMF, stated the matter thus:

There is a trade-off between the greater short-run volatility of the real exchange rate in a flexible rate regime versus the greater probability of a clearly defined external crisis or financial crisis when the exchange rate is pegged. The virulence of the recent crises is likely to shift the balance towards the choice of more flexible exchange-rate systems, including crawling pegs with wide bands. (Fischer, 1999)

Our paper explores this view. We argue that, while falling short of introducing currency boards or otherwise completely ceding national monetary autonomy, well-designed programmes of exchange-rate stabilization can reduce the incidence of overborrowing manias, and thereby reduce the exposure of emerging markets to sudden reversals of investor sentiment leading to financial panics. Commonly held exchange-rate objectives can even limit financial contagion, i.e. currency attacks spreading from one country to another, by helping to solve coordination problems among small open economies. However, no exchange-rate regime, however well chosen, can obviate the need for prudential regulation of domestic banks against undue risk taking—regulation which may well cover international flows of short-term capital.

The paper is organized as follows. Section II briefly reviews our Fisherian approach to analysing the overborrowing syndrome in the absence of currency risk. Section III reintroduces the exchange rate and the hedging problem. In section IV, the concept of the 'super risk premium' is developed to analyse the additional foreign-exchange incentive for overborrowing. Section V draws a distinction between 'good' and 'bad' fixes of the exchange rate and the implications for domestic interest rates. Section VI shows how credit risk in domestic lending interacts with currency risk greatly to magnify moral hazard in banks and other financial institutions. Section VII presents illustrative data on the evolution of interest-rate differentials between the crisis countries and the international capital

market before and after the currency attacks. In section VIII, we discuss when capital controls are desirable to avoid a bad fix. Section IX concludes by comparing the desirability of a good fix to free float in financially open economies.

II. MODELLING THE OVERBORROWING SYNDROME

Following the Chilean experience in the late 1970s, policy-makers concluded that avoiding over-borrowing was largely a matter of 'getting the exchange rate right'. Against this, in our earlier papers we abstracted from exchange-rate issues in order to show that substantial overborrowing and vulnerability to capital flight could emerge in reforming economies undertaking apparently successful 'real-side' liberalizations in domestic or foreign trade, but where the macroeconomic outcomes of such reforms were uncertain.

These papers demonstrated how overborrowing often follows a cyclical pattern similar to that described by Kindleberger (1996). To summarize our basic model, consider just the penultimate stage of the overborrowing cycle before the onset of financial crisis. In this stage, moral hazard pervades domestic banks, and possibly other financial institutions, because they expect the national government or international organizations to bail them out in the event of crisis. Unless tightly regulated, domestic banks will borrow excessively from the international capital market and on-lend the proceeds to speculative domestic investments or consumption.

To model this situation, we adopted a simple two-period Fisherian approach. Such a model retains the forward-looking optimization that is central to modern macroeconomics, while abstracting away from other complications. Two features distinguish our framework from a conventional Fisherian model. First, the production technology is not continuous (McKinnon, 1973, appendix to ch. 2). A discrete start-up investment (F) is required in order for firms to be able to produce output according to the production function $\alpha g(.)$. Second, all financial flows are intermediated through domestic banks. Because the emerging market being modelled is small and open to the global economy, we initially assume

that banks can borrow internationally at a given real interest rate.

In this context, banks are 'special' for two important reasons:

- On the liabilities side of their balance sheet, bank deposits enjoy a (possibly implicit) government guarantee. As mentioned above, this 100 per cent deposit insurance may itself be backed by the promise of a bail-out by international organizations, such as the IMF or World Bank.

- On the asset side of the balance sheet, bank lending is special because it is a necessary input to production. Domestic firms must borrow in order to finance the required start-up investment, and banks are the only source of such borrowing in this model. Therefore a 'credit channel' from bank lending to real activity exists.

In this financial environment, the government now embarks on a credible programme of economic reform designed to eliminate previous distortions, for example to end restrictions on foreign and domestic trade and/or to close an uncovered fiscal deficit. These reforms increase the productivity of new domestic investment. However, the magnitude of this productivity rise depends on the overall macroeconomic success of the reform programme, which is somewhat uncertain *ex ante*. Let us represent this 'productivity shock' to new investment by the random variable α.

Assume that the true expectation of the productivity shock, i.e. the unbiased expected pay-off to new investments, is α^{FB} (where FB stands for first-best outcome). In the equilibrium of this simple model, domestic firm/households will borrow from the international capital market to finance investment at point x^{FB}, while consuming c^{FB}. These choices are determined by the points of tangency A and B respectively, which represent the profit and utility maximizing decisions when the firm/household faces the world real interest rate.

However, in assessing investment risks in the reforming economy, banks may suffer from moral hazard and therefore truncate the lower tail of the probability distribution for α—corresponding to the

Figure 1
International Overborrowing with Domestic Credit Risk
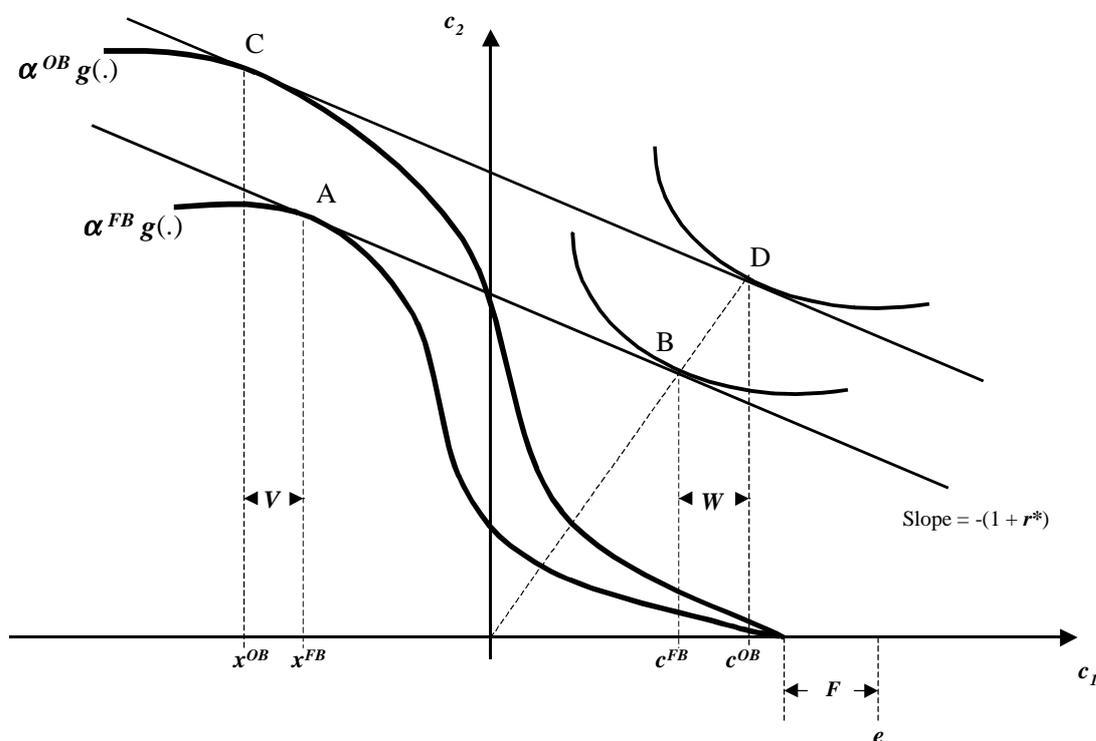
realizations of the macroeconomic productivity shock that result in bankruptcy. Because of deposit insurance and other government bail-out provisions, banks discount the risk of unfavourable collective outcomes. Consequently, this moral hazard leads them to behave too optimistically regarding the pay-off from new investment. They lend as if expected investment productivity was α^{OB}, where $\alpha^{OB} > \alpha^{FB}$ (where OB stands for overborrowing). For details of the overborrowing equilibrium, see McKinnon and Pill (1996).

Since the domestic banks all have access to the international capital market without currency risk (i.e. as if there was no distinction between the money circulating at home and that circulating abroad), domestic real interest rates are constrained to the world level by competition among the domestic banks. Because of the bank moral hazard in domestic lending, however, the quantity borrowed internationally is too high. This leads to an excessive expansion of credit relative to the 'first-best' outcome, where there is no moral hazard in bank-based international financial intermediation. Through the 'credit channel' discussed above, this excess lend-ing leads to both overinvestment (represented by V in Figure 1) and overconsumption (represented by W) by domestic residents. The lending is 'excess' in the sense that, *ex ante*, an unbiased assessment of the macroeconomic outcome of the reform programme would project lower returns to domestic investments than were necessary to repay the banks—and their external creditors—for the large capital inflows. Only a 'lucky draw'—an unusually good macro outcome—could prevent a financial crash. The magnitude of overborrowing is therefore closely related to the probability and magnitude of a financial crisis.

III. REINTRODUCING THE EXCHANGE RATE

After credible real-side reforms, our Fisherian model focused on banks overestimating domestic investment productivity irrespective of the exchange-rate regime. However, from the recent emerging market crises—especially those in East Asia—banks also took excessive risks in the way they financed themselves in the foreign exchanges. While it is

certainly the case that controlling overborrowing involves more than simply 'getting the exchange rate right', it is equally true that the exchange rate cannot be ignored entirely.

