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COMMENTS WELCOME

Do We Need an International Lender of Last Resort[1]

The world monetary system has changed dramatically from the arrangements envisaged at Bretton Woods in 1944, or indeed from any previous international economic experience. The Bretton Woods system envisaged a world of pegged but adjustable exchange rates, with countries linked together by mainly by trade but not capital movements. The global gold standard of the pre-World War I era, which covered a remarkable 89 percent of the world's population in 1908, was a system of high international capital mobility but almost no unbacked fiat money. The world of 1995 is a world of high capital mobility and the nearly universal use of unbacked fiat money.

It is perhaps not surprising that the world system has taken time to adjust to the new combination of arrangements. As Milton Friedman has repeatedly stressed, the novelty of fiat money first became dramatically apparent only after 1971, since up to that date, most of the world's fiat moneys were managed mainly to preserve a pegged exchange rate with the U.S. dollar. Only after 1971 have we had a worldwide, peacetime experience with fiat moneys not anchored by a single currency. This novelty probably helps to explain the worldwide inflation that occurred in the early and mid-1970s, as countries adjusted to their new monetary independence. Since that then, the experience has tended to show that most of the stable advanced democracies have succeeded in establishing domestic monetary institutions capable of preserving low inflation over a sustained period of time.

The second novelty was the return to high capital mobility in the 1970s, after nearly 60 years of collapse in international capital movements, beginning with the outbreak of World War I. It is clear that neither lending institutions (especially the commercial banks) nor the borrowing institutions in many of the debtor countries (banks, state enterprises, treasuries) had the governance, experience, nor incentives, to manage the new possibilities of extensive borrowing. Within 10 years of the outburst of international lending to the developing world in the early 1970s, dozens of developing countries were in default on their international loans. During the 1980s and 1990s, more than 50 countries recorded arrears or multilateral debt restructurings on their external liabilities.

The combination of unbacked fiat currency and access to foreign borrowing particularly plagued the politically unstable countries in the developing world, especially those that borrowed heavily in world markets despite highly flawed, overly-statist economic system (see Sachs and Warner, 1995). The extreme result was an outbreak of hyperinflation (defined as inflation in excess of 50 percent per month) on a scale never before seen in history, including the period immediately after World War I. Since 1985, more than a dozen countries have succumbed to hyperinflationary episodes: Argentina, Bolivia, Brazil, Nicaragua, Peru, Poland, Russia, Serbia, Yugoslavia, and other successor states of the former Soviet Union.

The International Monetary Fund was created in 1944 on the wise judgement that international financial markets and monetary arrangements are subject to instabilities and inefficiencies that require public intervention. Just as domestic financial markets are enmeshed in a complex network of laws and regulatory institutions, so too a stable functioning of international financial markets (and national economies linked by those markets) requires a set of laws and institutions to ensure their stable operation. The IMF was assigned three basic missions: to monitor the pegged exchange rate system; to lend short-term funds to cash-strapped governments, mainly to enable them to maintain their pegged rates; and to promote currency convertibility and cooperative management of monetary relations.

The IMF has periodically reinvented itself during the past 50 years as monetary and financial circumstances

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have changed. For the first 25 years of operation, the IMF main responsibility was to monitor the emerging adjustable peg exchange rate system originally envisaged at Bretton Woods. When that system foundered in 1971, and the currencies of the major economies began to float, the IMF was initially at a loss for a central function. It quickly took on the role of cheerleader and monitor of the large-scale financial flows to the developing world, championing the "recycling" of petrodollars in the second half of the 1970s. On a sporadic basis it also made short-term loans to countries in financial distress.

When the developing country debt crisis broke out in 1982, the IMF quickly asserted itself at the center of the debt restructuring process. Since then, almost all debt restructuring agreements of sovereign borrowers, both with official creditors in the Paris Club, and with private bank creditors in the London Club, have been linked in one way or another with an IMF loan to the debtor country. In addition, the caseload of financially distressed member governments rose sharply, so that the IMF took on the tutelage of dozens of debt-strapped governments. After 1989, the list of clients broadened considerably to include the post-communist countries of Eastern Europe and the former Soviet Union.

As much as the IMF has evolved, it has not kept pace with changes in the world financial system (see a similar judgement, with several points in parallel with this paper, in Minton-Beddoes, 1995). Compared with the institutional arrangements in domestic financial markets, the legal and institutional structure at the international level remains rather underdeveloped and poorly conceptualized. Major gaps in concept and practice of the international institutions, and mainly the IMF, add unnecessarily to the instability in international capital markets. These gaps are evident in many areas, of which I will highlight four.

1) The IMF was established, in part, to act as a kind of "international lender of last resort." It has recently played this part, together with the United States, in the Mexican peso crisis. And yet that crisis has more than anything exposed the *lack* of standards vis-a-vis this critical role. The IMF violated internal rules by granting Mexico a standby loan equal to *seven* times its quota. In the process it has exhausted a large proportion of its liquid assets. Can other countries now expect loans worth seven times their quota? If so, from where should the money come? If not, why not? Under what conditions should such bailouts be made?

2) The structure of IMF-led debt restructurings has been woefully inadequate from the start of the crisis in 1982. It took seven years for the IMF to acknowledge the need for debt reduction from bank creditors. Even after that, a country's ability to secure debt relief depends much more on its pecking order in international politics then it does on financial merit. Even in cases of mere debt rescheduling, it often takes several years before a country wins any relief at all on its debts, with the result that countries are forced willy-nilly into open default. Even when rescheduling agreements are reached, individual creditors are easily able to hold out for advantages vis-a-vis the other creditors.

3) The IMF has failed to define an adequate policy in its original area of core competence, exchange rate management. The issue of exchange rate management remains central in the economic policy over stabilization in the developing and post-communist economies. The IMF has tended to favor floating exchange rates over pegged exchange rates, despite the growing evidence that stabilization programs based on floating exchange rates are typically more contractionary. It seems clear that the pegged/floating dichotomy is too simple: successful economies often start with a pegged rate in order to end a high inflation, and then switch to a floating rate in order to preserve long-term flexibility.

4) Despite the growing importance of international capital flows, especially to the emerging countries, there are almost no international standards regarding data disclosure, capital controls, prudential standards for non-bank institutions, and the role of monitoring institutions, both public (such as the IMF) and private (such as the bond-rating agencies).

There is surely an important role for the IMF in future years, in helping to fill these institutional gaps. I will suggest below that the world indeed needs an international lender of last resort (ILLR), under certain circumstances.

It also needs a better set of mechanisms for debt workouts, exchange rate management, and prudential supervision of the financial markets. The IMF should play a role in each area, but that role has yet to be defined and properly enunciated. Interestingly, the G-7 countries have also called for a review of the international institutions, to be discussed at the Halifax Summit in 1995.

In recent months, particularly after the Mexican debacle, the IMF has argued that it needs more lending authority to carry out its enhanced role. Under current circumstances, however, increasing the lending authority of the IMF would be a mistake, akin to extending loans to a debtor country in the absence of accompanying policy reforms. What the IMF needs more than new money is a new and clear vision of its mission, more in line with the financial realities of the 1990s than the 1940s.

II. Coordination problems in financial markets

Financial markets are plagued by two basic kinds of coordination problems. The first arises because of **multiple equilibria** in asset markets, a deep implication of the fact that the value of financial assets depends on market expectations, while market expectations depend on asset values. This circularity gives rise to many forms of self-fulfilling prophecies, with attendant instabilities and inefficiencies. The second arises in circumstances of financial distress of debtors, as the result of **collective action problems** inherent in debt workouts. In this case, the market equilibrium is unique but inefficient. In both cases, domestic financial markets are supported by state institutions to mitigate the market inefficiencies.

A. Multiple Equilibria

The classic case of multiple equilibrium is the bank panic, described formally by Dybvig and Diamond (1983). The idea is the following. Banks are financial intermediaries that accept short-term deposits and re-lend the deposited funds to long-term investors. The depositors desire deposits that are fixed in nominal value and available upon demand so that they may be withdrawn at any time to meet contingencies that may arise. In normal periods, a small proportion of depositors will withdraw deposits from the bank in order to satisfy short-term liquidity needs. At the same time, investors require bank loans for long maturities, to finance long-term projects. If the loans are suspended in the course of the investment cycle, the project loses a substantial proportion of its value. As a result, banks not only identify and monitor investment projects, but also transform the maturities of deposits.

In principle, banks are obligated to transform deposits into high-powered money upon demand. In practice, of course, most of the bank's assets are tied up in long-term loans at any point. This opens the possibility of multiple equilibria in the market for bank deposits. If most depositors maintain confidence in the liquidity of the bank, they will maintain their deposits in the bank, and the bank will be able to meet the short-term random demands for high-powered money that arise at any point from a small proportion of bank depositors.

On the other hand, if each depositor suspects that the *other* depositors want to withdraw their funds in the near future, the individual depositor will expect that the bank will soon be faced with a liquidity crisis, and perhaps a forced and costly liquidation. It then makes sense for the individual depositor to race to the bank to withdraw his deposits ahead of the rest, thereby salvaging the value of the deposits. The result, of course, is a run on the bank, in which each depositor rationally races to withdraw funds ahead of the rest. As a result, even a solvent and healthy bank can be forced into a liquidity crisis.

We therefore face a canonical multiple equilibrium. Deposits maintain their face value today if they are expected to maintain their face value in the near future, while they lose their value today if they are expected to fall below their par value in the future. Moreover, the impairment of value today (because of a bank run) indeed impairs the value of the deposits in the future.

