

Capital Movements: Curse or Blessing?*

Michael P. Dooley and Carl E. Walsh

Interest in capital controls has been a highly cyclical industry. As Tobin (1996) observed “The interest that occasionally arose (for his transactions tax proposal) came from journalists and financial pundits. It was usually triggered by currency crises and died out when the crisis passed from the headlines.” Financial crises have certainly been a frequent and painful feature of the international monetary system in recent years. The obvious welfare costs of crises have led to a general reevaluation of strategies for opening repressed financial systems to international competition.

The limitations and fragility of private credit markets in developing countries should not have been a surprise. Financial markets in industrial countries are highly regulated and there is a very large and sophisticated literature on the market failures that make this regulation necessary. The primary objective for supervision and regulation in industrial countries remains the maintenance of financial stability. In this paper we note that the regulatory framework in industrial countries has evolved away from crude controls over insured banks' ability to compete for liabilities. Nevertheless, capital controls designed to limit insured residents ability to sell liabilities to nonresidents may be the best available prudential control in emerging markets today.

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We argue below that controls over bank liabilities, such as regulation Q ceilings on deposit interest rates in the United States, were effective prudential controls when the United States was an "emerging market." Limitations on "capital inflows" to banks were designed to limit banks' ability to compete for deposits in order to exploit government provided deposit insurance. Because such controls are costly, the United States and other industrial countries have moved to a regulatory environment based on complex assessments of capital adequacy and risk. But while financial liberalization in emerging markets has generally relaxed constraints on liability management of insured institutions, it is almost certain that the authorities cannot jump overnight to modern regulatory framework. For a newly liberalized emerging market, an appropriate entry tax on capital inflows may be an effective transitional measure. If the authorities cannot regulate the risk taking activities of domestic financial firms, it might still succeed in limiting their ability to compete for foreign funds.

Should governments of developing countries introduce controls on international financial transactions if controls could mitigate this loss? We should be careful to do the accounting correctly. If controlled capital markets generate a lower growth in tranquil times, the present value costs of this policy are potentially enormous. The complexity of intertemporal resource allocation gives market mechanisms the decisive edge over planning, but we have ample evidence that badly structured and poorly regulated private financial markets can also misallocate resources. Certainly the empirical literature provides conflicting answers. Edwards (2001) suggests that countries with more open capital accounts have benefited in terms of economic growth, although this positive effect may only operate once a country has reached a threshold level of development. Glick and

Hutchison (2000) find evidence that capital controls may actually make a country more vulnerable to currency crises. To begin to answer these important questions we have to better understand the relationship between capital controls and financial crises.

I. Net or Gross Capital Flows?

What is at stake in choosing to participate in international capital markets? Is it the net resource transfer that alters the time path for consumption and/or capital formation? Or is it the more efficient intermediation of foreign and domestic savings that results in a more productive capital stock? If we *assume* the productivity of the domestic capital stock is independent of the process of financial intermediation, controls on capital inflows or outflows can be evaluated according to their effect on the marginal real cost of domestic capital formation. An “effective” capital control program is defined as one which distorts yields faced by nonresidents and, in turn, alters net private capital inflows.

A very large traditional literature reviewed in Dooley (1996a) examines initial conditions that might make such a government intervention a second best welfare improving policy. An empirical study of the Chilean control program, (Edwards, 1999) estimates the cost of distorting net capital flows in recent years and finds it substantial.

In our view there is a good possibility that such exercises miss the essential issue in evaluating capital controls because they do not focus on the economic costs and benefits of international financial intermediation. That is, for a given trajectory for the current account, or its mirror image the net capital account balance, does two-way trade in financial assets improve the efficiency of the savings/investment process in the

participating countries? As Rogoff (1999) points out, the United States has done quite well with a low domestic savings rate, a small increment of foreign savings and a stable, competitive and efficient financial market.

Proponents of controls point out that financial structures that work in the industrial countries often do not work in developing countries. They emphasize moral hazard, asymmetric information and a variety of other potential market failures that require sophisticated *management* of financial markets. While there are a variety of welfare costs associated with these market failures the dominant cost seems to be associated with financial crises. Since sophisticated management is in short supply in emerging markets, unsophisticated management in the form of capital controls may be the next (third) best alternative.

Models of distortions in financial markets imply that an “effective” capital control program can be defined as one that alters the scale or the composition of two-way trade in financial assets. Industrial countries chose just such a system of very restricted domestic financial markets following the economic chaos of the great depression and World War II. The Bretton Woods system of international financial arrangements was built on the foundation of capital account restrictions.

There is no natural correlation between the welfare implications of gross and net capital flows. For example an “effective” welfare-improving capital control program might reduce the volume of gross capital flows and, if the remaining flows are more efficient, increase the net capital inflow to a country. Or an effective program might decrease net inflows but increase gross flows. By increasing the efficiency of intermediation this might increase the productivity of the capital stock and improve

welfare. We can think of circumstances where the two effects are related. Suppose for example that a net capital inflow swamps the ability of domestic financial intermediaries to make sensible investment decisions. In this case large inflows are also poorly intermediated.