Banks enjoying a government guarantee of their liabilities have an incentive to speculate on exchange-rate developments since, as with the credit risks discussed in section II, they are protected from the implications of adverse outcomes. Therefore, moral hazard could lead banks to take unhedged foreign-exchange positions, borrowing in foreign currency to on-lend to domestic residents at much higher interest rates in domestic currency, while implicitly transferring most of the currency risk incurred on to the government through the deposit insurance scheme.

In section II, we assumed real interest rates were equalized internationally. However, real interest parity (RIP) for borrowing in *domestic* currency requires both uncovered interest parity (UIP) and relative purchasing power parity (PPP) to hold continuously (Frankel, 1992). The empirical evidence in support of such propositions—even for small, open economies such as the emerging markets in question—is weak. Consequently, in this section we reintroduce the exchange rate into our simple Fisherian model of overborrowing by relaxing the assumption that RIP holds.

To do so, it is useful to recall a number of identities that decompose cross-country real interest rate differentials. As a bench-mark, consider the world real interest rate, r^*, that can be related to the world nominal interest rate, i^*, and the expected world inflation rate, $E\pi^*$. To avoid complications associated with Balassa–Samuelson effects in consumer price indices (Pill, 1995), define π and π^* to be rates of inflation in broad tradable goods price indices, i.e. as approximated by wholesale price indices.

$$r^* = i^* - E\pi^*$$
$$r = i - E\pi. \qquad (1)$$

In section II, it was simply assumed that the domestic real interest rate r was equal to the world real interest rate, i.e. that $r = r^*$, because of RIP.

However, when reintroducing the exchange rate into the model, a number of other considerations have to be entertained. First, consider the covered interest parity (CIP) condition, relating nominal interest rate differential, $i - i^*$, on bank deposits of the same term to maturity to the forward exchange-rate premium, f. In the absence of controls over foreign capital flows or domestic interest rates, we have

$$i = i^* + f. \qquad (2)$$

When there are no barriers to international financial flows, CIP, as defined by equation (2), must hold in portfolio equilibrium.[2] Otherwise, banks and other financial institutions, acting as covered interest arbitrageurs, could make unbounded profits while avoiding risk altogether. Collectively, covered interest arbitrage by all banks is what makes the forward foreign-exchange market in the course of determining f. For any one bank, CIP also implies that borrowing in foreign currency, while hedging the position in the forward market, is equivalent to borrowing in domestic currency.

For example, suppose that, as is normally the case in an emerging market economy, the deposit rate in domestic currency in, say, Thailand, is greater than if the same Thai bank accepted dollar deposits. That is, $f > 0$, and $i > i^*$. If a Thai bank were to accept cheaper dollar deposits, say, 30 days duration, but hedged the transaction by buying dollars 30 days forward, the cost in baht of buying the dollars forward would be just f per cent greater than buying them spot. The lower interest paid on the dollar deposits spot would just be offset by the higher cost of the forward cover. Consequently, when CIP holds, and banks are forced to hedge all their foreign-exchange borrowing in the forward market, the incentive for additional exchange-rate-related overborrowing is eliminated. The analysis collapses straightforwardly back to the simple model of section II.

However, in many, if not most, emerging market countries, the regulatory and supervisory institutions are too weak to impose and enforce 100 per cent hedging requirements on domestic banks.

[2] However, a country risk premium could be introduced if there were expectations that effective capital controls (that were able to prevent exploitation of this arbitrage opportunity through administrative restrictions) were to be imposed (Dooley and Isard, 1980).

Consequently, banks with moral hazard have an incentive to borrow unhedged in foreign exchange at a lower interest rate, transferring the resulting foreign exchange risk to the government through the deposit insurance scheme. This will lead to (further) overborrowing for the country as a whole. In order best to characterize the margin of temptation for banks to borrow unhedged in foreign currencies, section IV develops the concept of the *super risk premium.*

IV. THE SUPER RISK PREMIUM

What determines the nominal interest differential between baht and dollar deposits? This can be expressed using the UIP relationship between the expected nominal depreciation $E\hat{e}$ and the interest differential, i.e.

$$ i - i^* = E\hat{e} + \rho_{currency}. \qquad (3) $$

This is not a riskless arbitrage relationship like CIP because nominal exchange-rate developments are uncertain and introduce risk into the relationship. This is captured by the currency risk premium, $\rho_{currency}$. The currency risk premium represents the extra return required by investors to hold domestic rather than foreign currency assets. It reflects the correlations between returns on financial assets and other shocks to the income and consumption streams of wealth holders. In emerging markets, interest rates and price levels are typically more volatile than those in industrialized countries. Consequently, wealth holders demand more compensation for holding emerging market assets and the interest rates on assets denominated in emerging market currencies have to be higher to maintain international portfolio balance.

The existence of a risk premium also reflects the inherent asymmetry between national monies at the centre and on the 'periphery'. In Latin America, Asia, and much of Africa, the dollar is the international standard of value for invoicing goods and services in foreign trade, and for denominating most of international capital flows (McKinnon, 1999). The dollar is also the 'safe-haven' currency into which nationals in emerging markets fly in the face of a domestic financial crisis. Thus, to measure

$\rho_{currency}$ at different terms to maturity, interest rates on US dollar assets are the natural standard of reference as the 'risk-free' return in the international system. Moreover, for many emerging markets, the international price level in dollar terms is the main determinant of the domestic price level, given the exposure and openness of the formal sectors of the economy. (The European Union now provides a large, stable monetary safe harbour of its own, within which the dollar's asymmetrical role is less important.)

Equation (3) can be interpreted from this dollar-standard perspective. The greater the volatility in Thailand's interest rates and price levels relative to the United States, the higher will be $\rho_{currency}$ in Thailand. This is close to saying that the greater the volatility of the baht's exchange rate against the dollar, the greater will be the currency risk premium in Thai interest rates. Conversely, the more that Thailand succeeds in integrating its monetary policy with that of the United States so that its dollar exchange rate is naturally stable and price level is aligned with the American, the lower will be $\rho_{currency}$ and the closer will be the Thai and American nominal interest rates.

The other component of the interest differential—the expected depreciation of the domestic currency, $E\hat{e}$—can be decomposed into two parts. First, within a managed exchange-rate regime with a crawling or constant peg (typical of South-east Asian countries, Mexico, Brazil, and most emerging-market economies), the exchange rate might change predictably and smoothly according to government's policy announcements and commitments—such as the downward crawl in the Indonesian rupiah before the 1997 crash. Second, is the small probability of a 'regime change': a large, sudden devaluation whose timing is unpredictable.

$$ E\hat{e} \equiv E\hat{e}_{predictable} + E\hat{e}_{regime\ change}. \qquad (4) $$

Although both types of expected change in the exchange rate in (4) widen the nominal interest differential in (3), it is plausible that $E\hat{e}_{regime\ change}$ is part of the margin of temptation for banks with moral hazard to overborrow, while $E\hat{e}_{predictable}$ is not. If the exchange rate was expected to depreciate smoothly through time, even banks with very short time horizons will account for the higher domestic

currency costs of repaying short-term foreign currency deposits. Therefore, we exclude $E\hat{e}_{predictable}$ from our measure of the *super risk premium*:

$$\rho_{super} = \rho_{currency} + E\hat{e}_{regime\ change}$$

$$= i - i^* - E\hat{e}_{predictable}. \qquad (5)$$

The super risk premium, ρ_{super}, represents the margin of temptation for banks to overborrow in foreign exchange. It has two components: the currency risk premium, as defined above, and the part of the interest differential arising from the small probability that the regime could change through a discrete devaluation.

The latter source of upward pressure on the interest rate on assets denominated in the domestic currency is sometimes called 'the peso problem'. By borrowing unhedged in foreign currency, the domestic banks with deposit insurance and other government guarantees ignore downside bankruptcy risks implied by large devaluations whose timing is uncertain. In setting domestic nominal lending rates, the banks will only cover the 'predictable' component of the expected depreciation within the currency regime.[3] In the special case where the nominal exchange rate is fixed, unhedged banks lend on at the international *nominal* interest rate plus a normal profit margin. For ease of macroeconomic exposition in this paper, this profit margin between deposits and loans is simply set at zero.[4]

In expression (5), *i* represents the nominal interest rate that would be charged by a domestic bank that was borrowing in foreign currency but fully hedging its foreign exchange exposure. In contrast, a bank exploiting a government guarantee by borrowing unhedged in the international capital market will (in a competitive environment where bank profits are competed away) charge a lower rate ($\hat{i} = i^* + E\hat{e}_{predictable}$) that does not incorporate the super risk premium.

This highlights our first regulatory dilemma. If the super risk premium is high and the ability of the

regulatory authorities to enforce hedging rules is imperfect, then there will be large differences in the perceived cost of capital to different financial agents and firms in the domestic market. Those that the authorities succeed in policing will face a much higher cost of capital than those that gamble and borrow unhedged. A declining market share could undermine the resolve of even conservative banks to hedge their foreign-exchange positions.