For most of the 19th century, such bank runs were part of the economic landscape, even though the essential solution to these runs was recognized by Henry Thorton as early as 1802. Slowly, two main institutions evolved in the domestic economy to reduce the risks of spontaneous bank panic. The first was the role of the Central Bank as Lender of Last Resort (LLR). Under the doctrine first espoused by Thorton, and then enriched and promoted by Bagehot (1873), the Central Bank should provide ample liquid to a bank facing a run, to allow it to meet its depositors' demands, thereby breaking the expectations of panic. Each depositor regains confidence that his deposits will be honored at full value, even without running to the bank. Bagehot stated the three classic conditions for an effective LLR. The LLR should: (1) lend freely to solvent banks; (2) against good collateral; and (3) at a penalty interest rate.

It took time and much debate for the LLR principle to be established and widely accepted. In the 19th century, Central Banks were only beginning to come into existence as an identifiable. In the case of the Bank of England, a private bank slowly transmogrified into a state institute with public-goods functions. In the United States, it was not until the 1913 establishment of the Federal Reserve System that there was a national institution assigned the main roles of note issue, bank supervision, and LLR. The second complication was that most of the world was on the gold standard, with the note issue tied to the Central Bank's holdings of gold. As a result, the notion of spontaneous discounting of commercial paper to help illiquid banks ran against the classical rules of the game of credit management under the gold standard. The tension between the LLR function and the responsibility of maintaining gold backing continued until the abandonment of the gold standard in the 1930s, as I discuss below.

The second major institution to address bank runs was state-run deposit insurance. Again, this came very late in the day, not until 1934 in the United States. And as with LLR, there was considerable debate about the utility of deposit insurance right up to its adoption and application. Many observers, including Friedman and Schwartz (1963), consider the adoption of federal deposit insurance to be the key in ending the periodic bank panics in the United States.

It should be noted that a variety of private market responses to bank panics had been insufficient for more than a century in taming the sporadic outbreak of deep and serious crises. Private market innovations included: (1) temporary suspensions of convertibility of bank deposits into legal tender, as a *force majeure*; and (2) private deposit insurance schemes and bank clearinghouses, which lacked the financial strength and credibility to withstand full-fledged bank panics. Advocates of free banking have to contend with the clear historical record that private market solutions were chronically insufficient to head off deep and costly banking panics.

The basic logic of a banking panic carries over to two other important circumstances: a general creditor panic against a non-bank borrower; and a flight from the currency. Consider first the case of a non-bank debtor that is borrowing short-term to carry out a long-term investment project. Let us consider the situation in the middle of the project. The borrower owes D, has investment opportunities I, with fixed marginal product γ. The interest rate is $r < \gamma$. The new investment must be financed with new loans $L \leq I$. If the entire investment opportunity is taken, then the new loans and the pre-existing debts can be repaid, as we assume that $I(1+\gamma) > I(1+r) + D$. However, if no loans are made, the preexisting debt will be defaulted. Indeed, new loans can be repaid only if the new loans are larger than or equal to Λ, such that $\Lambda(1+\gamma) = \Lambda(1+r) + D$. Note that $\Lambda < I$.

The possibility of a panic comes if the size of the required loan is so large that it must be subscribed by a large number of creditors, each of whom may fear that other creditors will not subscribe to the loan. (Perhaps the loans must be arranged sequentially, with the earlier creditors forming expectations about the attitudes of potential creditors later in the queue.) Suppose that each creditor potentially lends an amount $\lambda = \Lambda/N$. Then, it is easy to see that if there $n < N$ creditors agree to take the loan, the existing debt will go into default, and the new lenders will share in the losses. If $n < N$ creditors agree to subscribe to the new loans, then both the old and the new debts will be repaid in full. Thus, as with the banks there are two possible equilibria: (1) all creditors reject new lending, on the grounds that the other creditors are also withholding new loans; or (2) all creditors up to the maximum number ($I/\lambda > N$) subscribe to the new loans, so that the entire investment program I is undertaken.

Such a creditor panic is relatively infrequent in the domestic economy for three main reasons. First, for many borrowers, the level of investment project will be small enough to be handled by a single bank or a well-defined consortium of lenders that can coordinate to overcome the adverse equilibrium. Second, it may be possible to arrange for collateralized borrowing against the new investment, giving the new creditors first rights on repayment. In this case, there is no possibility of a creditor panic, since new creditors will be happy to lend against collateral. The existing debt D will be irrelevant to the new investment decision. Third, in the case of a sovereign borrower, e.g. a Treasury borrowing short-term debt, the central bank will typically act as a lender of last resort, guaranteeing that the state's existing debts will be repaid, albeit at the possible cost of domestic inflation. Note that while sovereign lenders are unlikely to default on internal debt denominated in domestic currency, the debt may be subject to self-fulfilling fears of high inflation, as shown by Calvo (1988). The fear of an inflationary bailout of the public debt leads investors to boost nominal interest rates that they require to purchase the debt; the high nominal interest rates, and higher debt servicing charges that result, provoke the government into greater inflationary finance.

There is at least one vital episode of a domestic lender-of-last resort facility for the non-commercial banking sector: the Fed's provision of liquidity to the securities markets the day after Black Monday, in October 1987. As recounted by Mishkin (1991, pp. 101-2):

> Upon learning of the plight of the securities industry, Alan Greenspan, chairman of the Board of Governors, and E. Gerald Corrigan, president of the New York Federal Reserve Bank and the Fed official most closely in touch with Wall Street, began to fear a breakdown in the clearing and settlement systems and the collapse of securities firms. To prevent this from occuring, Alan Greenspan announced before the market opened on Tuesday, October 20, the Federal Reserve System's "readiness to serve as a source of liquidity to support the economic and financial system." In addition to this extraordinary announcement, the Fed encouraged key money-center banks to lend freely to their brokerage firm customers and, as in the Penn Central bankruptcy episode, made it clear that it would provide discount loans to banks so that they could make these loans.

Extreme creditor panics are more likely to occur in the context of *international* sovereign borrowing, when a government borrows in foreign currency in the international capital markets. First, the sums necessary for the new loans may well exceed the capacity of a small group of creditors (as is the case with the Mexican debt crisis of 1995). Second, collateralization may be difficult. Third, the domestic central bank will be unable to act as a lender of last resort, as the state debt is denominated in foreign currency. Fourth, the loans may need to be accompanied by various kinds of conditionalities on the behavior of the government (e.g. that the government uses the foreign loans for investment rather than consumption). A disparate group of private lenders will find it difficult, though not necessarily impossible, to negotiate the requisite conditionality. For these reasons, a solvent, but illiquid sovereign borrower may find itself unable to arrange the necessary credits in the international financial markets, and may thereby even be pushed into an unnecessary default on outstanding debts.

The third kind of multiple equilibria involves a shift of asset demands away from domestic currency and into foreign currency, thereby pushing an economy into high inflation or keeping it stuck there. Consider a government relying on inflation taxation to cover a fiscal deficit of size D. In the steady state, the inflation tax πm must equal D, where π is the inflation rate and m is the level of real money balances. Since m is itself a function of the inflation rate, the equality $D = \pi m(\pi)$ generally yields two (or more) equilibria. In the "good" equilibrium, the public holds a high level of real money balances, μ, so that the equation is satisfied with a low level of inflation: $D=\pi^L\mu$. In the "bad" equilibrium, the public flees from the domestic currency, so that real money balances are low, $\underline{m}$, and inflation is high: $D = \pi^H \underline{m}$.

This multiplicity of equilibria raises the possibility of a spontaneous flight from the currency. Suppose that a government is initially managing its deficit with the low inflation rate, but that inflationary expectations rise, leading households and firms to flee the domestic currency (perhaps in favor of foreign exchange). The drop of money demand will result in higher inflation as long as the government continues to finance the deficit D with money creation. The higher inflation, in turn, will confirm the adverse shift in expectations. This process of currency flight can be re-stated as the equilibrium of a non-cooperative game among a large number of money holders. Each moneyholder knows that a given amount of inflation taxation D is to be levied on the entire economy. If other

moneyholders flee the domestic currency, more inflation taxation will fall on those who stay with the domestic currency. Therefore, each moneyholder will have the individual incentive to join the herd if there is a flight from the currency. Just as in a bank panic, stampede behavior is individually rational, though socially costly.

A formal model of a flight from the currency is presented in the Appendix, to underscore an important point. We know that most countries, at most times, are not living on the knife edge of currency collapse. Moneyholders don't really just pick up and desert a currency without prior warning. In the formal model, households and firms incur costs of changing their money demand management strategies, and therefore do so only gradually. As a result, there is inertia in the aggregate demand for real money balances that prevents a quick, outright collapse of a currency. *As a result, the possibility of a rational, self-fulfilling collapse only occurs when the economy is already substantially demonetized, presumably because of a preceding bought of high inflation.* Like individuals in a plague, an economy is more likely to fall victim to a contagion of currency flight if it has been previously weakened by prolonged monetary mismanagement.

The fact that sovereign borrowers may be hit by adverse, self-fulfilling prophecies opens up the possible role for an international lender of last resort (ILLR), centered in an institution such as the International Monetary Fund. The IMF may have a special role to play in helping countries hit by a creditor panic to overcome the resulting liquidity crisis, or a country hit by a currency collapse to achieve renewed currency stabilization. As I discuss in the next section, such roles were of course envisaged by the founding fathers of the IMF. Nonetheless, the IMF lacks an adequate conceptual framework to fulfill this role, and therefore responds to creditor panics and currency crises on an ad hoc basis.

The urgency of establishing an appropriate ILLR is heightened by the fact that political governance is, itself, subject to multiple equilibria. The state's ability to preserve law and order (and therefore to defend property rights as well) depends on the state's success in asserting its monopoly of power in the use of force within the country. While there may be various contenders for power within the society, each alone is normally too weak to attempt to usurp the state's monopoly of force. In certain circumstances, however, the monopoly of force can collapse -- in an outbreak of criminality, regional separatism, civil conflict -- producing a "bad" equilibrium in which no group in the society is able to assert a monopoly of power. The society descends into a Hobbesian "war of all against all." In Sachs (1995) I argue that this kind of state collapse is particularly likely for financially weak states, that are unable to mobilize resources to protect the monopoly of power. Thus, the stakes for an ILLR may be very high: not merely the preservation of economic stability, but even the preservation of basic social and political stability.