With this in mind we turn to a series of models of crises in order to understand better the rationale, if any, for capital controls associated with each. Our main organizing principle is that alternative models have very different behavioral assumptions for governments and private investors. Alternative analytic frameworks place the “blame” for crises on governments, all private investors, some private investors, or some combination of private and government market participants.

II Sources of Financial Crises

The important message from first generation models of crises is that inconsistent macro policy regimes will end in spectacular but predictable and anticipated crashes. The timing of crises does not appear to be related to fundamental macroeconomic policies but it is. The policy advice that flows from this framework is straightforward. Get the fundamentals right and there is nothing to fear.

An important part of the appeal of first generation models is that private investors are rational and competitive and that capital mobility is perfect. At every point in time before and after the crisis private creditors earn a return on domestic securities and money that is consistent with an exogenous world rate of interest. Governments in contrast are quite myopic. They insist on trying to monetize a fiscal deficit but succeed only in financing the deficit by selling off a stock of reserves that was somewhat mysteriously there in the beginning.

The assumption of perfect capital mobility keeps net and gross private capital flows in the background. With no violence to the logic of these models, we could add the assumption that expected returns on foreign and domestic real capital are the same and that time preference is the same so there is no reason for net intertemporal trade. The assumption that the government cannot borrow is equivalent to the assumption of Ricardian equivalence. That is, the optimal current account balance is zero and is independent of government financial decisions.

In an important extension of the basic model, Calvo (1987) demonstrates that, even if the private capital account was completely closed, the inconsistent government

behavior posited in this model will eventually generate a crisis. If the private sector is prevented from adjusting their money balances through the capital account, they will do so through net trade in goods and services. In particular, residents will rearrange their intertemporal consumption so that the government's reserves are exhausted in financing a trade deficit and eventually there will be a crisis that forces a change in the regime. Clearly in this important class of first generation models, capital controls are not a promising policy tool. Governments are clearly to blame for crises, and capital control programs are simply incapable of righting this wrong.

III. Multiple Equilibria, Government Behavior.

The first generation models discussed above assume that private speculators are rational and competitive but that governments are very simple-minded. The apparent absence of such government behavior prior to the EMS crisis suggested that a more sophisticated model of government behavior might be needed to understand crises. Once a more complex assumption concerning government behavior is introduced, the same rational and competitive private investors are obliged to form expectations about government behavior in addition to the other fundamentals. We will refer to models in which multiple equilibria can arise due to the government's behavior as MEG models, because they rely on quite specific assumptions about government behavior. In the next section we discuss multiple equilibrium models based on financial intermediation.

In MEG models, arbitrary shifts in private expectations about government behavior can generate crises. It has long been recognized that expected changes in policy can generate a successful speculative attack even if the government follows fully

consistent policies preceding the attack (Krugman 1996, Garber, 1996). But this is not the story behind this literature.

A much more stringent condition for a self-fulfilling attack is that a shift in private expectations about government behavior generates a change in the *optimal* policy regime. Calvo (1987) summarizes the implications of the argument as follows: “The implications for policy could be staggering: for our results suggest that postponing taxes (i.e., falling into debt) may generate the seeds of indeterminacy; it may, in other words, generate a situation in which the effects of policy are at the mercy of people's expectations--gone would be the hopes of leading the economy along an optimal path.” Flood and Garber (1984) and Obstfeld (1986) show that if a government is expected to follow more expansionary monetary policies following a successful speculative attack on the fixed exchange rate regime, policy regimes that would otherwise be viable can be forced to collapse by self-fulfilling private expectations.

Obstfeld (1994) refines the argument by specifying the political economy that might account for the government's behavior before and after an attack. The analysis sets out a rational government that seeks to maximize a plausible objective function. Since the government's objectives are the same in any exchange rate regime, it follows that policy setting under different regimes must reflect changes in the economic environment rather than arbitrary assumptions concerning the government's behavior.

Several papers have examined crises in emerging markets and concluded that shifts in private expectations are important elements in an attack sequence. Calvo and Mendoza (1996) argue that the crisis in Mexico in 1994 is consistent with the idea that the government's short-term debt and the anticipation of a bailout for a weak banking

system made it vulnerable to a shift in private expectations. Cole and Kehoe (1996) also argue that events in Mexico are consistent with a self-fulfilling crisis. Sachs et al. (1996) examines characteristics of 20 countries that seem to contribute to their vulnerability to speculative attacks following the Mexican crisis in 1994. They find that prior lending booms, overvalued exchange rates and low levels of reserves relative to M2 explain a large part of this experience. They also find that fiscal and current account deficits seem to be unrelated to a country's vulnerability to attack.

III. Capital Controls and Multiple Equilibria

In MEG models, crises can be blamed on the government since the government decides to incur debt and to issue a debt structure that is vulnerable to shifts in private expectations about future government policy. But investors are also partly to blame since it is the arbitrary shifts in private expectations that trigger the swing from a good to a bad equilibrium.