V. 'GOOD' VERSUS 'BAD' FIXES AND THE REAL INTEREST RATE

To match these results with our two-period model of real borrowing and lending outlined in section II, we convert these nominal interest rates into real rates. The domestic real lending rate charged by a 'well-behaved' fully hedged bank will be:

$$r_{hedged} = r^* + (E\pi^* - E\pi + E\hat{e}_{predictable}) + \rho_{super}. \quad (6)$$

In contrast, the domestic real lending rate charged by a bank exploiting its government guarantee and therefore not hedging its foreign-exchange exposure will be:

$$r_{unhedged} = r^* + (E\pi^* - E\pi + E\hat{e}_{predictable}). \quad (7)$$

A banking sector with moral hazard will charge a lower domestic real interest rate (7) than one which is regulated to be fully hedged—as per (6).

Can domestic real interest rates differ from those prevailing on world markets? Suppose that relative purchasing power parity, defined with respect to the predictable component in the movement of the exchange rate, holds: the domestic (Indonesian) price level rises relative to the foreign (American) only by the amount of the ongoing smooth depreciation of the rupiah. Whether an unchanging peg or a downward crawl, let us call such PPP exchange-rate regimes *good fixes*. Because the exchange-rate regime seems secure enough, the small probability of a regime change and discrete devaluation is *not* incorporated into ongoing domestic inflation.

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[3] This 'predictable' component will be covered in order for the bank to operate as an on-going business, as it would otherwise not be able to cover its foreign currency liabilities while the initial 'boom' phase of the overborrowing syndrome was in progress and therefore enjoy the profits created for the banking sector during this period.

[4] But the determinants of this margin of bank profitability in hedged and unhedged settings are worthy of separate investigation.

Before the 1997 currency attacks, the Asian crisis economies—Indonesia, Korea, Malaysia, the Philippines, and Thailand—and other non-crisis economies, such as Hong Kong, Singapore, and Taiwan, had good fixes with sound macroeconomic fundamentals (McKinnon, 1999). Among other things, a good fix implies:

$$E\pi = E\pi^* + E\hat{e}_{predictable}$$
$$\Rightarrow \quad r_{hedged} = r^* + \rho_{super}$$
$$r_{unhedged} = r^*. \quad (8)$$

The unhedged real borrowing rate is equal to the world, i.e. centre country's, real interest rate; and the hedged borrowing rate exceeds this by exactly the super risk premium, ρ_{super}.

However with a *bad fix*, the domestic price level drifts up by more than the controlled rate of depreciation: $E\pi > E\pi^* + E\hat{e}_{predictable}$. Bad fixes have been common in Latin America—as in Chile in 1978–81, Mexico in 1992–4, and Brazil in 1996–8 before their currencies were attacked. With unhedged borrowing and in the presence of a bad fix, the domestic real interest rate unambiguously falls *below* the world rate—as per equation (9):

$$E\pi > E\pi^* + E\hat{e}_{predictable}$$
$$\Rightarrow \quad r_{unhedged} < r^*. \quad (9)$$

With hedged borrowing, however, equation (6) shows that the domestic real interest rate could be higher or lower than the corresponding 'risk-free' world rate. The excessive rise in the domestic price level unambiguously reduces the real rate, but the super risk premium could itself increase and more than offset this effect because the expectation of a 'regime change' in the exchange rate is likely to rise as the current rate drifts further and further from the rate consistent with PPP. Thus, under a bad fix, the domestic real interest rate seen by hedged borrowers could not only be higher than the world rate, but could be higher than if there had been a good fix.

Indeed, a bad fix is precisely when the super risk premium is a maximum. First, $E\hat{e}_{regime\ change}$ is high because it is less likely that the fixed exchange rate can last. Second, $\rho_{currency}$ is also high because of domestic price level and interest-rate instability. Thus regulatory discrimination through enforced

hedging on some, but not all borrowers, may become unsustainable.

The super risk premium, i.e. the financing 'penalty' imposed on hedged borrowers, is endogenously determined by monetary and fiscal considerations (not modelled in this paper), as well as by regulatory ones. To the extent that the economy (currency area) as a whole accumulates unhedged foreign exchange liabilities, ρ_{super} increases—and so does the penalty on hedged borrowers. Strengthening the government's regulatory mechanism to enforce hedging against exchange risk can be likened to a public good. It limits adverse spill-over effects from agents that have moral hazard to those that do not, as well as limiting overborrowing.

VI. THE INTERACTION BETWEEN CREDIT AND CURRENCY RISK

To isolate the effect of domestic credit risk on overborrowing in section II, the 'world' real interest rate was given *as if* the same currency circulated at home and abroad, i.e. as if currency risk was absent. Without moral hazard in domestic banks, borrowing at r^* yielded the 'first-best' solution, i.e. the socially optimal use of inflows of foreign capital—as per Figure 1.

With a separate domestic currency, however, this first-best solution must be suitably risk-adjusted. Now the appropriate domestic cost of foreign capital is $r^* + \rho_{super}$, i.e. that seen by fully hedged borrowers under a 'good fix' (the issue of exchange-rate flexibility is discussed below). The first-best solution involves firm/households borrowing, either in domestic currency or fully hedged in foreign currency, at the interest rate $r^* + \rho_{super}$. This leads to a tangency solution with the undistorted investment function $\alpha^{FB}g(.)$. With this risk adjustment and no domestic investment distortion, there is no overborrowing. The first-best solution in Figure 1 is replicated, albeit with the domestic real interest rate adjusted for foreign-exchange risk by the super risk premium.

However, even if foreign borrowing is fully hedged under a good fix, domestic credit risk could still elicit moral hazard in domestic banks, leading them to

Figure 2
International Overborrowing with Credit and Currency Risks
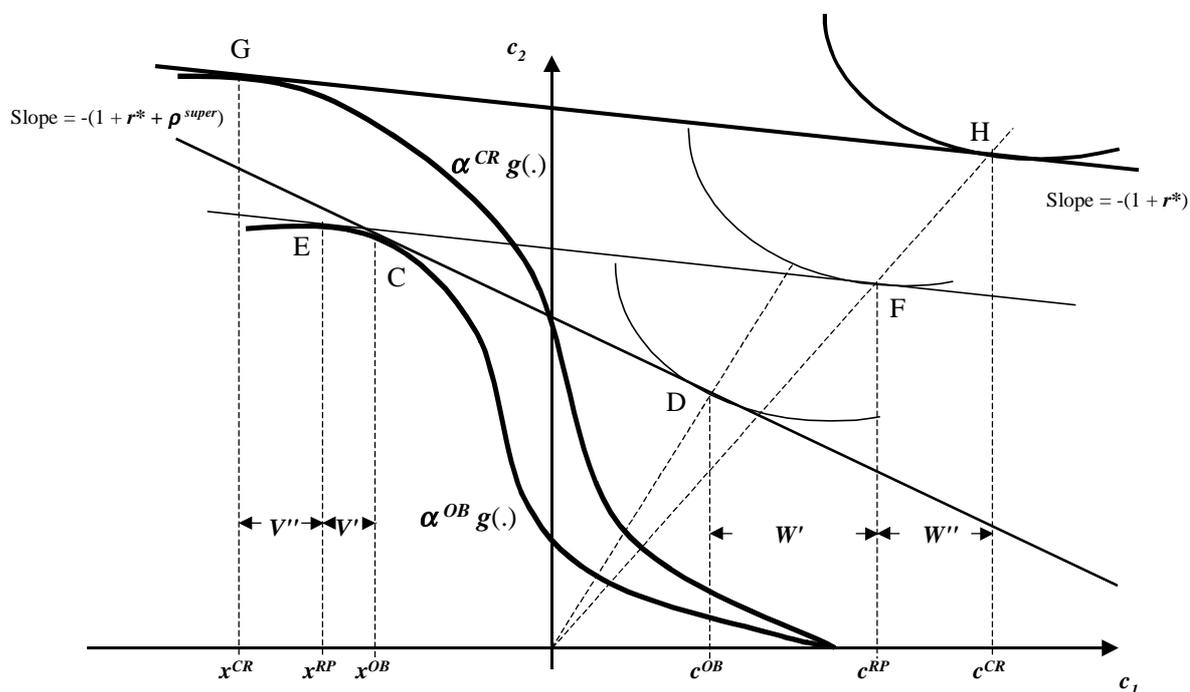
behave too optimistically, i.e. as if the investment function was $\alpha^{OB}g(.)$. In Figure 2, the tangency solution with $r^* + \rho_{super}$ leads to overborrowing—points C and D in Figure 2 correspond to points C and D in Figure 1, again with the domestic real interest rate adjusted for currency risks.

Consider a scenario where this (distorted) expected domestic investment function $\alpha^{OB}g(.)$ remains unchanged, but foreign borrowing by domestic banks is unhedged. In these circumstances, the real interest rate falls to r^*. Figure 2 demonstrates how the lower level of domestic real interest rates leads to still more overinvestment (represented by V' in Figure 2) and overconsumption (represented by W').

Furthermore, the two risks now faced by the domestic banking sector—credit risk associated with the uncertainty about the productivity implications of real economic reform and currency risk resulting from the unhedged foreign currency denominated borrowing—may be inter-related. The inter-relationships may dramatically raise the magnitude and riskiness of the overborrowing taking place.