B. Collective action problems in financial distress

Multiple equilibria are just one source of possible inefficiency arising in financial markets. Another host of problems revolves around the case of a debtor in extreme financial distress, that is unable to meet its debt obligations as they fall due, and that likely needs a partial cancellation of debts in the future. At each stage of a financial workout, collective action problems plague the readjustment of debt claims, to the detriment of the creditors as well as the debtor. Just as in the case of bank panics, special legal institutions have evolved in the domestic economy, especially bankruptcy law, to address these problems.[2] Similar solutions are needed in the international context.

Consider the case of an insolvent corporation, with a large unpayable debt. When there is a single creditor, the corporation and the creditor can efficiently renegotiate the terms of the loan, or the creditor can use the judicial system to take over the business. It may decide to keep the enterprise in operation (perhaps after a restructuring of operations) or to liquidate the enterprise and keep the proceeds of the asset sales. The choice will depend on whether the value of the assets in greater under reorganization or under liquidation. The creditor may even put more cash into the business after taking over the ownership, if the enterprise needs new working capital or long-term

2. For a superb theoretical treatment of the U.S. Bankruptcy Code which heavily influenced the discussion in the text, see Jackson, 1986.

investments to continue in operation.

When there are many creditors with complex and conflicting claims, normal market mechanisms, backed up by normal contract enforcement in the courts, are unlikely to be efficient.[3] Consider the case of a corporation with many creditors which should be reorganized rather than liquidated. Under normal contract law, each creditor is allowed to press its claim as soon as the enterprise fails to service the debts as they come due. The creditors have an interest not only in staking a claim against the enterprise, but in doing so *ahead* of the other creditors. This poses an enormous collective action problem for the creditors, in which all may lose.

There are three stages in a restructuring, and each is prone to deep collective action problems. The first stage is the onset of insolvency -- when the bills cannot be paid. This stage is prone to a "creditor grab race," in which each creditor races to the bailiff to try to seize assets ahead of the other creditors. The collective inefficiency can arise because the individually rational actions of the creditors quickly sends the firm into liquidation, as each creditor seizes whatever machinery, real estate, and financial assets they can lay their hands on. To delay is to invite other creditors to get ahead of the queue.

The second stage is during the restructuring itself, assuming that the enterprise hasn't been forced into liquidation by a preceding grab race. Restructuring takes time -- to readjust creditor claims, to find new management if necessary, and to assess which parts of the operation should be saved and which spun off or liquidated. During this period, the enterprise often needs ongoing access to the capital markets, for new working capital for example.[4] With an overhang of old, bad debt, no lender has an incentive to make a fresh loan unless it can guarantee that the new loan will be paid off ahead of the earlier claims.

The third stage of a restructuring is the adjustment of the balance sheet: debts may be written down to match capacity to pay, or may be converted into equity, or may be rescheduled for later payment. Ownership and control are likely to change hands. The balance sheet restructuring again poses an enormous collective action problem: each creditor is happy if the other creditors make concessions such as debt writeoffs, while individually holding out for a full repayment of the original claim.

Bankruptcy law, especially Chapters 9 (for municipalities) and 11 (for corporations) of the U.S. Bankruptcy Code, is designed with these collective action problems in mind. Chapter 11, of course, is devoted specifically to the case of corporate restructuring rather than liquidation (which is covered in Chapter 7), or individual bankruptcy (which is covered in Chapter 13). The law makes specific provisions for each stage of the restructuring.

The initial creditor grab race is forestalled by the Automatic Stay provision of the Bankruptcy Code, 11 § 362. The section prevents "any act to collect, assess, or recover a claim against the debtor that arose before the commencement" of the bankruptcy proceeding. The stay remains in force until a final reorganization plan is put into operation.

The provision of working capital to an enterprise in restructuring is made possible *by Debtor-in-Possession (DIP) Financing* under the Bankruptcy Code, 11 §364. The key to DIP financing is that the bankrupt firm is permitted, under court supervision, to attract new loans by assigning administrative priority to the repayment of the new loans ahead of the pre-bankruptcy loans.[5]

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3. Or as Posner (1986, p. 375) has put it in his influential analysis, "The reason for having involuntary as well as voluntary bankruptcy is a transaction-cost problem that is created when there is a major default and many creditors."

4. It is sometimes naively argued that a bankrupt firm should not borrow more, since it has already evidently borrowed "too much." This confuses the burden of the stock of pre-existing debt, which is a fixed cost, with the marginal productivity of a new loan, which might be very high, and therefore merited on efficiency grounds.

5. Specifically, under 11 364 (c), "The court, after notice and a hearing, may authorize the obtaining of credit or the incurring of debt -- (1) with priority over any or all administrative expenses of the kind specified in section 505 (b) or 507 (b) of this title; (2) secured by a lien on property of the estate that is not otherwise subject to a lien; or (3) secured by a junior lien on property of the estate that is subject to a lien."

The problems of holdouts and free-riders in the final reorganization of the balance sheet are also addressed by the conditions for *Acceptance of the Reorganization Plan* under the Bankruptcy Code, § 1126 and § 1129. The main idea is that the plan may be *confirmed*, i.e. put into operation, in one of two ways. Most directly, the plan may be approved by each of the creditor classes as described below. Alternatively, the court may impose the plan in a "cramdown," which forces the confirmation of the plan over the objection of some of the creditor classes.

When a plan is presented, the creditors vote on the plan under § 1126. Specifically, the plan is put to a vote by each class of creditor (e.g. senior bank creditors, junior bank creditors, unsecured bondholders, etc.). A class is said to *accept* the plan if it is accepted by two-thirds or more of the class by amount of claim, and by more than one-half of the class by number of claimants. Alternatively, a class of creditors is deemed to accept the plan if the class is not impaired by the plan (e.g. there is no writedown of the claims).

Under § 1129, the plan is confirmed either by acceptance by all creditors, or by "cramdown" by the bankruptcy court, § 1129 (b). Specifically, the court may confirm a plan

> if the plan does not discriminate unfairly, and is fair and equitable, with respect to each class of claims or interests that is impaired under, and has not accepted, the plan.

The rest of the subsection defines the meaning of "fair and equitable." By the provisions of § 1126 and § 1129, the Bankruptcy Code prevents holdouts in two ways, either by preventing less than one-third of a creditor class to block a plan, or by permitting the court to enforce a plan notwithstanding its rejection by one or more creditor classes.

Bankruptcy law does several other things to reduce transactions costs and collective action problems. It prevents *fraudulent conveyances*, in which the debtor attempts to put part of his assets out of reach of the creditors. Additionally, the bankruptcy courts may adjust the debtor's estate at the time of bankruptcy by reversing certain debt payments made by the corporation on the eve of bankruptcy, to ensure fairness among the various creditors.

There is considerable confusion as to how the principles of bankruptcy should translate to the case of sovereign borrowers, i.e. governments. In the international context there is little formal law covering state insolvency, and certainly no bankruptcy code. Therefore, the question is mostly a normative one-- how should international practice, and specifically IMF practice, be arranged in view of the lessons of bankruptcy law. In the domestic context, Chapter 9 of the U.S. Bankruptcy Code is addressed to municipal governments. As a recent case, Orange County's finances are now being reorganized under the protection of Chapter 9.

The main analytical point is that the pressures and problems that have led to corporate bankruptcy law also operate in the case of a sovereign borrower in financial distress. When a government goes bankrupt, it must be reorganized (liquidation is obviously very rare in the case of a municipality, and basically out of consideration for a debt-strapped national government). Just as with a corporation, there are profound collection action problems among the creditors: a grab race at the time of bankruptcy; huge problems in obtaining working capital credits during the period of reorganization; and great obstacles to debt restructuring, especially because of the risk of holdouts among particular creditor groups.

Some have maintained that Chapter 11 is a poor analogy for governments in financial crisis, because under Chapter 11 the creditors may eventually take over the ownership of the corporation, while that is not true in the case of a bankrupt government. This point is correct, but it doesn't go very far. The problems of collective action are true whether or not the creditors eventually take over the equity. Whatever resource transfers are made from the debtor to the creditors, it is in the common interest of both the creditors and debtor that these transfers should be made in an efficient manner. Decentralized market-based behavior will not be efficient when governments fall into financial distress for all of the reasons we have seen.

Chapter 9 of the U.S. Bankruptcy Code extends the principles of corporate reorganization to the municipal

government sector, but with an important addition. The three basic principles of Chapter 11 still hold: the automatic standstill, debtor-in-possession financing, confirmation of the reorganization plan by vote of the creditor classes or by cramdown. But now, the Bankruptcy Code explicitly recognizes that Governments carry out political functions that should not be impaired by financial distress. In particular, for a municipality that has properly qualified for relief under Chapter 9,[6] the bankruptcy court may not, under § 904, interfere with --

1. any of the political or governmental powers of the debtor;
2. any of the property or revenues of the debtor;
3. the debtor's use or enjoyment of any income-producing property.

The fact that the debtor is a government is not seen as a reason to forgo the relief of the bankruptcy law, but on the contrary, as a reason to strengthen the relief in order to maintain the political functions of the government, and to prevent the descent into the Hobbesian world, brought on the by the financial weakness of the state. The essential task is to keep the state functioning in an orderly and necessary manner -- in provision of law enforcement, public order, a stable currency, basic social protection, and necessary public infrastructure -- while at the same time eliminating the underlying economic policies that led to the disorder. Of course, a financial workout under bankruptcy protection should not be misconstrued as an opportunity for maintaining the *status quo* of a poorly functioning government, whose policies caused the descent into bankruptcy. Rather, financial support should be designed to facilitate the rapid and deep restructuring of the state itself, including a retreat from the areas that brought on the state bankruptcy in the first place.