Capital controls are surprisingly difficult to evaluate in this class of crisis models. If only a subset of investors were prone to shifting expectations, it follows that a control program that prevented such investors from acquiring claims on the debtor country would be effective in preventing crises. The argument is even more attractive if it is possible to limit investors with volatile expectations while at the same time interfering less, or not at all, with investors that base their expectations on fundamentals. This is the basic logic behind the well-known Tobin Tax proposal. The key feature of this government intervention is that it is designed to tax relatively heavily capital inflows that are held for short periods of time. This presumes such flows are dominated by traders that move in

and out of the market more frequently than could be “reasonably” associated with changes in expectations about the fundamentals:

"The hope that transactions taxes will diminish excess volatility depends on the likelihood that Keynes's speculators have shorter time horizons and holding periods than market participants engaged in long-term foreign investment and otherwise oriented toward fundamentals. If so, it is speculators who are the more deterred by the tax."¹

This is a sensible conjecture but does not stand up to empirical evaluation. Dooley (1996b) argues that there is no evidence that high transactions costs tend to deter noise traders relative to investors who evaluate fundamentals, and there is some weak evidence to the contrary. Perhaps more importantly, there is considerable doubt that reducing the variability of prices can generate increases in welfare since the turnover tax tends to increase the volatility of expected yields

The more conventional assumption is that expectations are uniform across private speculators but subject to arbitrary shifts. In this case an effective ex post restriction on capital outflows would prevent the move to a bad equilibrium. But self-fulfilling attacks can go the opposite direction. For example, a spontaneous decline in private inflationary expectations could set in motion a sequence of falling interest rates and fiscal deficits that generate a good equilibrium. It is perhaps informative that there seem to be few examples of changes in private expectations generating self-fulfilling virtuous responses by governments. Countries that start from a bad equilibrium should shun capital controls since they would delay adjustment to the new more optimistic private expectations.

A number of papers have exploited the idea that controls themselves might be powerful signals concerning the government's future policies. If private sector investors

knows that the system is protected by controls, they would be less impressed by observed stability. Lane and Rojas-Suarez (1992), for example, argue that the use of controls has ambiguous implications for credibility of a monetary policy regime.

Dellas and Stockman (1993) show that a speculative attack might be generated by the expectation that capital controls will be introduced. If the government can commit not to introduce controls, the fixed rate regime is sustainable. In this model a regime that is otherwise viable becomes vulnerable to expectations that controls will be imposed in response to the attack. This increases interest rates before the attack and generates the conditions for a self-fulfilling devaluation.

Bartolini and Drazen (1997) develop the idea that controls themselves are a signal that affects private sector expectations concerning the government's future treatment of investors. In their model the removal of controls signals to investors that the government is less likely to tax foreign capital income, or reimpose controls once the capital inflow is in place.

Finally, Obstfeld (1986) shows that capital controls can generate multiple equilibria where none exist with capital mobility. In this model multiple equilibria are a feature of a maximizing model with effective capital controls. Residents of the controlled economy maximize the utility of real money holdings and consumption over time subject to their balance sheet constraint. Owing to effective capital controls residents can accumulate real money balances only through current account surpluses, which have as a mirror image increases in the central bank's net foreign assets. Because the net foreign asset position of the central bank earns the world interest rate, a current account surplus

1 Eichengreen et al (1995)

generates an increase in the expected permanent income of residents. An unstable equilibrium occurs if the increase in real money balances, and the associated increase in expected income, is not more than matched with an increase in current consumption. If not, the current account surplus increases and money balances and income continue to rise until a stable equilibrium is reached. This is not an argument for or against capital controls. It only demonstrates that when the domestic interest rate is distorted through a capital control program the usual assumptions that generate convergence to unique steady state equilibrium are not sufficient.

This literature presents a genuine problem for the policy implications of capital controls. On the one hand, an effective capital control program might buy enough time for the government to move the fundamentals to a region where self-fulfilling speculative attacks are less likely. The implication seems to be that controls might be a temporary measure to buy time for a virtuous government to establish its reputation. On the other hand, it is easy to show that the fact that controls might be introduced in the future can generate attacks where none would occur otherwise. Finally, the market might interpret the removal of controls on capital outflows as a commitment not to penalize foreign investors. If so, the removal of controls would generate capital inflows.

On the surface it appears that controls might delay or even prevent a speculative attack and the associated costs. But the typical policy of imposing controls as the attack occurs, probably because the authorities believe that the controls are not effective for long, can also be a powerful force to trigger speculative attacks. Finally, a careful treatment of expectations can suggest that policies designed to limit net capital inflows might have just the opposite effect.

IV Capital Controls and 3rd Generation Models of Speculative Attack

Third generation models of speculative attacks also predict that good and bad equilibria are possible but in these models shifts in private expectations interact with private financial intermediaries rather than with the government. In our view MEF, multiple equilibria financial structure, models offer the most interesting and potentially useful framework for evaluating capital controls.

There is a range of closed economy models that provide insights into the structure of financial markets, the sources of financial fragility, and the role that policies might have on both the efficiency of financial markets and their stability. By and large, these models have not been designed to address directly the issues associated with international capital flows. Typically, theory deals with broad classes of agents – lenders versus borrowers, consumers versus firms, entrepreneurs versus savers. These categories do not necessarily correspond to whether the market participants are foreign or domestic residents. However, economic theory does highlight important sources of credit market imperfections and their implications for financial instability.