Consider the situation where credit risk and currency risk are positively related. The most dramatic

manifestation of this is when the cumulative bad loan positions of domestic banks induce a run-off in deposits. Because many of these deposits are in foreign currency, this forces a devaluation as the domestic banks bid for foreign exchange. In the event of an adverse productivity shock, the losses incurred by banks are now greater than they would have been in the pure real-side model discussed in section II. Not only does the bank suffer defaults by its borrowers that erode the bank's capital, but the associated devaluation of the currency imposes even larger capital losses because the bank's foreign exchange exposure is unhedged. Consequently, the probability of bankruptcy is increased and, by implication, the lower tail of the distribution for the productivity shock α that leads to bankruptcy is enlarged. Therefore a bank that enjoys government guarantees of its liabilities and, by implication, suffers moral hazard, will truncate a greater proportion of the distribution of the productivity shock, leading to a value of α even greater than α^{OB}.

In Figure 2, we show banks behaving (after this truncation) as if the investment pay-off function was exaggerated to $\alpha^{CR}g(.)$. The tangency of this function with r^*, the non-risk-adjusted world interest rate, defines an equilibrium where there is

Figure 3
Evolution of the Super Risk Premium under a 'Bad Fix'
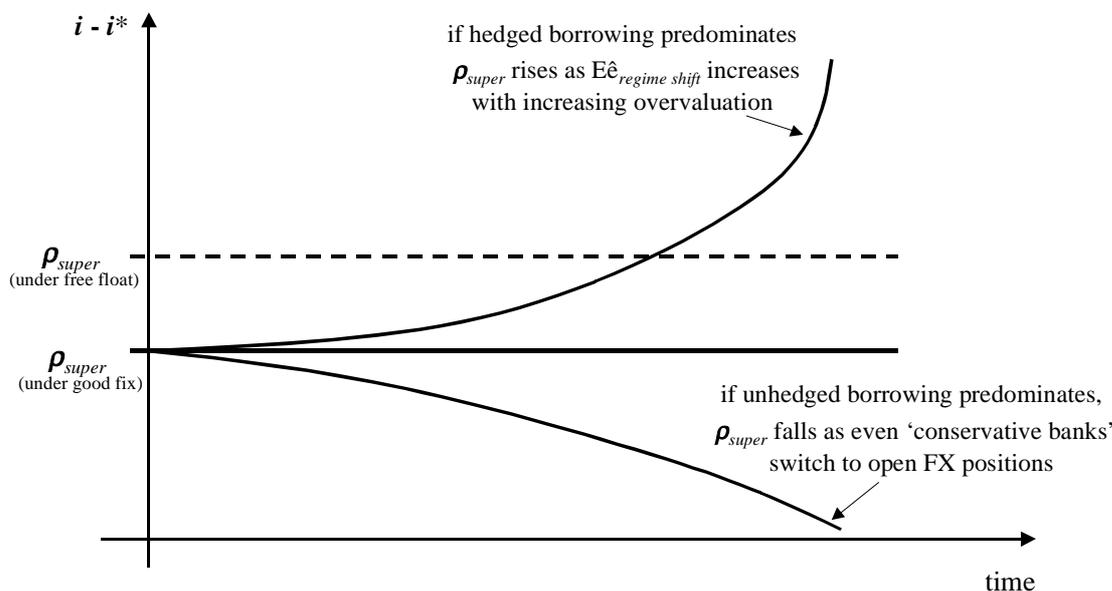
massive overborrowing—an additional V'' of overinvestment and W'' of overconsumption, beyond that which was observed in the scenario where banks did not exploit the correlations between productivity shocks and the exchange rate. Clearly, if the domestic regulators allow banks and other financial institutions to assume both credit and foreign-exchange risks simultaneously, the regime is unlikely to survive (a proposition supported by the evidence presented by Kaminsky and Reinhart (1999)).

In many emerging markets (e.g. Korea and Thailand, where the crisis was triggered by a small number of high-profile bankruptcies), failures by bank borrowers appear to trigger the devastating currency devaluations that impose enormous capital losses on banks with unhedged foreign exchange exposures. Moreover, it is precisely the adverse realization of productivity shocks (and consequent bankruptcies) that is likely to trigger the collapse of foreign investor confidence that is characteristic of the sudden, dramatic, and apparently irresistible currency crises of recent years. Therefore the confidence channel provides a behavioural justification for assuming that productivity shocks and exchange-rate developments are likely to be positively related.

VII. INTEREST-RATE DIFFERENTIALS IN OVERBORROWING COUNTRIES

How will the real interest-rate differential evolve as overborrowing occurs? Contrary to the discussion in section V, the conventional wisdom assumes a 'bad fix' where a real appreciation of the domestic currency occurs. Real appreciation results in growing overvaluation of the emerging market's currency. Ultimately, the real overvaluation becomes unsustainable as the country's exports become uncompetitive on international goods markets. As real appreciation progresses, the super risk premium rises, since the expectation of a sudden devaluation of the exchange rate required to maintain goods market competitiveness increases. Using expression (6) above, the domestic real interest rate associated with fully hedged borrowing in such a scenario would rise over time as the super risk premium rises, causing a *divergence* of the domestic and international real rates. This is illustrated heuristically in Figure 3.

However, as also illustrated in Figure 3, the real interest-rate differential would behave quite differently in the event of such a 'bad fix' should moral hazard exist in the domestic banking system. As is

shown by expression (7) above, where there is moral hazard, domestic banks exclude the super risk premium when setting interest rates, since the risks implied are transferred to the government through the guarantee of insured deposits. Through time, this would imply that the domestic nominal interest rate falls towards the world nominal interest rate, as previously 'conservative' domestic banks (that have been hedging their foreign currency exposures) are forced by competitive pressures to pursue the riskier unhedged strategy. With continuing real appreciation, the domestic real interest rate could then fall *below* the world rate.

The empirical validity of some of these assertions can be assessed, albeit in a simple manner, by investigating the interest differentials observed between the international capital market and domestic interest rates in the emerging market economies that have recently suffered from currency and financial crises at the culmination of the overborrowing syndrome. If the exchange-rate risk is an important cause of overborrowing, the analysis presented above would suggest that, as the crisis approached, domestic nominal interest rates (on loans denominated in domestic currency) tended to converge towards international nominal interest rates (on loans denominated in US dollars), once the correction for a differential associated with any predictable pre-announced 'crawl' of the nominal exchange rate has been made. Where such a convergence took place, one would anticipate a large inflow of foreign capital (equivalently, a large current account deficit) and rapid growth of domestic investment and consumption. At this stage, no attempt is made to measure inflation expectations, so the results can be at best suggestive since they focus on nominal rather than real rates.

In contrast, if exchange-rate risk is not an important cause of overborrowing because most of foreign borrowing is hedged, the spread between domestic and international rates should widen and the inflow of foreign capital should slow as the crisis approaches. As overvaluation grows, the super risk premium increases since the probability of a sharp depreciation of the exchange rate rises.

To illustrate these points, we compare domestic interest-rate data for Thailand, Malaysia, Indonesia, and Korea with the US dollar interest rate (measured as London Inter-bank Offered Rate (LIBOR)). These East Asian examples are then compared with Russia and Brazil—two countries that could more easily be identified within the 'bad fix' group. To focus attention on the short-term 'hot money' capital flows that are at the heart of analysis of the overborrowing syndrome, we choose to investigate 3-month rates. Analysis of other maturities and of the relationship with other currencies (especially the Japanese yen in the East Asian context, as in McKinnon (1999)) would offer useful extensions, but this is left to future work.
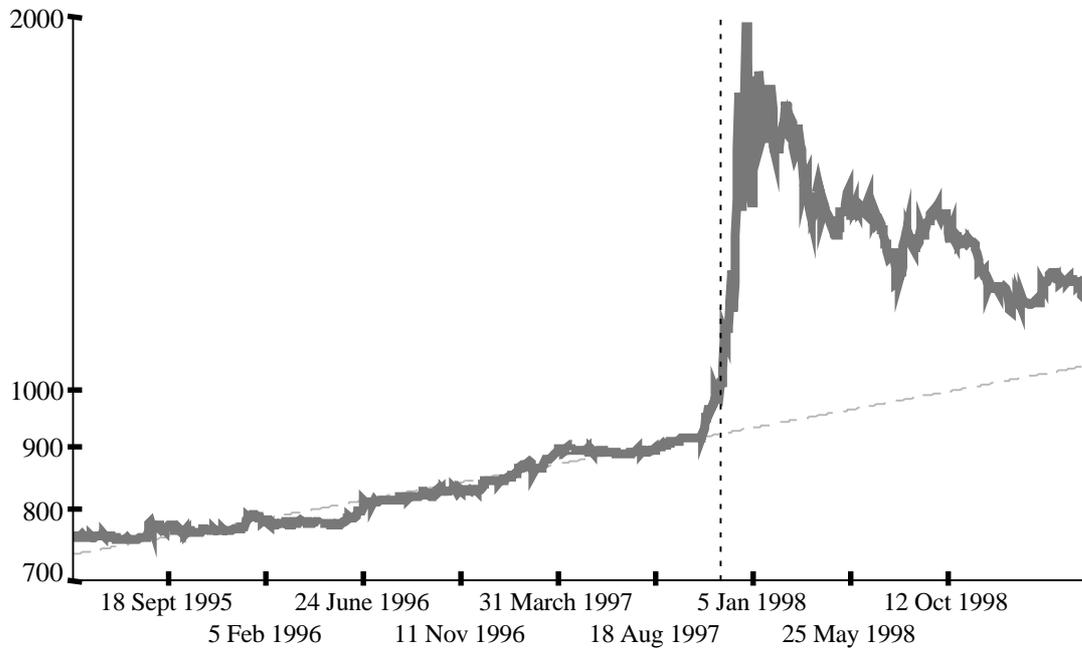
The time series are shown in Figures 4–9. These charts cover the period from the beginning of May 1995 to the end of April 1999. The upper panel of each of the charts shows the development in the exchange rate against the US dollar. Before the currency attacks began, a predictable rate of crawl (generally very low) was typical of the East Asian countries' US dollar exchange rates (this is shown by the dashed line). This modest expected depreciation of the exchange rate accounts for some of the remaining spread between the US dollar 3m LIBOR and the domestic rate in Korea, Thailand, Malaysia, and Indonesia. Nevertheless, the nominal interest rate observed spreads are quite narrow and there is some suggestion (e.g. in Indonesia) that they narrowed during the period approaching the currency crisis.