In the case of debt-strapped sovereign borrowers, there are no close analogies to Chapters 9 and 11. IMF procedures fall far short of the needs for a coherent approach. There are no procedures for automatic standstill, priority borrowing, or the negotiation of a comprehensive debt restructuring deal. Free-rider problems abound, and the process remains highly inefficient, at significant cost to creditors and debtor countries alike. The next section discusses ways to move IMF procedures closer to the domestic bankruptcy model.

III. The IMF and the international financial system

International institutions such as the IMF should provide public goods not provided by the market. Most importantly, they should provide an international legal framework for overcoming problems of market failure, in analogy to domestic institutions that provide that role within national economies. In each of the three areas discussed in the preceding section -- currency instability, creditor panic, and financial insolvency of sovereign borrowers -- the international framework is currently inadequate. Reform of the IMF could therefore help to improve the efficiency of the international capital markets by better addressing these sources of market failure.

A. Currency stabilization

One of the original purposes of the IMF was oversee and facilitate an adjustable-peg exchange rate system. Each member country was to commit to keep its currency convertible and stable vis-a-vis the U.S. dollar or gold. IMF resources were to be available on a short-term and revolving basis, to help member governments to support their currencies in the presence of short-term financing difficulties. These arrangements, of course, collapsed after 1971. Afterwards, the IMF not only formally endorsed the possibility of freely floating exchange rates (a fait accompli with regard to the major currencies), but also began to champion floating rates as a way for developing countries to overcome their long-term debt servicing problems in the 1980s. After the collapse of communism between 1989 and 1991, the IMF has generally supported floating rates for the newly convertible currencies of the post-communist economies.

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6. To qualify for relief under Chapter 9, the municipality shall be insolvent, and shall have met one of the following conditions: (1) that it has obtained agreement among the majority of each creditor class that it may seek relief under the Bankruptcy Code; (2) that it has negotiated in good faith but failed to reach such an agreement; or (3) that it is impractical to negotiate such an agreement.

The floating rate system has shown considerable resilience and merit (see Obstfeld, 1995, for a comprehensive and cogent review and defense of the floating rate system). There is justification for the IMF's general position in support of floating rates, vis-a-vis most member countries at most times. Our earlier analysis of the possibility of currency collapse suggests, however, a key role for a *temporarily* pegged exchange rates in certain circumstances: when an economy is attempting to establish currency stability in the face of risks of a self-fulfilling flight from the currency. As the formal model in the Appendix suggests, these risks are greatest for a demonetized economy, in which the domestic money holdings are already low.

Two key cases therefore suggest themselves as critical exceptions to the general prescription in favor of floating rates: (1) countries attempting to introduce and stabilize a new national currency, with low initial levels of acceptability; and (2) countries attempting to stabilize after a bout of very high inflation, currency flight, and demonetization of the economy. Other exceptions might include: very small economies (not prone to currency overvaluation by dint of their extreme openness), and economies tightly linked together in an optimal currency union.

Recent theory (e.g. Bruno and Fischer, 1990) and monetary experience have demonstrated how a temporary peg of the exchange rate, backed by adequate foreign exchange reserves, can overcome the problem of self-fulfilling currency flight. Essentially, the pegged exchange rate ties down the price level through commodity market arbitrage, while the provision of adequate foreign exchange reserves strengthens the market confidence in the temporary peg. Therefore, an emergency stabilization fund (as provided by the U.S. to Israel in 1985, and by the G-7 to Poland in 1990), provided the needed backing for currency stabilization. In both cases, importantly, the pegged rate was temporary: long enough to anchor the currency and to defeat a self-fulfilling flight from the currency, but not so long as to invite a subsequent crisis of overvaluation. Both countries subsequently moving to a gliding pegged exchange rate, to forestall chronic overvaluation. Several recent studies have confirmed that pegged exchange rate arrangements have lowered the costs of stabilization of high inflations, in part by bolstering market confidence in the currency. (See, among others, Bruno, 1993; Sachs, 1995; Robelo and Vegh, 1995; Hansson and Sachs, 1995).

At the same time, recent history has suggested the *futility* of a long-term commitment to a fixed exchange rate, except perhaps for very small economies. Recent crises in Chile in the early 1980s, and Mexico and Argentina in the past year, suggest the vulnerability of *long-term* pegged rates to chronic overvaluation, and to subsequent market speculation that is either impossible or highly costly to defeat. It is true that even an overvalued exchange rate can be defended with very tight domestic credit, but the costs are usually exorbitant. If domestic credit is extremely tight, the banking system is put at risk. Banks become subject to panics that can only be relieved by a resumption of domestic credit, though the expansion of domestic credit then threatens or finally undermines the pegged rate. A profound banking crisis undermined the Chilean pegged rate during 1989-91. Recently, it was partly fears of a commercial banking crisis in Mexico that led the Bank of Mexico to pursue expansionary credit policies during 1994, which eventually wiped out the central bank's reserves and forced Mexico off its pegged rate.

Banking crises, rather than an exhaustion of reserves *per se*, were probably most important in forcing the Scandinavian countries out of the ERM in 1992. Moreover, the post-devaluation experience of the European countries amply demonstrates the general effectiveness of floating rates in facilitating a return to internal and external balance, and without creating problems of a self-feeding loss of confidence. (Remember that these countries enjoyed low inflation and high monetization at the time of the devaluation). The devaluing countries -- U.K., Sweden, Finland, Norway, Italy -- have enjoyed sustained economic recoveries and continued low inflation after their devaluations.

Some advocates of pegged rates have suggested that *super-tough* credit policy, backed by a gold standard or a currency board, would be enough to defeat market speculation against a currency. History shows, however, that this is not the case, once the nominal exchange rate has become overvalued in real terms. The problem, again, is that super-tough credit policy is tantamount to an abandonment of the lender-of-last resort function of the central bank, which opens the economy to painful and highly destabilizing bank runs. In a fascinating and compelling piece of monetary history, Wigmore (1987) demonstrates that the 1933 bank run in the United States (which eventually

forced the national bank holiday in the first week of the Roosevelt Administration), was prompted by deposit withdrawals in anticipation of a devaluation of the dollar vis-a-vis gold. The Fed failed to act as a lender of last resort, not out of obtuseness, as suggested by Friedman and Schwartz (1963), but because of the recognition that expansionary credit policy would drain the remaining gold reserves of the Fed. In the event, the banks were temporarily closed; the dollar was severed from gold, and then devalued; and the banks were then capable of re-opening without a renewed panic. Events in Argentina in 1995 have had a similar dynamic: tight credit policy invited bank runs, since the National Bank of Argentina was not empowered to act as a lender of last resort under the currency board arrangements. Argentina has therefore had to be bailed out, at least temporarily, with an emergency $11 billion international credit aimed at bolstering confidence and liquidity in the banking system.

Our conclusion is that the IMF has been more than half right, but less than completely correct, in its recent advocacy of floating exchange rates. For most countries with low or moderate inflation, floating rates are prudent and effective, while fixed rates are difficult if not impossible to sustain when real exchange rates move out of line. On the other hand, for highly demonetized economies, there is a case for pegged rates to prevent a self-fulfilling flight from the currency, and to reduce the costs of stabilization. These countries, moreover, merit financial backing in the form of emergency stabilization funds at the outset of stabilization. Once stabilization and remonetization are achieved, however, the evidence points to the need for a gradual transition to a more flexible exchange rate arrangement, to ward against chronic overvaluation. A gliding peg, or gliding band, exchange regime has proved to be effective in many cases.

B. Creditor panics

We have seen that even a solvent sovereign borrower may be subjected to a costly, inefficient, but rational creditor panic, akin to a bank run. This, indeed, is the best interpretation of the meltdown in Mexico after December 1994, as argued at length in Sachs, Tornell, and Velasco (1995). Mexico, like Sweden, was forced off of a pegged exchange rate, when the nominal exchange rate became overvalued and therefore inconsistent with internal balance. But Mexico, unlike Sweden, did not bounce back rapidly from the devaluation, with lower interest rates and better growth prospects, but just the reverse: interest rates soared and the prospects grew for a deep recession in 1995.

The difference, of course, is that Mexico was unable to roll over its short-term public debts after the devaluation in December. International investors realized that Mexico had around $29 billion of dollar-denominated public debts (*tesobonos*) falling due in 1995, with Bank of Mexico reserves at around $6 billion. Though the *tesobono* debt stock was not large as a percent of Mexican GDP (roughly 10 percent of an estimated 1994 GDP of $270 billion), it was large enough to expose Mexico to a creditor panic. Each potential *tesobono* purchaser realized that if other creditors refused to roll over the debts, then Mexico would be pushed into default, despite it long-term solvency. As a result, interest rates shot sky-high to reflect market expectations of default risk, and the combination of high interest rates and scanty debt rollovers quickly pushed Mexico to the brink of a self-fulfilling default.

These are classic circumstances for an ILLR. Mexico surely meets Bagehot's classic conditions for a lender-of-last resort facility. Mexico is illiquid but solvent, and can provide adequate collateral against short-term loans (in this case, its oil export earnings, pledged to the U.S. Treasury). In these circumstances, Bagehot advises to lend freely, at penalty rates. This indeed is the basic policy stance adopted by the U.S. Government in conjunction with the IMF, in mobilizing an international support package of roughly $50 billion. So far, the loan package has succeeded in keeping Mexico out of default. In recent weeks, the Mexican peso has recovered from panic-driven lows, and the stock market has staged a slight recovery. Nonetheless, the ultimate success of the Mexican package is yet to be achieved, as market confidence remains low and interest rates punishingly high (and therefore still threatening economic instability and banking failures).