In this section, some key models of financial market structure are reviewed. We begin with a discussion of bank runs, situations in which a bank is unable to meet the withdrawal demands of its depositors. Bank runs represent one possible equilibrium, a bad one, in models in which the absence of a run, the good equilibrium, is also possible. The role of the sequential service constraint, herd-like behavior, and information cascades that might generate bank runs are discussed in the next section. We then turn to

the asset side of the bank/country balance sheet. Here, moral hazard problems and asymmetric information affect the nature of financial contracts.

1. Depositor/investor runs

A useful starting point for an analysis of financial fragility is the classic Diamond-Dybvig (1983) model of bank runs. This model provides a well-defined environment in which there is a demand for liquidity, and banks can perform a maturity transformation function that, in equilibrium, is welfare improving. However, there is a second equilibrium in which a bank run occurs. In this second equilibrium, all depositors attempt to withdraw their funds from the bank. Losses are suffered as the bank liquidates its assets to meet these withdrawals.

The basic Diamond-Dybvig model focuses on two key factors. First, investments normally require that funds be committed for some period of time. This can be thought of as reflecting higher expected returns on long-term investments, or simply that there are costs of liquidating asset holdings. Assets held to maturity offer higher returns than assets sold before maturity. Second, individuals are uncertain as to when they will need their funds. There is a positive probability that an investor will need to liquidate before maturity.²

In the absence of aggregate uncertainty, a predictable fraction of all individuals will discover they need their funds early. In this environment, a bank can provide

² In autarky, each individual would self insure by investing less than his whole wealth in the productive asset, holding some wealth in liquid form. If a bond market opens, an agent who discovers that he needs liquidity can finance early consumption by issuing a bond rather than liquidating (at a cost) the long-term asset. This improves over autarky but still fails to provide liquidity insurance efficiently.

liquidity risk insurance to individual agents, accepting deposits and investing in the long-term asset. The deposit contract specifies the amount a depositor may withdraw prior to the asset's maturity. Because there is no aggregate uncertainty, banks can always hold exactly the level of reserves necessary to meet withdrawals by impatient consumers. Patient consumers will be better off if they leave their funds in the bank and receive a higher payout when the investment asset matures.

A bank run can take place; however, if patient depositors believe other patient depositors will draw their deposits. If all patient depositors attempt to withdraw their funds from the bank, the bank will, even after liquidating its assets, have insufficient funds to meet withdrawals – the bank falls. So if a patient depositor expects others to withdraw early, it is individually rational to try to withdraw early as well.

2. Bank runs and country runs.

The idea that there are patient and impatient international investors has been a prominent feature of informal discussions of international capital flows. The traditional analysis of “hot money” flows assumes that the nature of the financial instrument traded reveals something about the behavior of the investor. In particular, investors that are likely to become impatient and start a run on a country are assumed to prefer short-term debt instruments.

Chang and Velasco (forthcoming) use the Diamond-Dybvig structure to analyze international capital flows. They focus on the problem of illiquidity, defined as a situation in which the domestic financial sectors' short-term potential liabilities exceed the liquidation value of its assets. Access to foreign borrowing can reduce the chances of a

bank run by providing the domestic bank with an additional source of short-term funds. However, failure of foreign lenders to extend lending when domestic banks experience a run has the effect of making banks more vulnerable to runs. The belief on the part of domestic depositors that foreign lenders will refuse to extend short-term credit can trigger a bank run and force the closure of domestic banks. The presence of short-term foreign borrowing makes the domestic financial sector more vulnerable to a decision by foreign lenders not to roll over the existing stock of debt. In that sense, short-term foreign debt increases financial sector fragility.

The basic insights of this model have focused attention on two issues. First, what might cause panic runs on the bank/country? This is essentially a question about equilibrium selection. What determines whether the good (no-run) equilibrium or the bad (run) equilibrium occurs? Second, can the deposit/external debt contract offered by the bank/country be restructured to eliminate the possibility of a run? This question is of particular relevance for an analysis of capital controls. Can the nature of domestic liabilities held by foreign investors be altered via regulations in ways that reduce the possibility of a panic?

3. Narrow banking

Four basic solutions that focus on the nature of the deposit contract have been examined. The first is narrow banking. A bank could be required to hold a level of reserves sufficient to meet withdrawals in all possible circumstances. While narrow banking eliminates the possibility of a run, it does so by essentially eliminating the ability of banks to offer maturity transformation services. Since this was the benefit to be

derived from banks in the first place, narrow banking essentially returns the economy to the autarkic equilibrium.

The capital control regime that is the counterpart to narrow banking is one which would require that the maturity structure of a country's external liabilities match the maturity structure of the country's assets. While this solution to runs is a nonstarter for banks, it makes more sense in the context of international financial markets. Emerging markets have typically borrowed short and invested in a portfolio of assets including international reserves, private claims on foreigners and the domestic capital stock. But it is not clear that liquidity transformation is a necessary or welfare-improving aspect of international lending to developing countries.