Comparing the East Asian countries with Russia and Brazil reveals a very dramatic difference. In both Russia and Brazil, the nominal interest rate differential against the US dollar narrowed very appreciably in the period preceding the currency and financial crisis. This is consistent with the analysis presented above, suggesting that in countries with a 'bad peg' of the nominal exchange rate, banks exploited the moral hazard offered by government guarantees and lack of regulation of foreign-exchange positions to avoid paying the 'super risk premium'. The speculative currency positions adopted by these banks drove domestic interest rates down and thereby exacerbated the magnitude and riskiness of borrowing from abroad to finance the ongoing current account deficit.

Overall, this simple empirical exercise does not discriminate fully between the two hypotheses concerning the role exchange-rate risk plays in the overborrowing syndrome.

Figure 4
Korea

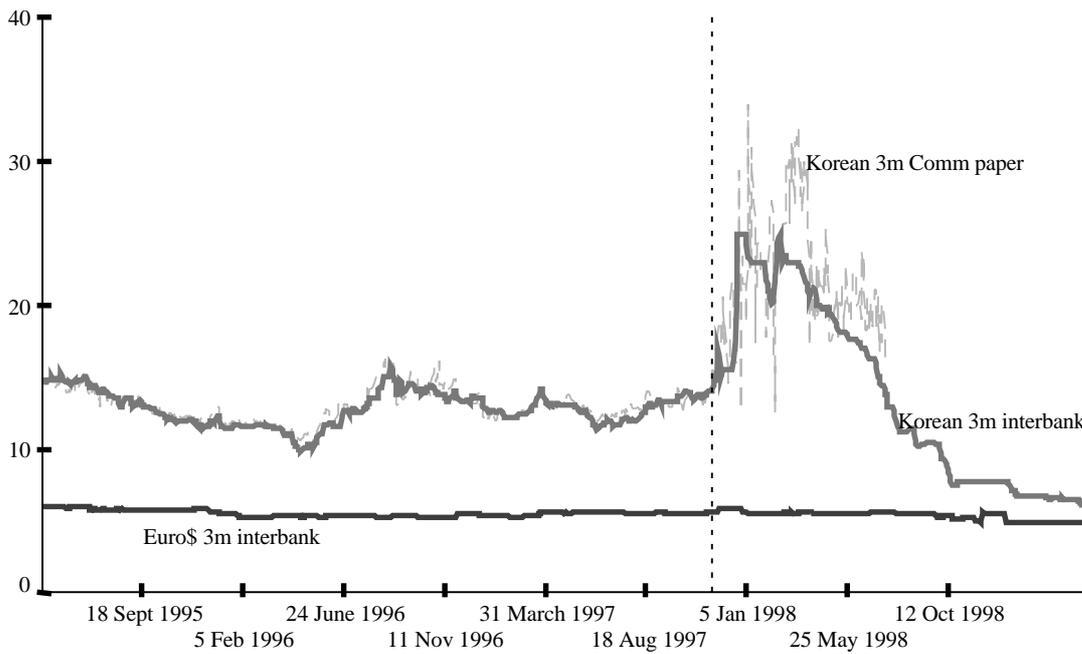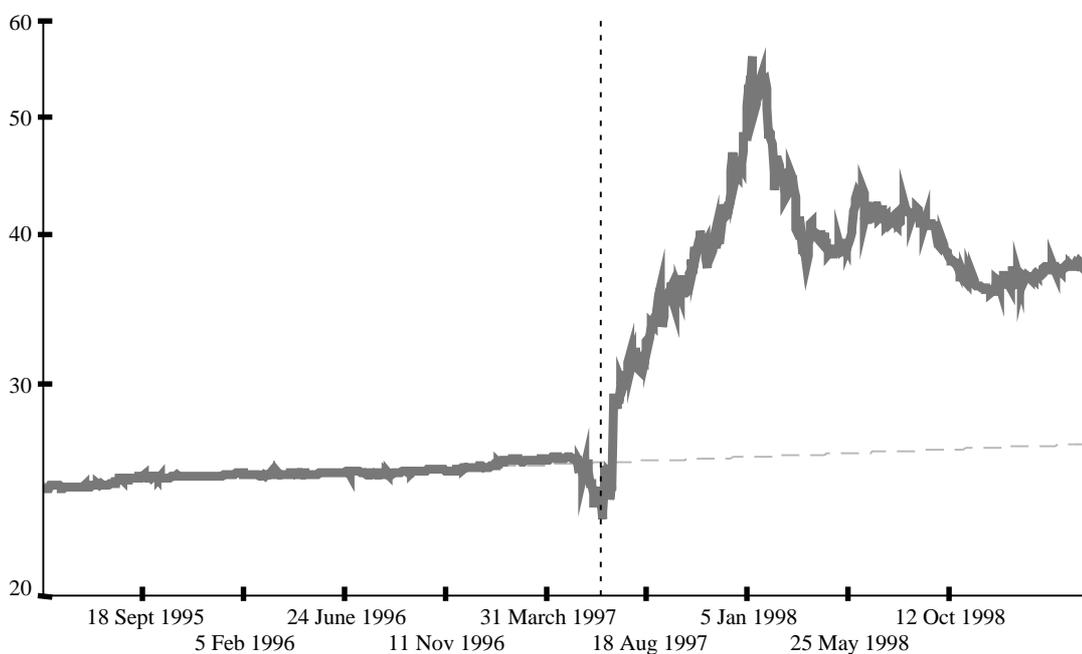**Exchange Rate**
(Korean won per US dollar)

Interest Rates
(% per annum)

Figure 5
Thailand

Exchange Rate
(Thai baht per US dollar)

| | 18 Sept 1995 | | 24 June 1996 | | 31 March 1997 | | 5 Jan 1998 | | 12 Oct 1998 |
| 5 Feb 1996 | | 11 Nov 1996 | | 18 Aug 1997 | | 25 May 1998 |

Interest Rates
(% per annum)

Thai 3m rate

Euro$ 3m rate

| | 18 Sept 1995 | | 24 June 1996 | | 31 March 1997 | | 5 Jan 1998 | | 901 |
| 5 Feb 1996 | | 11 Nov 1996 | | 18 Aug 1997 | | 25 May 1998 |