While Mexico seems to suggest a case for IMF intervention as an effective ILLR, our previous discussion of Chapter 9 and Chapter 11 of the Bankruptcy Code point to alternative methods for the IMF to discharge its ILLR function. In principle, the IMF should not have to lend taxpayer dollars at all. Like a bankruptcy court, the IMF could supervise the extension of "administrative priority" for new private-market borrowing for a liquidity-strapped

member government. For example, would authorize that Mexico could borrow $20-30 billion of new funds on a priority basis vis-a-vis the pre-December 1994 debt. The IMF would imposed traditional conditionalities on the priority borrowing, so that Mexico would not simply squander the new funds to the detriment of the pre-existing creditors. In addition to assigning seniority, the IMF could facilitate Mexico's use of collateral on the new borrowing. The assignment of oil revenues that Mexico has made on the U.S. Treasury loans could have been just as easily directed towards private debt instruments. If necessary, during the arrangements of these new market borrowings, the IMF would have the authority (in parallel with a bankruptcy court), to administer a temporary standstill on debt servicing.

There would be enormous advantages to a shift in IMF practices to rely on private capital markets. Countries would remain in contact with the private markets. There would be a market test on each loan and on each adjustment program (albeit a weak test, since the new loans would be supported by the assignment of administrative priority over existing debts). Mexico would be expected to make a rapid transition back to market borrowing once the panic had subsided.

It is not clear whether the IMF could develop a mandate to enforce administrative priority, either explicitly or implicitly. It is already the case, for example, that governments and banks understand that in the course of a debt rescheduling, a rigorous line will be drawn between loans before a given "cutoff date" and loans after the cutoff date. Loans after the cutoff date are not to be rescheduled. In effect, they are given administrative priority over pre-cutoff date loans, which are rescheduled. Similarly, it is understood that bonds are not rescheduled, so that new bond financing would in practice have administrative priority over rescheduled bank debt. Finally, IMF and World Bank loans are already accorded informal and effective priority over other forms of debt servicing (since IMF and World Bank loans are not rescheduled), though the legal basis for such priority is murky.

The IMF has already demonstrated in the early 1980s that it has the muscle to press banks into "non-spontaneous" loans, and even to prevent much free riding on such loans. The IMF also has a mandate under the Articles of Agreement (article 8, section 2b) to approve exchange restrictions, which are then not subject to court challenge in the member countries.[7] It is possible that priority lending, debt restructurings, and debt standstills could be designed as forms of exchange control, that would then be given legal protection against challenges by disgruntled creditors. Of course, more directly, the Articles themselves could be amended to allow for more orderly ILLR functions.

In any event, the issue is not only the legal power of the IMF, but also the interest of the IMF to play the role of coordinator among the creditors. The IMF typically ignores the need for debt standstill, and underplays the need for emergency liquidity. Mexico is the exception that proves the rule. Mexico's IMF program is unprecedented in scale (700 percent of quota), and nearly unprecedented in speed of negotiation. Not many countries share a 2,000 mile border with the IMF's largest shareholder!

If the IMF behaved more like a bankruptcy court, it could also shed its monopoly position as macroeconomic advisor to governments in distress. The governments themselves could arrange for a team of experts (including foreign advisors, government officials, and domestic consultants) to prepare the economic adjustment program, in preparation for a return to market borrowing. The IMF staff could assess the program, and even compete for an advisory position, but there would be no presumption that the IMF staff itself would prepare the adjustment effort. Certainly the bankruptcy judge does not presume to know how to restructure a department store,

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7. The specific provision is as follows:

> Exchange contracts which involve the currency of any member and which are contrary to the exchange control regulations of that member maintained or imposed consistently with this Agreement shall be unenforceable in the territories of any member. In addition, members may, by mutual accord, cooperate in measures for the purpose of making the exchange control regulations of either member more effective, provided that such measures and regulations are consistent with the Agreement. (Articles of Agreement, Article VIII, Section 2(b).

or airline, or Orange County, or any other debtor that seeks protection under Chapter 9 or Chapter 11!

C. Debt Workouts

Mexico presents a particularly striking example of a case for an ILLR. There are, however, dozens of liquidity starved or insolvent member countries that fail to receive timely financial help. There countries and their creditors are therefore subjected to the enormous inefficiencies of outright default and a near absence of short-term financing.

In all too many IMF-supported reform programs, there is no successful breakthrough to stabilization and renewed growth for many years. Attempts at stabilization and reform may fail repeatedly, for up to a decade or more. In many countries, IMF programs are adopted and then suspended, only to be tried again. The debtor governments fail to re-establish creditworthiness in the private capital markets. In many cases, the reason is straightforward: the government lacks a strong reform team. But that is not the full story. The IMF's own tactics -- and failure to act like a bankruptcy manager -- help to breed failures.

The main problem is that the IMF does not adequately appreciate the linkages between reform and timely financial assistance. Financial assistance, I have stressed, is typically needed at three points of a debt workout: a debt service standstill at the outset of reforms; fresh working capital during restructuring, so that critical governmental functions don't collapse; and (often) some debt reduction at the culmination of reforms, to help reestablish the government's solvency. The IMF typically drops the ball at each stage.

To see this vividly, let us consider a relevant comparison. Both Macy's Department Store and the Russian Government suspended debt servicing in January 1992. Macy's filed for Chapter 11 protection, while the Russian Government notified the G-7 creditors that it would be unable to continue to service the debt. Macy's received an immediate and automatic debt standstill at the time of filing. Just three weeks later, Macy's was able to arrange a fresh loan of $600 million from several N.Y. commercial banks, as debtor-in-possession (DIP) financing.

In the case of Russia, by contrast, there was no standstill, and still no comprehensive standstill on commercial bank debt! Russia has been in default on the bank debt, and individual creditors have been free to harass Russia with legal challenges or other forms of pressure.[8] As for the official creditors in the Paris Club, Russia did reach an agreement for a rescheduling of debts, but more than one year after the "filing" for bankruptcy. In the meantime, Russia was subjected to intense foreign policy pressures by some of the governments to continue some types of debt servicing.

Even more importantly, there was no DIP financing available for Russia, and the IMF itself was dreadfully slow to mobilize funds to support the cash-strapped government. While it is true that Russia did not become a member of the IMF until June 1992, the IMF was already monitoring the Russian reform program since late 1991, and signed its first formal agreement with the Russian Government in March 1992. Yet at no time in the first part of 1992 did the IMF suggest to the G-7 or any other institutions that there was an urgent need to mobilize financial assistance. More egregiously, when the IMF made its first loan of $1 billion in July 1992, it did it under the condition that Russia hold the IMF funds as central bank reserves, and not actually draw upon them during the year. The IMF funding was cosmetic: it did not provide real resources to the Russian Government.

In general, the IMF has shown remarkably little interest in coordinating the actions of the creditors to achieve efficient debt relief, whether a standstill, new loans, or debt reduction. Aside from a few highly publicized cases of pressuring the banks to lend in the early 1980s, the IMF usually takes a nearly passive role vis-a-vis a

8. At various points, the Russian Government has made side payments to particular banks, in order to avoid harassment or to curry special favors. Russia and the bank creditor committee have also reached several agreements on temporary standstill that are advisory to the banks, without legal force.

country's private-sector creditors. The IMF is almost always silent on crucial questions of the negotiating framework between the country and the creditors: how to avoid holdouts; how to speed the negotiations; how to achieve comparability across creditor classes.

As I have stressed earlier, the IMF, unlike a bankruptcy court, does not merely facilitate new loans, but actually provides them directly out of its own resources. This fact has enormous implications for IMF behavior and helps to explain many of the shortcomings of the IMF approach. Since the IMF is lending "taxpayer dollars," it is extremely reticent to lend in risky circumstances. But, of course, all extreme crises are inherently risky. The result is that IMF loans are usually too little, too late. By the time they arrive, the government may have lost control of the situation.

Remarkably, the IMF lacks adequate standards for assessing a member government's needs for emergency loans. The IMF works with a deeply flawed concept known as the "balance of payments gap." The IMF estimates a level of "import needs," and then calculates how much in financial aid the country will need to be able to afford that level of imports.[9] The approach makes little sense. When a government is in financial distress, it is the government, not the country as a whole, that needs financing. The real financing gap is almost always a fiscal gap, not an import gap.

Russia, for example, does not need foreign financing to pay for imports. Indeed, there is extensive private capital flight out of Russia, which could in principle be used to pay for imports. Rather, the Russian Government needs budgetary support, since the budget is deeply out of balance and cannot be immediately brought back into balance. Russia's real choice, therefore, is whether to rely on the inflationary financing (from the central bank) or to rely on foreign borrowing to cover the budgetary gap. Foreign loans could make it possible for the Russian government to cover its bills in a non-inflationary manner.

Another flaw of the balance-of-payments gap methodology is that, in fact, the IMF typically works backwards in its calculations. It calls around to the G-7 Governments to see "what's on offer" to the country. The IMF then calculates a "target" import level based on its assessment of the available financing. In this sense, there is no real analysis of "import needs" at all. The IMF only very rarely makes an attempt to mobilize funds for a debtor country beyond what is on offer from the donor governments.

All of these problems -- no debt standstill, no DIP financing, no coordination of creditors, no assessment of the fiscal gap, slow negotiations on IMF lending -- lead to a *chronic under-financing of IMF-supported adjustment programs*. Ironically, this chronic underfinancing leaves governments as wards of the IMF far longer than necessary. Rather than achieving a decisive reform breakthrough, most governments simply struggle on with half measures and chronic instability.