If nonresident investors were forced to accept long-term debt or equity claims on the debtor country this could be viewed as a useful way for them to coordinate on the good (patient) equilibrium. Moreover, if the problem was self-fulfilling runs, foreign investors would presumably recognize this as a superior structure of debt and lend on better terms.

4. Suspension

Diamond and Dybvig offer a second solution – suspension of convertibility. If the bank can perfectly predict the number of impatient consumers, it can hold reserves sufficient to meet the withdrawals of impatient consumers. If additional depositors attempt to withdraw funds, the bank simply suspends convertibility. All the impatient consumers are able to withdraw their funds, and the patient consumers have no incentive to withdraw early since they know the bank will always have adequate funds in the

future. The bank will have adequate funds because it suspends convertibility if deposit withdrawals threaten its reserves.

Allowing for a suspension of convertibility does not affect the fundamental maturity transformation service banks provide. It acts more as an equilibrium selection device, ensuring that the economy achieves the good equilibrium without runs. Prior to the founding of the Federal Reserve System, U.S. banks normally suspended convertibility during banking crises.

This model offers a relatively clear and convincing reason for seriously considering capital controls as a policy to minimize crises. Diamond and Dybvig advocated suspension of convertibility as a cure for bank runs that allowed banks to continue to provide liquidity services. The obvious parallel in international financial markets are the controls on capital outflows from Malaysia following the 1999 crisis. Such controls make nonresident claims temporarily inconvertible into cash, much like the suspension of bank deposits into cash. There is of course the problem that nonresidents may doubt the temporary nature of this policy and may also doubt that they will ever receive the fair market value of their investments following the crisis. But if the policy actually is temporary and prevents fire sales, nonresident investors should welcome such a policy as being in their collective interests. The fact that they did not welcome this initiative may have more to do with the perceived intentions of the Malaysians than with the economic logic behind the policy.

Proposals for IMF sanctioned suspension of debt service payment are also in the same spirit. The problem, of course, is in deciding when the problem is only impatient investors and when there is a real loss to be allocated. Nevertheless the logic is

compelling. If the “fault” for the crisis lies with the incomplete contracts, in this case with the fact that the contracts are not state contingent, then a natural solution to the problem is to make the contracts state contingent ex post.

5. Deposit insurance or lender of last resort

A third class of solutions to the bank run problem, deposit insurance or a lender of last resort, is the most commonly observed. Under a deposit insurance scheme, patient depositors have no incentive to withdraw their deposits. Of course the presence of deposit insurance can lead to a moral hazard problem as banks have an incentive to hold riskier assets. The role of government insurance in creating the conditions for a crisis is discussed in section V below.

The interesting application to international crisis management is that an international lender of last resort is an *alternative* to capital controls in preventing runs. But as discussed below, the moral hazard generated by insurance can also provide a powerful rationale for controls.

6. Equity or direct investment only

A fourth solution, due to Jacklin (1987), alters the nature of the deposit contract, essentially replacing it with an equity stake in the bank. Depositors who discover they are impatient can sell their shares at a market-determined price. Depositors who discover they are patient will wish to buy additional shares in the bank. While eliminating the possibility of a run, equity contracts may do worse than deposit contracts as a means of providing liquidity insurance.

The potential inefficiency with equity contracts is of less concern when applied to international capital flows. There, the stability of the domestic financial sector, rather than the provision of liquidity to international investors, would be of primary concern. While equity contracts do solve the problem of runs, the attractiveness of equity contracts is diminished as soon as additional credit market imperfections are recognized. Imperfect information about investment projects, for example, can lead to agency costs that, in turn, give rise to a role for collateral. In such an environment, fluctuations in the share price of the bank may affect the bank's ability to raise funds.

7. Effectiveness and derivatives

An important problem with these and similar arguments for capital controls is the assumption that different types of capital flows can be differentially taxed. This is an empirical issue, since it depends on the authority's ability to monitor the behavior of private investors and to tax only some types of activities. In our view recent experience is not encouraging. While capital control programs have been able to change the description of capital flows, it is not clear that this also changes the economic behavior of the investors. It is quite easy to modify the economic nature of an international investment by combining the balance sheet entry subject to regulation with a derivative position that is very difficult to monitor. Professionals in this area claim they can "undo anything better than you can."

8. Sequential service constraints, herding, and financial fragility

The first-come-first-serve nature of deposit contracts creates an incentive for even patient depositors to withdraw funds immediately if they fear others may withdraw their deposits. The same problem is obvious in the international context. Investors that get to the central bank before its reserves are exhausted are paid in full while late comers suffer losses. In this environment investors' beliefs about what other investors will do become critically important, and multiple self-fulfilling expectational equilibria can exist. A set of financial institutions and regulations may support an efficient and welfare enhancing equilibrium, but the same set of institutions may also be vulnerable to shifts in expectations that push it into a bad equilibrium.