31
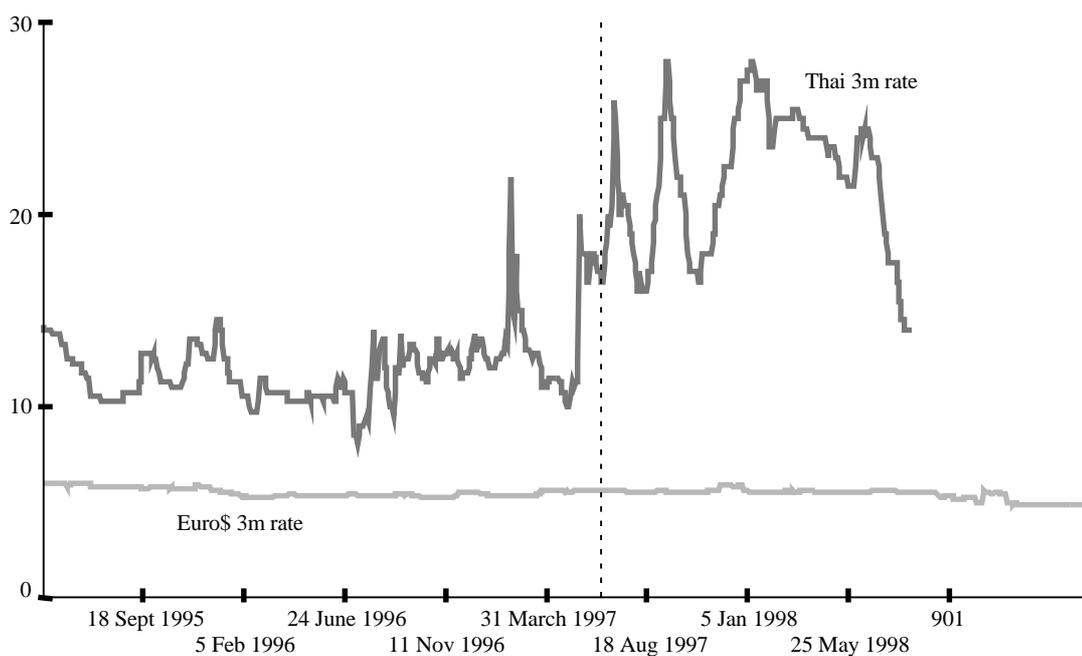
Figure 6
Malaysia

Exchange Rate
(Malaysian ringitt per US dollar)
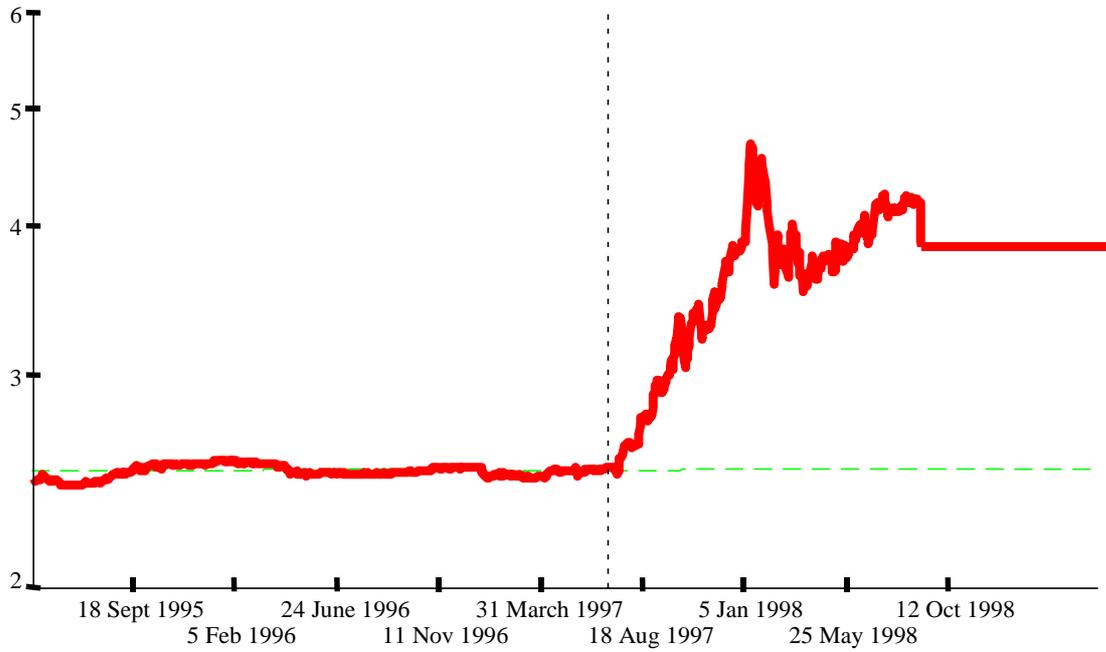
Interest Rates
(% per annum)
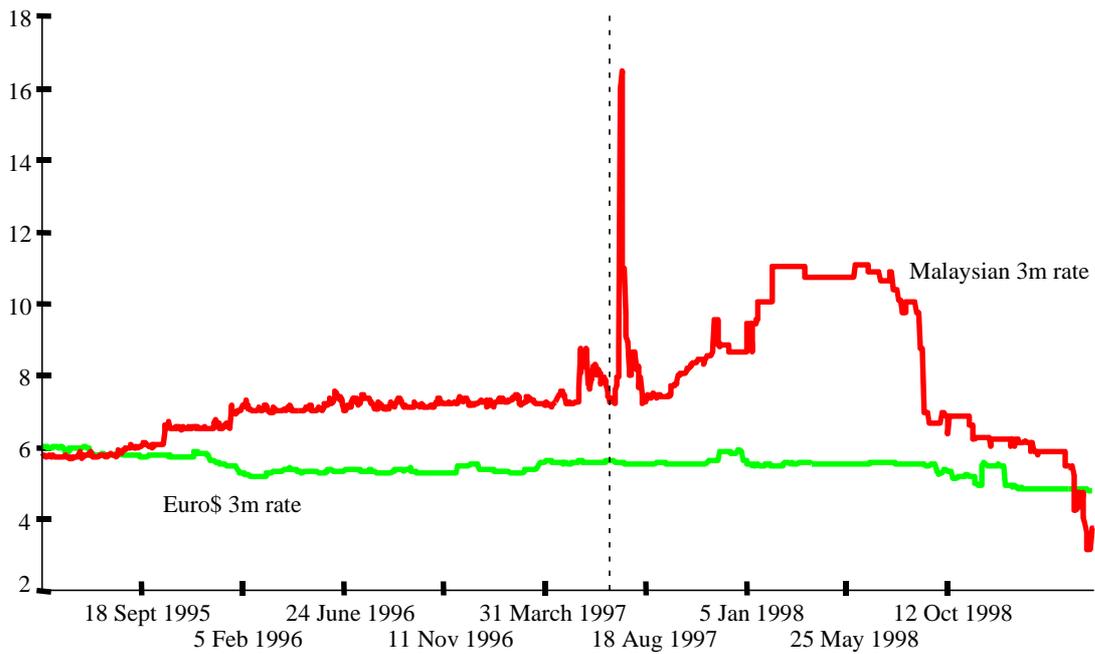
Figure 7
Indonesia

Exchange Rate
(Indonesian rupiah per US dollar)
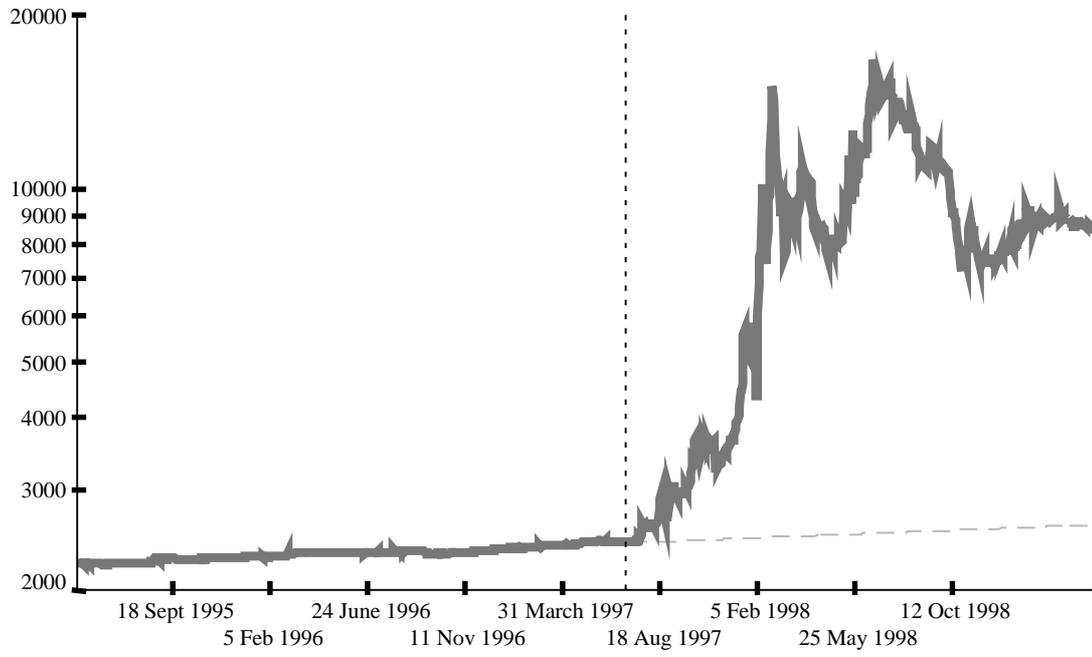
Interest Rates
(% per annum)
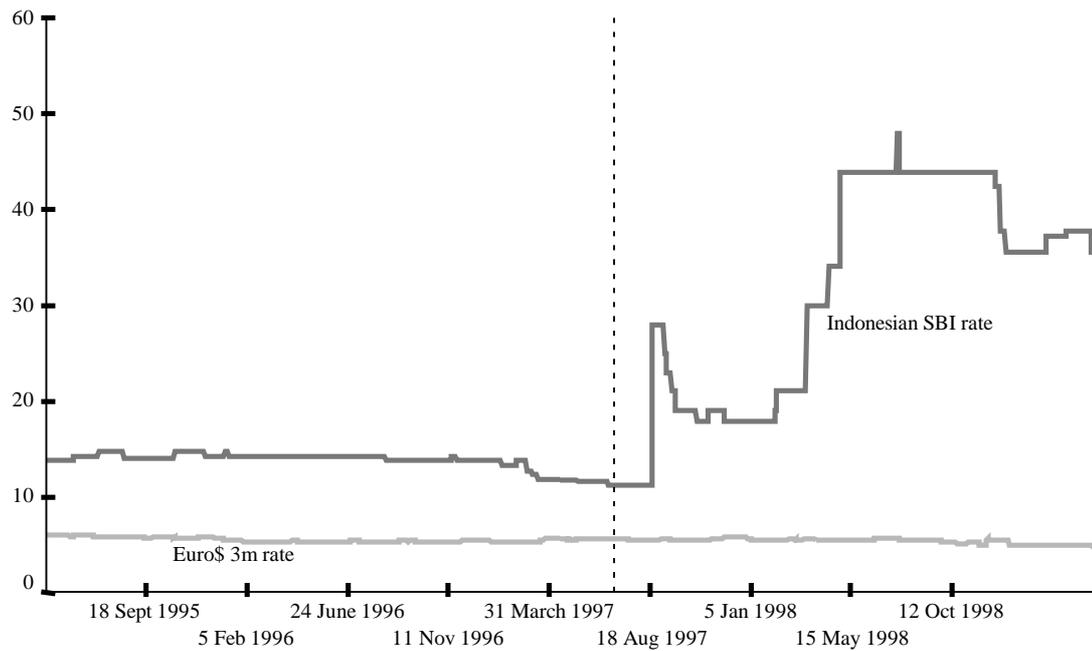
Figure 8
Russia