IMF practices should be reorganized so that the IMF plays a role far more like an international bankruptcy court and far less like the lender of last resort to member governments. IMF-supervised programs would then be redesigned: to provide greater liquidity to member governments, a more realistic assessments of overall financial needs of the government, and a greater chance of breakthrough on financial stabilization. The IMF should completely scrap its calculation of a "balance of payments gap," and instead make a direct assessment of the financing needs of the government. An important test of the IMF programs would be the time until the government re-establishes solvency in the private markets. A quick return to the markets could be achieved through borrowing supported by "administrative priority." Debt reduction operations should be more aggressive, to allow governments

9. Mechanically, the IMF proposes a target level of imports for the year; makes an estimate of exports for the year; establishes a target for changes in net international reserves of the central bank; and then, as a residual, calculates the amount of net international financing that would be needed to meet the import and reserve targets. It then subtracts off all identifiable net capital movements that are already committed for the year (such as debt payments, or disbursal of loans that have already been arranged). The remaining amount is the "balance of payments gap." This gap is then to be filled by a combination of IMF funds and balance-of-payments support from other sources.

to reestablish solvency. The era of 10 or 20 years of continuous IMF drawings and lack of access to international financial markets should be brought to a close.

D. Preventing financial crises

A lender of last resort must divide its time between firefighting and fire prevention. Central banks and ancillary institutions generally have responsibility for oversight of the commercial banking system (though many central banks perform this function inadequately, corruptly, or virtually not at all), to try to forestall the onset of financial panics. There is a growing list of preventative items on the international policy agenda that could help to make the international financial system less prone to crisis.

Most relate the inadequacy of banking supervision within the member countries of the IMF. Many countries, such as Argentina until the past few weeks, lack even a rudimentary system of deposit insurance. That fact, especially when combined with pegged exchange rate policies, virtually invites a bank run. Moreover, bank capital adequacy standards are weakly enforced and supervised internationally. The consequences spill over internationally, not least in the need of the IMF and creditor governments to provide emergency financial assistance to countries that fall into crisis.

Additionally, there should be an international review of national practices regarding the public and private use of foreign-denominated contracts. In many countries, the widespread use of foreign currency deposits (generally dollar-denominated deposits) within the domestic commercial banking system invites a high-degree of currency substitution which often turns into a bank panic or flight from the domestic currency. Countries such as Mexico, Turkey, and Russia have likely introduced financial instability, and vulnerability to panics, by their encouragement of such foreign currency accounts.

More generally, there is a need for the review and harmonization of private-sector bankruptcy practices; for the harmonization of financial disclosure standards, concerning both public-sector and private-sector financial information; and for the use of prudential standards in restricting or encouraging international capital flows. There is also the need to examine whether various devices for limiting "hot money," such as Chile's controls on short-maturity capital inflows, would help to reduce the incidence of self-fulfilling runs on national currencies and banks.

VII. **Conclusions**

The IMF has an important role to play in helping governments to overcome extreme financial crises. Just as in domestic financial markets, international law is needed to overcome market failures and instability. The IMF has the central role to play in establishing the international legal arrangements to promote an efficient international monetary and financial system.

As stressed in this paper, there is the need for an extensive overhaul of IMF activities in helping governments in financial distress. Dozens of countries still find themselves today in serious liquidity or solvency crises, and many of these countries are battling high inflations. A lucky few, such as Mexico, get prompt and generous attention, but the rest are not so fortunate. The current crises will persist for several years, so that improved IMF practices are of the highest importance. And even when the great wave of current insolvencies is past,[10] history teaches that new episodes of state insolvency are sure to arise.

In thinking about an overhaul of IMF practices, the most important consideration is that we are living in a world of extensive capital mobility. There is no reason in principle for the IMF to rely solely on taxpayer dollars in

10. As suggested in Sachs and Warner (1995), the current spate of financial difficulties and hyperinflations is the legacy of strategies of socialism and state-led industrialization adopted by much of the developing world in the postwar era. In most cases, these non-market strategies ended up in the insolvency of the state.

the financing of countries in crisis. As in bankruptcy proceedings, the IMF could begin to rely much more on spurring *private* capital inflows to the debtor countries, by improving the overall regulatory and legal environment. Indeed, this would provide a salutary market test of the IMF's actions, which does not now exist.

Appendix. A Model of Self-Fulfilling High Inflation

As discussed in the text, monetary economies may be characterized by multiple monetary equilibria. In the "good" equilibrium, agents have confidence in the currency, and therefore hold high levels of real money balances. In the "bad" equilibrium, economic agents flee from the domestic currency as a result of inflationary expectations, and the flight from the currency itself results in the high expected inflation.

The model in this appendix offers a simple framework for analyzing self-fulfilling inflations. The model has the virtue of clarifying why self-fulfilling inflations seem to occur only in economies that have departed from "normal" monetary conditions as the result of prior adverse exogenous shocks. These countries are pushed into a vulnerable condition in which self-fulfilling prophecies may occur. The model is therefore distinguished from most existing models of multiple monetary equilibria, in which the flight from the currency is seemingly possible from almost any initial condition. Traditional models are deficient in failing to account for the fact that self-fulfilling high inflations tend to be possible yet rare.

Let M be nominal high-powered money, V be velocity (of high-powered money), P be the price level (GDP deflator), and Q be real output. Let m = M/P. The basic identify for velocity is:

(A.1) $V = PQ/M = Q/m$

The evolution of high-powered money is given by

(A.2) $\dot{M}/P = D$

Here, D is the real *flow* of domestic credit from the central bank (i.e. the change in net domestic assets). D may be considered as the amount of the budget deficit that must be financed by central bank seignorage, although in practice part of D may be directed to the non-state sector as well as to the budget.

As usual, we may re-write $\dot{M}/P = D$ as $\dot{m} + \dot{P} / P$. We also denote inflation as $pm = D - \dot{m}$. Then, (A.2) may be re-written as:

(A.3) $pm = D - \dot{m}$

By dividing both sides by m, we have:

(A.4) $p = D/m - \dot{m}/m$

Standard models of money demand (e.g. money in the utility function), lead to the conclusion that money demand is a negative function of inflation:

(A.5) $m = m(\pi)$ $m'<0$

Consider first the *steady state* relationship implied by (A.4) and (A.5). We return to dynamics in the following section. With constant inflation we have:

(A.6) $\pi = D/m(\pi)$

or

(A.7) $D = \pi\, m(\pi)$

Equation (A.7) has well-known properties that lead to the possibility of multiple equilibria. In general, there is a maximum level of D consistent with a steady-state level of inflation. Let us denote as DM the maximum D such that $D = \pi\, m(\pi)$ has a solution. Then, for values of D such that $0 < D < DM$, there are usually *two* or more values of inflation that satisfy (A.7). This well-known fact is depicted graphically in Figure 1 in the familiar "Laffer-curve" of inflation taxation, which graphs the relationship between the inflation rate π and the level of seignorage financing D.

Consider an intermediate level of seignorage financing $D0$ below the maximum. As seen in Figure 1, this level of seignorage financing is consistent with two steady-state inflation rates, a low inflation rate π^L and a high inflation rate π^H. The high inflation rate is characterized by lower real money balances, and is therefore less efficient. (With real money balances in the utility function it leads directly to a lower level of utility).

In case the economy settles at π^H, we may speak of a rational, self-fulfilling flight from the currency. Agents flee from the domestic money because of expectations of high inflation. Those expectations are realized as a result of the fall in real money demand, which then requires a high level of inflation to achieve the necessary seignorage financing for the government.

Monetary models have not been very successful in demonstrating whether an economy will settle at π^L or π^H when the government must finance its budget deficit with seignorage at the level $D0$. Practical monetary economists often regard the π^H equilibrium as a theoretical nuisance, since operating at the "wrong" side of the Laffer curve would imply that cuts in the budget deficit could actually lead to increases in inflation! Nonetheless, there is nothing inherent in the money demand equation that rules out an equilibrium at π^H.

Theoretical monetary models based on equations like (A.5) or (A.7) suggest a tenuousness to money demand that does *not* seem to apply to most actual economies. According to (A.7), if an economy is initially operating at π^L and is suddenly subject to inflationary expectations of π^H, real money demand simply collapses and inflation jumps to the new higher level in a self-fulfilling process. Empirical money demand equations, by contrast, show a strong effect of lagged real money demand on current real money demand, suggesting a *sluggish* response of real money balances in response to changes in inflationary expectations. This slower process of revising money demand tends to limit the pure self-fulfilling collapse of money demand.

The gradual changes in observed money demand patterns probably arises from fixed costs for businesses and households in altering the procedures governing their use of money, so that decisions over operating rules for money demand are made infrequently. For long periods of time, a firm operates under one payments system (e.g. wages and materials purchased on a monthly cycle), implying a particular pattern of money demand. That pattern remains unchanged unless underlying monetary conditions change drastically, or perhaps until the firm goes out of business.

Even if individual firms change their money demand patterns rarely and discontinuously, the economy-wide demand for money can evolve gradually and continuously if enterprises change their money demand patterns on a staggered basis. At any time, a small proportion of firms is adjusting the levels of real money balances, while the other firms continue to operate according to previously set rules. In the aggregate, money balances thereby evolve slowly. To capture this idea in the theoretical exercise, we will assume that <u>new</u> (start-up) enterprises choose their money-demand strategy at the moment of birth, and that the selected strategy remains constant during the life of the enterprise. However, aggregate money demand patterns change gradually because a small proportion of existing enterprises go out of business, while another group of enterprises are starting up.

Our specific interpretation of multiple monetary equilibria will depend crucially on the assumption that aggregate money demand patterns evolve gradually. With gradual changes in money demand patterns, a sudden, economy-wide fall in money demand is no longer possible. A flight from the currency can occur only gradually, and then only under restrictive initial conditions. We will show that a gradual, self-fulfilling collapse of money demand can occur when it is rational for each start-up firm to believe that all *future* start-up enterprises will want to flee the domestic currency. In that case, a new start-up firm will have the incentive to flee the currency, in anticipation of similar actions by future firms.