The fragility of financial markets to runs and investor panics has always provided a primary rationale for regulation. Regulations typically are designed to reduce the incentive for runs by such means as deposit insurance and to limit the riskiness of the underlying asset portfolio held by the bank through prudential regulation. Capital controls can be viewed as one mechanism for changing the incentives to run, but to evaluate their possible role requires some consideration of the underlying reasons for investor panics.

One approach has emphasized the problems that may arise when investors have little information themselves, and so base their actions to a large extent on what they see others doing. Seeing others invest in emerging markets, for example, other investors draw the conclusion that such investments are promising, leading to a large flow of capital to emerging markets. Seeing others pull their funds out, others follow suit. This highlights the potentially important role of "herd" behavior and informational cascades. Investors may base their actions on what they see others doing, rather than on their own

information about underlying fundamental conditions.³ The distinction between observing the information of others versus simply observing what others have done is critical, but it is also quite realistic. Particularly in the environment of a crisis, “actions speak louder than words.”

If enough individuals are observed having made one choice (say withdrawing deposits), subsequent agents will disregard their own private information and mimic the actions of others. The weight of the evidence the choices others have made outweighs the individual’s own information. Agents may behave in ways that are inconsistent with their own private information if others have made a different choice. At some point, herd behavior results. Everyone ignores their own information and follows the behavior of the earlier movers.

In this environment, the decisions by the earlier movers can be critical. For example, if a few investors liquidate holdings in a country, others may assume that they must have had good reason to do so (whether in fact they did or not). Drawing such an inference, they also liquidate positions, and a run occurs. This can happen even if the later movers all had private information that indicated they should not liquidate.

Three important points are worth emphasizing. First, the quality of the individual agent’s own information will be important. If an individual believes he has very good information, he may ignore the actions taken by others, deciding instead to act on his own private information. Second, beliefs about the quality of the information others possess is

³ Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) provide models of herd behavior. The common structure of these models involves a discrete choice (leave funds in the bank or withdraw them, for example) that must be made sequentially by agents on the basis of limited information. Agents are assumed to have two sources of information. First, they have a private but noisy signal about which choice is the correct one. Second, they can observe what others before them have done. A key assumption is that while agents can observe the choices made by those who have gone before them, they cannot observe the private signals the earlier movers received.

also important. If investors think that the first to liquidate are likely to be better informed on average, it becomes more likely that herd behavior will result. Third, herding behavior can result in the wrong choice being made.

When multiply equilibria based on non-fundamental factors are possible, it may be possible for government policies to serve a coordinating role that focuses expectations, and therefore the actual outcomes, on the good equilibrium. When capital outflows result from herding behavior, can capital controls help select the correct equilibrium? If capital flows are particularly sensitive to herd behavior, does a role for controls emerge?

The heart of the problem is information, or rather the lack of accurate information. Public information might help, but two difficulties present themselves. First, it is not clear that anyone knows the true state. Second, a government might attempt to provide information on the state of the economy, but clearly a domestic government faced with a financial crisis has an incentive only to release information that would stem the panic. Credibility becomes a critical issue.

Herd behavior arises when agents infer beliefs from observed actions. But it is also the *ability* to react to the observed actions of others that generates the information cascade. Capital controls would make it more difficult, or more expensive, to withdraw funds. This by itself would not affect the argument that information cascades can generate panic outflows unrelated to underlying values. But controls could serve to stem outflows in a crisis simply by limiting the actions available to foreign investors. If shorter-term funds are restricted, uninformed agents no longer have the actions of others to guide their own decisions.

Pure information cascades may have implications for contagion effects as well. Key is what inferences investors make based on the actions of others that they observe. The information provided by observing actions is very coarse – in the case of a currency crisis, for example, the general conclusion drawn might simply be that expected returns have fallen, but it will matter greatly whether international investors assume this is due to country specific factors or more general factors. In the case of the latter, they will conclude that expected returns are now lower not just in the country under attack, but in all countries viewed as similar.

This type of contagion might be expected to be the norm. Herding behavior is most likely to arise when individual agents have relatively poor private information. This is why they may ignore their own information and follow the herd. In such situations, it is unlikely that investors will be able to draw a clear inference about whether a crisis results from country specific factors or whether it results from factors affecting all countries in a similar risk class. Any signs of a crisis spreading may lead quickly to attacks on other countries.

Because information cascades can lead to runs that, ex post, are based on incorrect information, they generate inefficient outcomes. As noted earlier, the solution is to provide better information, but this may not be possible. Governments might have little credibility since they clearly have no incentive to provide accurate information unless it is “good” news. International agencies might have greater credibility, but again the likelihood is that they too would be viewed as unlikely to provide truthful information unless it is good news.

9. Rational Information-Based Runs

Both the Diamond-Dibvig model of runs and the herd behavior that results from information cascades are essentially reflections of bubble phenomena – there is no fundamental reason for the runs. An alternative view of bank runs is that they are based on fundamentals and, in particular, that they can be information based (Gorton 1985).