Exchange Rate
(Russian roubles per US dollar)
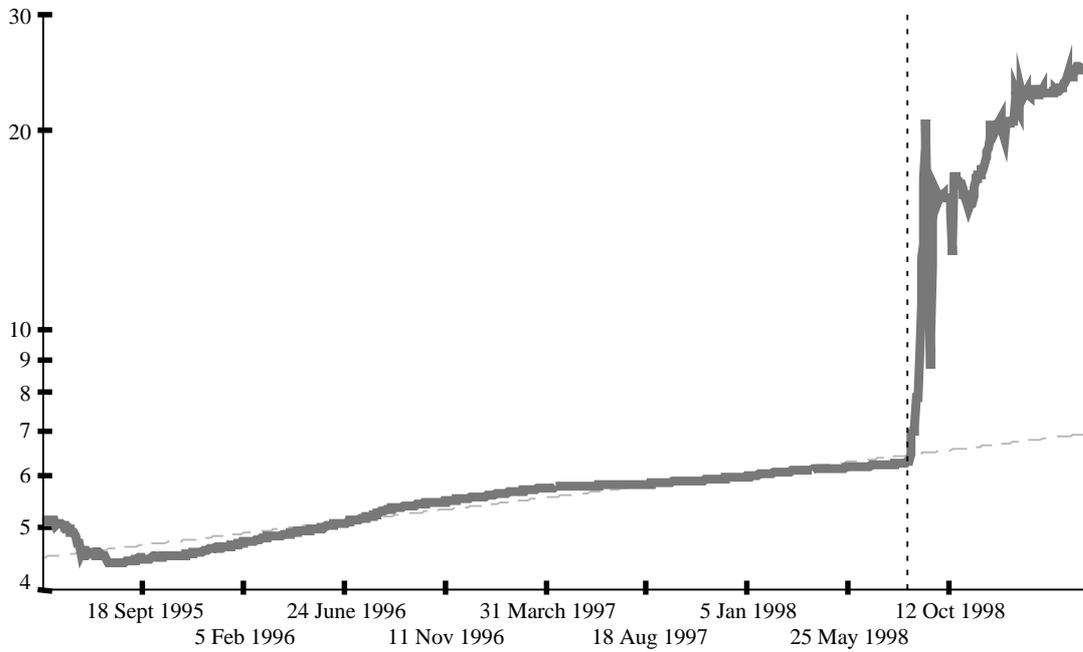
Interest Rates
(% per annum)
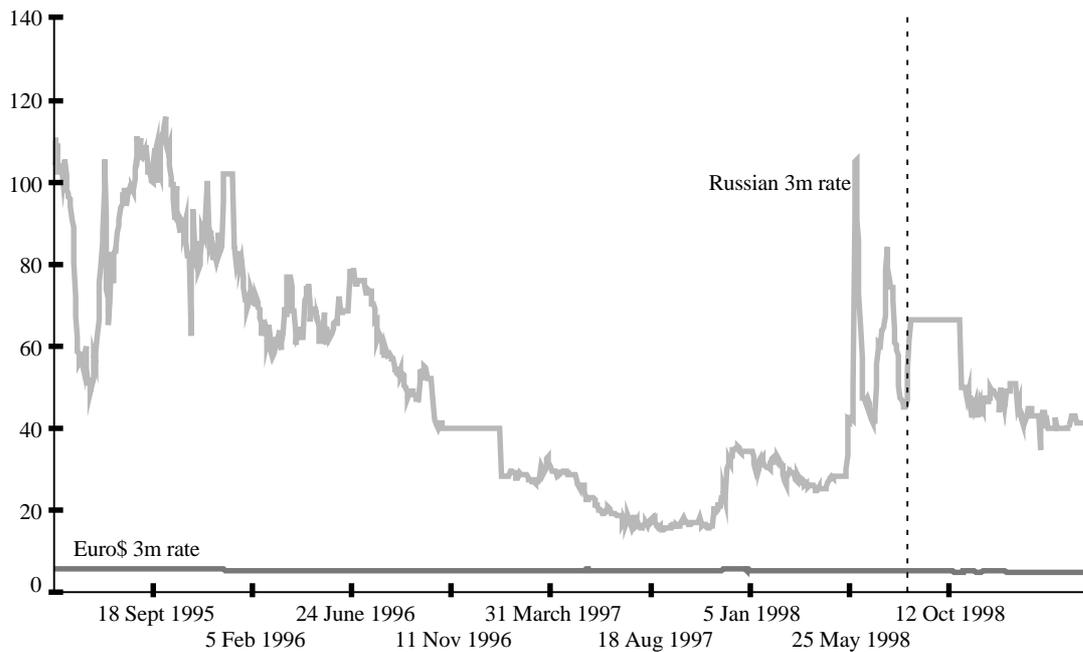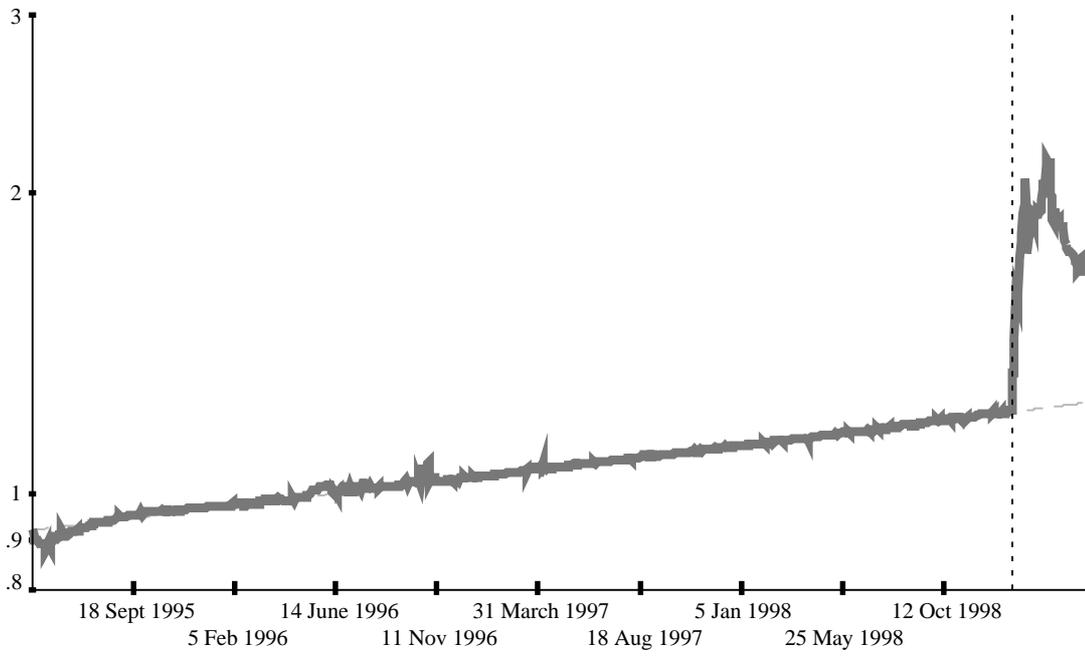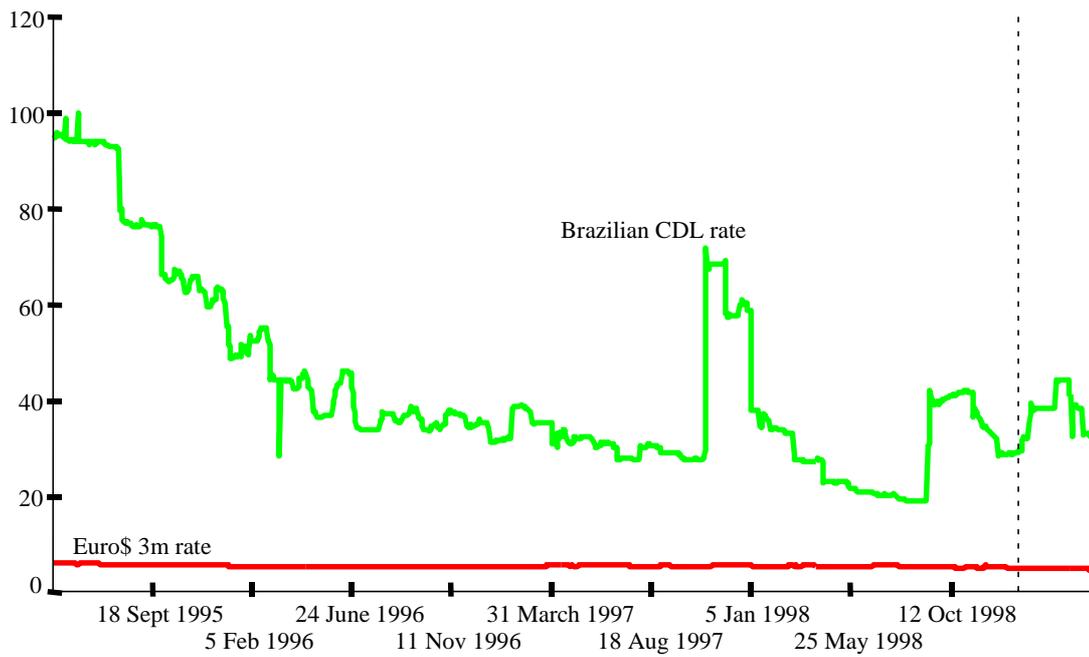
Figure 9
Brazil