To fix ideas in a simple setting, suppose that economic agents can choose one of two distinct levels of real money balances, $\underline{m}$ or μ, with $\underline{m} < \mu$. At any given time, a fraction Θ of agents is operating with μ, and a fraction $1 - \Theta$ is operating with $\underline{m}$. Thus, the economy-wide money demand is:

(A.8) $m = \Theta \mu + (1-\Theta) \underline{m}$

In addition, the proportionate change in *m*, is given by (9):

(A.9) $\dot{m}/m = \dot{\Theta}(m - m)/m$

Corresponding to m and $\dot{m}$ is the inflation rate $\pi = D/m - \dot{m}/m$ according to (A.5).

In a steady state, $\dot{m} = 0$, and inflation is given by $\pi = D/m$. There are two possible steady-state rates of inflation, associated with the two possible steady-state levels of money demand. When money demand is given by $\underline{m}$, inflation is equal to $\pi^H = D/\underline{m}$. When money demand is given by μ, inflation is equal to $\pi^L = D/\mu$. Note that $\pi^H < \pi^L$.

We assume that individual agents have finite lives, with probability of death p at any instant. The birth rate is also p, so the population size is constant. We assume, furthermore, that each individual agents fixes its money demand at the start of its life, and that pattern of money demand is set forever. Aggregate patterns of money demand change only as old agents die and new agents choose new patterns of money demand. While this assumption is obviously unrealistic, it is the simplest way to model two crucial points: that the aggregate demand for money changes gradually, and that optimizing agents base their money demand on expectations about the future <u>path</u> of inflation, not just the contemporaneous rate of inflation. We will assume that expectations are fully rational. Indeed, since the model will not involve uncertainty, we will assume that inflation expectations are held with perfect foresight.

Let $U(\underline{m})$ be the instantaneous utility associated with a low level of money demand, and $U(\mu)$ be the instantaneous utility associated with a high level of money demand. We of course assume that $U(\underline{m}) < U(\mu)$. There is also the opportunity cost of holding real money balances, equal to the nominal interest rate times the level of m. Since the nominal interest rate is equal to the real interest rate r plus the rate of inflation π, the opportunity cost of holding money is $(r+\pi)m$. Also, let λ be the marginal utility of wealth (assumed constant). Thus, overall instantaneous utility Γ is equal to:

(A.9) $\Gamma(m) = U(m) - \lambda (r+\pi) m \qquad m = \underline{m} \text{ or } \mu$

The difference in instantaneous utility for high and low levels of money demand is therefore given by:

$\Delta = \Gamma(\mu)-\Gamma(\underline{m}) = U(\mu) - U(\underline{m}) - \lambda (r+\pi) (\mu-\underline{m})$, or:

(A.10) $\Delta = \alpha - \beta \pi$

where $\alpha = U(\mu) - U(\underline{m}) - \lambda r (\mu - \underline{m})$, and $\beta = \lambda (\mu - \underline{m}) > 0$. Clearly, Δ is a decreasing function of inflation π. With $\pi = 0$, $\Delta > 0$. As π rises, Δ falls. For some finite level of inflation, denoted $\underline{\pi}$, $\Delta = 0$. Specifically, $\underline{\pi} = \alpha/\beta$. For $\pi > \underline{\pi}$, $\Delta < 0$. Thus, for low levels of inflation, instantaneous utility is higher with a high level of money balances, while for high levels of inflation, instantaneous utility is higher with a low level of money balances (since the opportunity cost of money outweighs the direct utility effects of higher money balances).

Multiple stable equilibria can arise when $\underline{\pi}$ is between π^H and π^L. To see this, we suppose that the main parameters are such that:

(A.11) $\pi^L < \underline{\pi} < \pi^H$

where $\underline{\pi}$ is equal to α/β. Now can we argue informally that both π^H and π^L are locally stable equilibria. Suppose that all firms but the Nth have already selected μ, so that inflation is close to π^L. The Nth firm must now make its decision. Since inflation is less than $\underline{\pi}$, $\Delta > 0$. Therefore, it makes sense for the Nth firm also to choose μ. As old firms die and new firms are born, each new firm will similarly choose to hold μ. Alternatively, suppose that all firms but the Nth have already selected $\underline{m}$, so that inflation is close to π^H. We see in (A.11) that inflation is greater than $\underline{\pi}$. As a result, $\Delta < 0$, and the Nth firm will also choose $\underline{m}$. Each newly born firm will similarly choose to hold $\underline{m}$. Thus (informally) we see that both π^H and π^L are locally stable equilibria.

It is possible to interpret this multiple equilibrium as the result of an inherent *pecuniary externality* in money demand. The government must raise a given amount of resources through the inflation tax. This inflation tax must be shared among the N firms. If most firms are holding high levels of real money balances, then the inflation tax rate will be low, and it will make sense for any individual firm to hold a high level of money balances as well. If most firms are holding low levels of real money balances, then the inflation tax rate is high, and it will make sense for any individual firm to economize on real money balances.

We now analyze dynamic stability more formally. We assume that agents choose between μ and $\underline{m}$ in order to maximize their expected lifetime utility. Assuming a discount rate δ and an instantaneous probability of death p, the appropriate discount factor is $\delta + p$, and the expected <u>difference</u> in discounted utility in choosing μ compared with $\underline{m}$, denoted by Ω, is equal to:

(A.12) $$\Omega(t) = \int e^{[-(d+p)(t-t)]\Delta[p(t)]dt}$$

At a given time t, a fraction p of agents must choose whether to hold $\underline{m}$ or μ. They form expectations about future π and then calculate $\Omega(t)$. If $\Omega(t) > 0$, then they choose to hold μ. If $\Omega(t) < 0$, then they choose to hold $\underline{m}$. If $\Omega(t) = 0$, then they are indifferent. Therefore, Θ changes as a function of $\Omega(t)$. At all instants, a fraction p of the population (representing start-up firms) will be deciding on money demand. When $\Omega(t) > 0$, these new firms will choose μ. Contrariwise, when $\Omega(t) < 0$, start-up firms will choose $\underline{m}$. Then, it is easy to verify that the dynamics for Θ are governed by the following equations:

$$\begin{aligned} \dot{\Theta}(t) &= p[1-\Theta(t)] \quad \Omega(t) > 0 \\ &= -p\Theta \quad \Omega(t) < 0 \\ &= [-p\Theta, p(1-\Theta)] \quad \Omega(t) = 0 \end{aligned} \tag{A.13}$$

Using (A.5), (A.9), and (A.13), we may write the instantaneous rate of inflation as a function of $\Omega(t)$. When $\Omega(t)$ is positive, the level of real money balances in the population is increasing. According to (A.5), that leads to reduced inflation, since $\dot{m}/m > 0$. Similarly, when $\Omega(t)$ is negative, the level of money is falling, thereby raising the instantaneous inflation rate. Specifically,

(A.14) $p(t) = D/m - \dot{\Theta}(m - \underline{m})/m$

Notice that we can write π as a function of Θ for the separate cases when Θ is increasing, when Θ is decreasing, and when Θ is constant. Note that when Θ is increasing, $\dot{\Theta}$ is equal to p(1-Θ), and when Θ is decreasing, $\dot{\Theta}$ is equal to p(1-Θ). Therefore, using (A.8) and (A.14), we can write:

$$
\begin{aligned}
p^I(\Theta) &= \left[D - p(1-\Theta)(m-\underline{m})\right]/[\Theta m + (1-\Theta)\underline{m}] \quad for \quad \dot{\Theta} > 0 \\
p^D(\Theta) &= \left[D + p\Theta(m-\underline{m})\right]/[\Theta m + (1-\Theta)\underline{m}] \quad for \quad \dot{\Theta} < 0 \\
p^C(\Theta) &= D/[\Theta m + (1-\Theta)\underline{m}] \quad for \quad \dot{\Theta} = 0
\end{aligned}
\qquad \text{(A.15)}
$$

π^I, π^D, π^C stand for the function $\pi = \pi(\Theta)$ with increasing (I), decreasing (D), and constant (C) values of Θ. It may be verified that in the region $\pi > p$, $\pi(\Theta)$ *is a decreasing function of* Θ in all three cases. We assume this condition to hold in the discussion below.

Suppose the economy starts at t=0 with an initial value of Θ, designated $\Theta(0)$. Will this economy converge to $\Theta = 0$ or to $\Theta = 1$? We define an equilibrium path for Θ as in (A.16).

(A.16)

{Θ(t)} is a *perfect-foresight equilibrium path* if it satisfies the following conditions:

(a) $\Theta(0)$ is given

(b)
$$
\begin{aligned}
\dot{\Theta}(t) &= p\left[1 - \Theta(t)\right] && \Omega(t) > 0 \\
&= -p\Theta && \Omega(t) < 0 \\
&= \left[-p\Theta,\ p(1-\Theta)\right] && \Omega(t) = 0
\end{aligned}
$$

(c) $\Omega(t) = \int e^{[-(d+p)(t-t)]}\left[a - bp[\Theta(t)]\right]dt$

(d)
$$
\begin{aligned}
\Pi(\Theta) &= \left[D - p(1-\Theta)(m-\underline{m})\right]/\left[\Theta m + (1-\Theta)\underline{m}\right] && for \quad \Omega(t) > 0 \\
\Pi(\Theta) &= \left[D + p\Theta(m-\underline{m})\right]/\left[\Theta m + (1-\Theta)\underline{m}\right] && for \quad \Omega(t) < 0 \\
\Pi(\Theta) &= D/\left[\Theta m + (1-\Theta)\underline{m}\right] && for \quad \Omega(t) = 0
\end{aligned}
$$

In principle, an equilibrium path of Θ could wander between 0 and 1 in a complicated, non-monotonic path. We will limit our search for equilibria to monotonic paths of Θ, i.e. those in which Θ is steadily increasing towards 1 (that is, a steadily rising proportion of firms is holding μ), or is steadily declining towards 0 (a steadily rising proportion of firms is holding $\underline{m}$). Of course, as $\Theta \to 1, p \to p^L$, while as $\Theta \to 0, p \to p^H$.