The basic idea is that bank portfolios are subject to risk, and depositors have only imperfect information about the value of these underlying portfolios. As in any model of the pricing of risky assets, current portfolio choices and asset prices will depend critically on the perceived co-movements among asset returns. Thus, any new information about returns on one class of assets will also affect prices of other assets with correlated returns.⁴ In particular, bad news about returns in one country will lead investors to sell off holdings in other countries viewed as similar. Contagion arises as the rational response to new information.

Gorton (1985) shows how suspension of convertibility can be an efficient response to information-based bank runs. Healthy banks need to signal to their depositors that they are healthy. One means of doing so is to suspend convertibility. Such actions were beneficial to depositors since they prevented solvent banks from collapsing.

A rational, information-based financial panic bears some resemblance to inefficient, information cascades. Imperfect information plays a key role in each case. A key distinction is that information cascades can lead to inefficient equilibria in which agents ignore valuable information. Information-based runs of the type Gorton analyses reflect rational reassessments of risk on the basis of new information. Since agents cannot

⁴ See Kaminsky and Reinhart (1999).

distinguish solvent from insolvent borrowers, any inefficiencies are ex-post, not ex-ante, in nature.

As in any information-based crisis, there may be a role for policy that either provides information or that limits the ability of investors to run. The first type of policy emphasizes the role of prudential regulation. Countries with adequate systems of financial supervision and regulation are unlikely to suffer contagion effects. When runs are based on a reassessment of risks, standard recommendations to limit short-term capital flows may also play a role in limiting a crisis. Again, however, this is only the case if the underlying system is actually solvent.

V. Insurance Attacks

The distortion in the model outlined in this section is generated by a Lender of Last Resort solution to financial panics caused by runs. This policy regime generates incentives for investors to acquire insured claims on residents and to then acquire the government's assets when yield differentials make this optimal. The credit constraint faced by governments of developing countries is important in determining the incentives faced by private investors and the timing of their international investment decisions.

A key feature of the insurance model (Dooley 2000a) is that free insurance raises the market yield on a set of liabilities issued by residents *for a predictable time period*. This yield differential generates a private gross capital inflow (a sale of domestic liabilities to nonresidents) that continues until the day of attack. The private inflow is

necessarily associated with some combination of an increase in the government's international reserve assets, a current account deficit and a gross private capital outflow. When the government's reserves are exactly matched by its contingent insurance liabilities, the expected yield on domestic liabilities falls below market rates and investors sell the insured assets to the government, exhausting its reserves. The speculative attack is fully anticipated and at the time of the attack nothing special happens to the fundamentals or expectations about the fundamentals.

This sequence of events is illustrated in Figure 1. The positive vertical axis in the top panel measures the stock of assets the government, including the central bank, is expected to liquidate *during a crisis* in order to redeem liabilities to the private sector. The negative vertical axis measures the government's total stock of contingent and noncontingent liabilities. We start from a situation in which the value of assets, A_0 , is growing but is less than L_0 , the value of debt. A fall in international interest rates at t_1 reduces the value of government's long term liabilities from L_0 to L_1 , but it does not affect the contractual value of short term assets. A part of the government's assets can now support additional liabilities.

The critical difference between industrial and developing countries is not the nature of the insurance distortion but the conditions under which the insurance is credible. For industrial countries it is reasonable to assume that the government can always borrow in order to honor implicit or explicit insurance commitments. Thus, governments of industrial countries must *always* monitor and discourage efforts by the private sector to exploit the insurance.

For governments of developing countries it is reasonable to assume that they will face market interest rates in the midst of a crisis that make borrowing unattractive or infeasible. It follows that their insurance commitments are credible only if they have assets, or lines of credit with predetermined interest rates, that can be liquidated to support the insurance. The interesting problem is that insurance and ineffective monitoring of the private sector do not generate a distortion all the time but only when the government has acquired assets. Moreover the distortion will not last for a long time because the private sector will immediately set out to capture assets acquired by the government.

In the middle panel we illustrate this process. At t_1 a capital gain on existing government liabilities or assets generates a net liquid asset position for the government. Residents that can issue insured liabilities will now offer to do so in order to appropriate some share “ s ” of the proceeds.⁵ Sellers of such liabilities are residents simply because only residents' liabilities are eligible for insurance. The government's contingent liability is the same fraction of new insured liabilities (the shaded area in the middle panel).

The value of s is specific to the country and is small in a well-regulated market and large in a poorly regulated market. The time derivative of the flow of new issues (the slope of PL) is also specific to each country and is also a function of the supervisory system in place. Relatively poorly regulated financial markets will see a relatively rapid increase in insured liabilities.⁶

⁵ A more realistic form of appropriation is state contingent. That is, insured residents exploit insurance by reaching for risk. They share returns earned in good states of the world and default in bad states of the world.

⁶ We assume in this example that the growth in liabilities is greater than the growth in assets but this is clearly an empirical issue.

Investors are willing to buy residents' liabilities because they are insured and because competition among (resident) sellers will force them to share a part of their appropriation with (nonresident) creditors. This will take the form of above market expected yields on residents' liabilities.⁷ Yields will be the same for both domestic currency and foreign currency liabilities of residents as long as the insurance is expected to cover both types of domestic liabilities.