Exchange Rate
(Brazilian reals per US dollar)

Interest Rates
(% per annum)

VIII. 'BAD FIXES' AND THE CASE FOR CAPITAL CONTROLS

What light does our analysis shed on the question posed in the introduction, namely, what is the appropriate exchange-rate regime for an emerging market? Because domestic supervision and regulation is assumed to be insufficient fully to curtail moral hazard in banks, our policy proposals are inherently second-best. The best solution would be to implement regulatory reforms for directly limiting domestic credit risks and open positions in foreign exchange. Then, the choice of exchange-rate regime—at least on the dimensions discussed below—would be of secondary importance.

However, even in our second-best world, a 'bad fix' looks unambiguously bad in aggravating the moral-hazard problem. Domestic banks accepting unhedged foreign-exchange deposits see the upward drift in the real exchange rate reducing their real interest rate below even the 'risk-free' world interest rate. In addition, as $E\hat{e}_{regime change}$ rises sharply, so does the super risk premium measuring the greater cost of capital (interest rates in domestic currency) seen by hedged borrowers compared to those with unhedged foreign-exchange liabilities. Faced with having their economic positions completely undermined, normally conservative banks and firms would also begin to gamble by borrowing unhedged in world markets. Public morale for enforcing prudential regulations could crumble altogether—as in the Russian débâcle in the summer of 1998.[5]

When potential moral hazard is extreme both in deposited-insured banks and in government-sponsored corporations, *capital controls* that prevent agents from taking net positions in foreign exchange may well supplement domestic prudential regulations. In the order of economic liberalization, capital controls should be liberalized only after everything else—including macroeconomic stabilization and prudential bank regulation and control—is securely in place (McKinnon, 1973, 1993*b*).

For example, China's commercial banks have had festering bad-loan problems for many years, and many of its state-owned enterprises are loss-makers. Wisely, the government has contained the moral hazard by ringing the country with capital controls so that corporate short-term indebtedness in foreign currencies is negligible. Together with more stable macroeconomic policies leading to a good fix for the yuan/dollar exchange rate, this regulatory prudence has been rewarded with a negligible super risk premium. From 1997 into 1999, interest rates on yuan-denominated assets in China were virtually the same as those on dollar denominated assets in the USA.

In incompletely reformed economies, the case for capital controls as an extension of prudential regulations over the domestic financial system can hardly be faulted—even if this is difficult to implement in economies that are already highly dollarized as in much of Latin America. But where successfully implemented, as in China or Malaysia at the present time, then 'floating the exchange rate' is simply not an option. By definition, banks and other important market-making institutions are restrained from taking open positions in foreign exchange. Thus, the exchange rate cannot float freely. The government must make the foreign exchange market because private agents are now prohibited from doing so by the existence of controls. What sort of managed exchange-rate regime should the government aim for?

First, the authorities must recognize that a forward market in foreign exchange cannot exist with capital controls in place. The natural market-makers, banks, are prohibited from covered interest arbitrage, which otherwise would make a forward market possible—as per equation (2) above. But domestic importers and exporters need some kind of official forward signal as to what their future foreign-exchange earnings and costs in terms of the domestic currency are likely to be. (The need of banks and other financial institutions for forward cover is obviated if the controls themselves succeed in preventing them from having net foreign-exchange exposure.) A 'good fix' to the dollar, the effective international standard of value for most emerging market economies other than Eastern Europe, is an appropriate bench-mark on which importers and exporters can

[5] This paper focuses on international overborrowing on the liabilities side of banks' balance sheets without looking at the parallel shift by households and firms of their non-interest bearing domestic money into foreign exchange. Under a bad fix with ongoing inflation, this two-way flow of capital—where some entities deposit abroad while others overborrow—has been analysed in McKinnon (1993*b*, ch. 9).

base their decisions. Ideally, a stable dollar exchange rate could also provide an effective nominal anchor for the domestic price level—as was true throughout the high-growth East Asian emerging market economies before the currency attacks of 1997 (McKinnon, 1999).

With more erratic domestic inflation, however, a managed downward crawl—perhaps with a band around it—can help stabilize the real exchange rate seen by importers and exporters by making movements in the nominal exchange rate more predictable. With capital controls in place from the mid-1980s to the mid-1990s, both Chile and Israel successfully managed downward crawls without overborrowing. In inflationary economies, some such exchange-rate system, combining a crawling peg with capital controls, dominates a 'bad fix' without capital controls.

IX. GOOD FIXES VERSUS FREE FLOATS IN FINANCIALLY OPEN ECONOMIES

Now suppose our prototype emerging market economy is financially open, i.e. there are no capital controls. Hedging against currency risk is now possible because forward markets exist. However, it is likely to remain difficult to enforce hedging requirements on domestic banks because of the weakness of financial supervision and regulation. In this context, floating the exchange rate is an option. If the macro fundamentals are sound (in the sense that there is fiscal balance and no need to resort to the inflation tax), a 'good fix' of the exchange rate is also an option. McKinnon (1999) shows that, before 1997, the East Asian economies—both those that were subsequently attacked and those that were not—had 'good fixes' for the exchange rates. From our fairly narrow perspective of minimizing moral hazard in international capital flows and mitigating the tendency towards overborrowing, how should the government choose between a 'good' fix and a 'free' float?

Referring back to equation (5), this boils down to the question of which exchange-rate regime *minimizes the super risk premium*, the margin of temptation

for domestic banks to accept unhedged deposits in foreign exchange. Would ρ_{super} be greater under a good fix or a free float? Under a good fix, PPP holds but, unlike a permanent fix such as under a currency board, the regime could change. In determining the size of the differential between deposit interest rates in domestic and foreign currency, the term $E\hat{e}_{regime\ change}$ is a significant component. But so is $\rho_{currency}$, the penalty for having ongoing volatility in domestic prices and interest rates greater than the centre country's.

Suppose an emerging market economy had succeeded in integrating its monetary policy with that of the centre country so that its nominal exchange rate—as well as its internal price-level and interest rates—have been quite stable. Under such a good fix, both $E\hat{e}_{regime\ change}$ and $\rho_{currency}$ would be quite moderate. For example, Malaysia's nominal interest rates were less than 2 percentage points higher than America's before the 1997 attacks. Then ask the question, if the authorities (had) decided to 'float' the exchange rate, would this interest differential have narrowed further?

True, $E\hat{e}_{regime\ change}$ could decline under floating as the danger of a discrete devaluation seemed more remote. But as the exchange rate begins to move randomly, which is one way of defining a free float, surely $\rho_{currency}$ would rise? As the economy lost its nominal anchor, domestic price-level and interest rate volatility would increase—and so would the currency risk premium.

To express this in another way, it has been argued (McKinnon, 1999) that in financially open emerging market economies that are fully integrated into the world trading system, such as Thailand or Korea, the domestic price level needs to be aligned towards the international price level expressed in US dollars. A 'good fix' to the US dollar achieves this objective. Allowing the domestic currency to float against the dollar from this starting point simply introduces 'noise' into the domestic price level associated with 'portfolio shocks' in the international capital market. Within the framework we have described above, this 'noise' is a pure cost. Not only does it make the domestic price level less stable directly, it also reduces macroeconomic stability by introducing a

risky margin on which banks enjoying government guarantees can speculate. This can lead to overborrowing and the type of crisis that has been common of late.

We conclude that floating need not succeed in reducing ρ_{super}, and thus need not succeed in reducing the temptation to borrow unhedged in foreign exchange. Indeed, with inadequate domestic prudential controls over foreign-exchange exposure and domestic credit risk, a floating rate could be suddenly attacked much like a fixed one.

From the broader perspective of monetary policy, however, giving up on a good fix loses the price-level anchor—which the smaller East Asian economies had used quite effectively in their 'miracle' growth phases. By all pegging to the same monetary standard before 1997, they also had mutual protection from competitive devaluations. In assessing what went wrong in the Asian crisis economies, we would implicate the breakdown in domestic prudential bank regulations—including the premature elimination of capital controls—but we would not fault their 'good-fix' exchange-rate regimes.

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