On a monotonically increasing path of Θ, $\dot{\Theta} = p(1-\Theta)$:

(A.17) $\Theta^I(t) = -\left[1 - \Theta(0)\right]e^{-pt} + 1$

On a monotonically decreasing path of Θ, $\dot{\Theta} = -p\Theta$:

(A.18) $\Theta^D(t) = \Theta(0)e^{-pt}$

For which initial conditions $\Theta(0)$ will $\Theta(t)$ approach 0 or 1?
We may establish the following result:

There exists a $\underline{\Theta} \leq 1$ such that for all $\Theta(0) \in [0, \underline{\Theta}]$, the path $\Theta^D(t) = \Theta(0)\, e^{(-pt)}$ is an equilibrium path. The economy converges to $\Theta = 0$, and inflation converges to π^H.

There exists a $\underline{\Theta} \geq 0$ such that for all $\Theta(0) \in [\Theta, 1]$, the path $\Theta^(t) = -[1-\Theta(0)]e^{(-pt)}+1$ is an equilibrium path. The economy converges to $\Theta = 1$, and inflation converges to π^L.

For all $\Theta(0) \in [\underline{\Theta}, \Theta]$ both $\Theta^D(t)$ and $\Theta^I(t)$ are equilibrium paths. The economy may converge to $\Theta=1$ or to $\Theta = 0$. (Note that the range of multiple equilibria could possibly be the entire interval [0,1].)

The economic logic of this key result is as follows. When the initial value of Θ is close to zero, most firms have already fled the domestic currency, by choosing m = $\underline{m}$. Inflation is therefore high. It is therefore rational for all start-up firms to flee the domestic currency as well by choosing m = $\underline{m}$. The economy necessarily converges to $\Theta = 0$ and $\pi = \pi^H$. On the other hand, when Θ starts out close to 1, inflation is low, and start-up firms also choose m=μ as their money demand. The economy necessarily converges to $\Theta = 1$.

When Θ takes an intermediate value (specifically, between $\underline{\Theta}$ and Θ), then both the low-inflation and high-inflation equilibria are possible end-points. If all start-up firms have *pessimistic* expectations, in the sense that they expect later firms to choose m = $\underline{m}$, then they too will choose $\underline{m}$, and the economy will converge to $\Theta = 0$ and $\pi=\pi^H$. If all start-up firms have *optimistic* expectations, in the sense that they expect later firms to choose m = μ, then they too will choose μ, and the economy will converge to $\Theta = 1$, and $\pi = \pi^L$. Note that we are using the terms "pessimistic" and "optimistic" to refer to long-term assessments of inflation. Pessimism signifies expectations of high inflation in the long run, and optimism signifies expectations of low inflation in the long run.

As in the models of Krugman (1991) and Matsuyama (1991), the long-term equilibrium therefore depends on both history and expectations. If history has left the economy with a high degree of monetization (Θ close to 1), then the economy will converge necessarily to a low inflation rate. It would be irrational for start-up firms to choose a low level of money demand, since inflation will necessarily be low for quite a while in the future. If history has left the economy demonetized (Θ close to 0), then the economy will converge necessarily to a high inflation rate. In a middle range of , however, history is not enough. New firms will choose $\underline{m}$ or μ depending on whether they are "optimistic" or "pessimistic" about future inflation. Either course of action is rational. A flight from the currency is self-confirming, in that it produces a high rate of inflation over time that justifies the original flight from the currency.

To find the values of $\underline{\Theta}$ and Θ, we proceed as follows. We can construct two functions $\Omega^I(\Theta 0)$ and $\Omega^D(\Theta_0)$ that have the following definitions:

(A.19)
$$\Omega^I(\Theta_0) = \Omega(t) \quad for \quad \Theta(t) = \Theta^I(t) \quad and \quad \Theta(0) = \Theta_0$$
$$\Omega^D(\Theta_0) = \Omega(t) \quad for \quad \Theta(t) = \Theta^D(t) \quad and \quad \Theta(0) = \Theta_0$$

These functions are the values of Ω for an initial Θ, assuming that Θ rises over time (in which case Ω^I), or that Θ falls over time (in which case Ω^D). Under our assumptions, each of these functions is a monotonically rising function of the initial level of Θ, but with $\Omega^I > \Omega^D$. Also, $\Omega^D(0) < 0$ and $\Omega^I(1) > 0$. We can interpret Ω^I as the value of holding μ compared with the value of holding $\underline{m}$, under the "optimistic" expectations that all future firms will choose $m = \mu$. Similarly, Ω^D is the value of holding μ compared with the value of holding $\underline{m}$, under the "pessimistic" expectations that all future firms will choose $m = \underline{m}$.

The Ω^I function is graphed in Figure 1, using parameter values described below. We see that for any $\Theta(0)<\underline{\Theta}$, $\Omega^I < 0$. Thus, for $\Theta(0)$ in the interval $[0, \underline{\Theta}]$, new firms will necessarily choose to hold low levels of money balances ($m=\underline{m}$). Even if the firm is optimistic that all future firms will adopt high levels of money balances ($m=\mu$), the value of the firm is still higher with $m = \underline{m}$. The Ω^D function is also graphed in Figure 1. We see that for any $\Theta(0) > \Theta$, $\Omega^D > 0$. Thus, for $\Theta(0)$ in the interval $[\Theta,1]$, new firms will necessarily choose to hold high levels of money balances ($m=\mu$). Even if the start-up firm is pessimistic that all future firms will adopt low levels of money balances, the value of the start-up firm is still higher with $m = \mu$.

In the interval $[\underline{\Theta},\Theta]$, we have $\Omega^I > 0$ and $\Omega^D < 0$. In this case, if firms are optimistic (so that Θ is expected to increase), then they should hold $m = \mu$, since $\Omega^I > 0$. On the other hand, if firms are pessimistic, then they should hold $m = \underline{m}$, since $\Omega^D < 0$. Thus, the interval $[\underline{\Theta},\Theta]$ leads to an indeterminate outcome, depending on expectations.

III. A Numerical Illustration

In this section, we provide a numerical illustration of the model, based on a discretization of the continuous-time dynamics in the preceding section. The relevant discrete-time model is as follows.

As before, we assume that enterprises hold either μ or $\underline{m}$. The utility of holding money is assumed to be linear in the level of real money balances. There is the marginal productivity of holding money, which we denote a. There is the opportunity cost in terms of foregone real interest, which has a present value $rm/(1+r)$, assuming that the interest is paid in the following period. There is the inflation tax on real money balances, which in present value terms equals $m (1 - P_t/P_{t+1})/(1+r)$, which may be re-written as $m \pi_{t+1}/[(1+r)(1+\pi_{t+1})]$, where $\pi_{t+1} = (P_{t+1} - P_t)/P_t$. In sum, $\Gamma(m) = am - rm/(1+r) - m \pi_{t+1}/[(1+r)(1+\pi_{t+1})]$. Therefore, $\Delta(t) = \Gamma(\mu,\pi_{t+1}) - \Gamma(\underline{m},\pi_{t+1})$. The inflation rate is given by: $\pi_{t+1} = [D - (m_{t+1} - m_t)]/m_{t+1}$, where m_t is the economy-wide level of real money balances at time t.

By earlier definitions, $m_t = \Theta(t)\mu + (1-\Theta(t))\underline{m}$. In discrete time, the evolution of $\Theta(t)$ is as follows:

$$\text{(A.20)} \qquad \begin{aligned} \Theta^I(t) &= (1-p)^t\ \Theta(0) + [1-(1-p)^t] \\ \Theta^D(t) &= (1-p)^t\ \Theta(0) \end{aligned}$$

The indicator function $\Omega(t)$ in discrete time is given as follows:

$$\text{(A.21)} \qquad \Omega(t) = \Sigma\,[(1-p)/(1+r)]^t\,\Delta(t)$$

The parameter values for the simulation exercise are as follows. $D = 0.2$; $p = 0.05$; $r = 0.2$; $a = 0.35$; $\underline{m} = 0.4$; and $\mu = 1$. The firm is indifferent between $\underline{m}$ and μ when inflation is given by $\underline{\pi} = 0.28$. In this model, the high-inflation equilibrium is $\pi^H = 0.5$, while the low-inflation equilibrium is $\pi^L = 0.2$. Thus, as is required for a multiple equilibrium, $\pi^L < \underline{\pi} < \pi^H$.

The two functions Ω^D and Ω^I are graphed in Figure 1. These two functions determine the following

intervals:

Initial Conditions	Convergence to:
$\Theta(0) \in [0,0.24]$	high-inflation equilibrium
$\Theta(0) \in [0.24,0.81]$	high-inflation or low-inflation equilibrium
$\Theta(0) \in [0.81,1]$	low-inflation equilibrium

Consider the two possible time paths of inflation when the economy starts out at an intermediate level of monetization, $\Theta(0) = 0.5$. In the pessimistic equilibrium, inflation begins at 0.31 and climbs towards the long-run equilibrium at 0.5. In the optimistic equilibrium -- with the same underlying seignorage needs -- inflation starts at 0.26 and falls to the long-run equilibrium at 0.20. Note that even at the start, the optimistic equilibrium produces a lower inflation than the pessimistic equilibrium. This is because real money balances are rising in the optimistic equilibrium and are falling in the pessimistic equilibrium.

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