As long as the “foreign” investors earn above market yields there is a disincentive for an attack on the government’s assets. Investors will prefer to hold the growing stock of high yield insured liabilities of residents and allow the government to hold reserves that earn the risk free rate.⁸ Private profits are realized before the attack. The attack itself is generated by competition to avoid losses. When the contingent liabilities of the

7 The accounting is straightforward if we abstract from financial intermediation. Suppose a resident household can issue a \$10 liability to a foreign investor. The household plans on repaying \$5. The household shares its gain by paying the investor \$2.50 and keeping \$2.50. The investor expects the government to purchase the liability for \$10 in one year. The government's contingent liability is \$5.00. More realistic examples will involve one or more financial intermediaries in this process. The distribution of the rents among the participants will depend on their relative bargaining power. If investors' demand for claims on residents is very elastic, residents will capture most of the rents. This seems to us the most likely outcome. It is difficult to interpret historical evidence for deposit rates. As insurance became credible after 1989, deposit rates should have fallen as the government absorbed default risk. In Mexico real ex post rates on domestic deposits (adjusted for actual changes in dollar exchange rates) fell from about 15 percent above US rates in 1990 to equality with US rates in late 1994. While this pattern in returns is consistent with our model, Mexico's stabilization program may have had important implications for this history of yield differentials.

8 In most emerging markets the capital inflows have been partially sterilized so that gross reserve assets also begin to grow more rapidly at t_1 . However, the government must issue domestic currency debt to finance the purchase of reserves. In this simple example we assume that sterilized intervention does not add to the net stock of liquid assets expected to be exhausted at the time of attack. A more realistic treatment of the relative seniority of alternative government liabilities and expected capital gains and losses on gross positions would not change the qualitative results of the model.

government are just equal to liquid assets ($A_2 = L_2$), competition among investors will insure that all will “call” the insurance option.

The bottom panel of Figure 1 reflects the assumption that nonresidents demand a constant premium in order to accumulate insured deposits. On the day of the attack the expected value of this premium *becomes negative* because each depositor’s share of the insurance pool will begin to shrink. Resident borrowers will continue to appropriate a part of new loans and this will depress expected yields on deposits that after t_1 are only partially insured.

Following an attack the regime returns to its initial equilibrium in which the government's net international reserves have returned to zero.

The insurance model provides a clear rationale for taxing distorted capital flows. The appropriate tax can limit the access of banks and other insured firms to international capital flows and in turn reduce their ability to profitably exploit insurance. This was a central feature of the US banking system after the FDIC was established in 1933 to insure deposits. The authorities recognized that individual banks would have strong incentives to offer high deposit rates and reach for risk in order to take advantage of insurance. The ceilings on deposit rates were understood as a device to discourage competition among banks and thereby reduce the incentives to exploit insurance. This type of liability restraint has been largely abandoned in the industrial countries but there is no reason to believe that it cannot play a role in emerging markets today.

The insurance model outlined above does suggest that welfare reducing capital flows might be taxed more heavily by a transaction tax, or its close relative an entry tax, on capital flows to a developing country. Moreover, an entry tax is much less subject to

evasion since a comprehensive tax on capital inflows cannot be easily avoided through derivative transactions. Capital inflows motivated by an insurance policy have a known -- and probably short -- expected holding period.

The model also suggests that the capital inflow/crisis sequence depends on the condition that the resident can appropriate more than must be paid to the nonresident investor to increase his claims on residents of the developing country. Other things equal, an increase in the spread demanded by nonresidents to hold domestic deposits reduces the profitability of exploiting insurance for the resident bank or firm. There is an interesting interaction here in that the entry tax necessary to stop an inflow crisis sequence is higher if the profitability of appropriation is high but is lower if the inflow crisis sequence is short. This is because investors enjoy unusual returns only during the inflow phase of the sequence.

In summary the insurance model suggests that controls can be a useful policy option. The simple argument is that regulation of capital inflows might be an effective way to starve an insurance crisis of the fuel that sustains it. The key is that the insurance model provides a good reason to believe that holding periods of investors exploiting insurance are different, and probably shorter, as compared to normal (honest) investors. The capital inflow-attack sequence has an expected duration. If this is relatively short a transactions tax might fall disproportionately on this type of capital flow. The right tax would eliminate the incentive to exploit the insurance. Moreover the usual finding that controls effect the structure of the capital account but not total private flows is exactly the result that might reduce the probability of an insurance inflow/attack sequence.

VI. Conclusions

There is an interesting relationship between domestic liberalization and the liberalization of international capital flows. The first offers obvious advantages in terms of resource allocation. But domestic financial liberalization also means that "good policies" include a number of additional and stringent constraints on governments' behavior. In the short run it may prove difficult to get all of these conditions right. In these circumstances international capital flows might feed the growth of welfare reducing financial intermediation. In fact, a good summary of the historical record is that any very rapid growth in financial intermediation is likely to turn out badly. In a fully liberalized economy prudential controls will sort this out, but in the early phase of domestic liberalization some residual control on international capital mobility might be a useful component of the government's array of prudential controls.

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Figure 1

