

NBER WORKING PAPER SERIES

DOLLAR SHORTAGES AND CRISES

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Working Paper 10845

<http://www.nber.org/papers/w10845>

NATIONAL BUREAU OF ECONOMIC RESEARCH

1050 Massachusetts Avenue

Cambridge, MA 02138

October 2004

This paper reflects my opinions and are not meant to represent the views of the International Monetary Fund or its member countries. I thank Ioannis Tokatlidis for extremely helpful research assistance and Douglas Diamond, Olivier Jeanne, Se-jik Kim, and Ashok Mody for helpful comments. The paper is based on talks given at the Central Bank of Argentina and the Central Bank of Chile. The views expressed herein are those of the author(s) and not necessarily those of the National Bureau of Economic Research.

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Dollar Shortages and Crises
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NBER Working Paper No. 10845
October 2004
JEL No. G15, G28, F21, F32, F34

ABSTRACT

Emerging markets do not handle adverse shocks well. In this paper, I will outline an explanation of why emerging markets are so fragile, and why they may adopt contractual mechanisms – such as a dollarized banking system -- that increase their fragility. I draw on this analysis to explain why dollarized economies may be prone to dollar shortages and twin crises. The model of crises described here differs in some important aspects from what is now termed the first, second, and third generation models of crises. I then examine how domestic policies, especially monetary policy, can mitigate the adverse effects of these crises. Finally, I will ask if there is a constructive role for international financial institutions both in helping to prevent the crises and in helping resolve them.

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There is a strong correlation between the stoppage of capital flows to a country, the extent of dollarization of the country's banking system, and the prevalence of banking crises. Between 1974 and 2003, while 56 percent of all episodes where capital flows underwent a "sudden stop" were associated with a banking crisis, 75 percent of those episodes where the country also had a high level of dollarization ended in a banking crisis, and 100 percent of episodes where the country also had a high level of dollarization and a fixed exchange rate ended in a crisis (see IADB (2004)). What accounts for these correlations? Are there domestic policies that can mitigate these risks? Can international financial institutions be useful here? These are the questions addressed in this paper.

I start first with why emerging markets may adopt contractual mechanisms – such as a dollarized banking system -- that accentuate vulnerabilities. I will argue that emerging markets have weak institutions that tend to make it particularly hard to cope with economic adversity. As a result, instead of sharing the burden of downturns in predictable ways, it is spread in unpredictable ways, for example, through selective defaults and high inflation. The best protection for investors against such risks in an environment with limited contract enforcement may well be a domestic deposit denominated in foreign currency (following the tradition in this literature, I will call the foreign currency "dollars").

Critical to the functioning of the dollarized system is that there be enough dollars at all times. I will argue that an incipient dollar shortage, which can arise from a variety of causes including excessive government borrowing, an external "liquidity" shock, or an overvalued exchange rate, can be magnified by a dollarized banking system, into a total collapse of the financial system, the exchange rate, and other asset prices. The model of crisis described here differs in some important aspects from what is now termed the first, second, and third generation models of crises.

The links between the government and the banking system can come about simply because both dip into a common pool of dollars, and not necessarily because the banking system

holds significant amounts of government debt or the contingent liabilities of the banking system are borne by the government (see Burnside, Eichenbaum and Rebello (2001)). Similarly, the collapse in the exchange rate and the collapse in the banking system can occur close together, not just because the corporate or banking system's liabilities explode in value as a result of depreciation (see Aghion, Bachetta, and Benerjee (2001)) but also because the depreciation is a result of the banking system's desperation for dollars. Also, while dollar shortages can cause banking system crises, the reverse is also possible. This is not to say any of the other channels are unimportant, but rather I intend to focus on one particular channel, the banking system's need for dollar liquidity, which can tie many of these effects together.

Finally, I will explore various possible policy interventions to mitigate the effect of dollar shortages, including whether the international financial institutions have a role to play. If dollarization arises primarily from institutional infirmities rather than a distorted incentive to take on risk, it may be costly to legislate it away. Countries may have to learn to live with dollarization for a while. At the same time, if poor institutions rather than poor incentives are to blame, interventions to mitigate the effects of dollarization may not significantly enhance moral hazard.

The rest of the paper is as follows. I start in section I with the basic argument, buttressed with some evidence for the assumptions. I then examine various interventions domestic authorities could undertake, and end with a discussion of possible interventions by the IFIs.

I. A Framework

1.1. Why are emerging markets different?

Start first with what makes emerging markets different from developed countries. A growing number of economists see the main difference to be the quality of institutions. Since the word "institutions" seems to be so widely used nowadays, it is probably useful to define what I mean. Broadly speaking, one could group institutions into whether they are *basic* or *narrow*. By basic, I mean institutions such as whether there is security of property, whether contracts are enforced, and whether people have democratic voice. By narrow, I mean more detailed features

of the institutional environment such as whether the central bank is de-facto independent or whether there is a functioning bankruptcy code. With few exceptions, a country with weak basic institutions also finds it difficult to build effective narrow institutions.

One important role played by basic institutions is to mediate the outcome of conflicts in times of adversity. Typically, most differences can be papered over in a growing economy. But a downturn seems to bring out latent conflicts.

Why growth seems to be easier to share than adversity is an interesting question. If agents are prone to habit formation in consumption, an income loss is much harder to swallow, while it is not that important to fight for a gain. Similarly, individual aversion to losses in wealth is a well-documented phenomenon in behavioral science, and to the extent that individuals have already capitalized future incomes into their wealth, they may indeed feel less strongly about unanticipated income gains than about unanticipated losses. Finally, growth opportunities may indeed be more sensitive to conflict than losses (if workers and management squabble, they drive away investors and lose the chance to start new projects, but the old plant remains regardless of the level of conflict), so when there are substantial growth opportunities on the horizon, parties have the incentive to mute conflict (see, for example, Rajan and Zingales (2000)).

Regardless of why conflicts are greater in times of economic adversity, how a society deals with them depends on the kind of institutions of conflict management it has. In a comprehensive study of failed states, Collier et al. (2003) find that armed conflict is preceded by years of poor economic growth. Moreover, even after concluding a peace, the probability of these states lapsing anew into conflict is high. Not surprisingly, these states typically have weak institutions of conflict management such as patchy enforcement of the law, limited adherence to democratic principles, and few meaningful checks and balances on the government. Similarly, Rodrik (1999) finds that countries that experienced the sharpest drops in growth after 1975 were those with divided societies and weak institutions of conflict management (as proxied for by

indicators of the quality of government institutions, rule of law, democratic rights, and social safety nets).

Acemogulu, Johnson, et al.(2003) find that countries with poor institutions have the highest volatility of growth as also higher levels of inflation. Satyanath and Subramanian (2004) show that over and above the effect of policies, the quality of political institutions affects the extent of nominal macroeconomic instability in a country.

In short, societies with well functioning institutions allocate burden sharing in times of distress in predictable ways. For example, those who suffer the most adversity can fall back on an explicit social safety net – a minimum level of unemployment insurance. Debtors and creditors can appeal to bankruptcy proceedings to determine their relative shares. Given that there is an explicit and contingent institutional sharing mechanism that dictates the division of pain, there is no need to take to the streets, the backrooms, or to the money printing press to settle outcomes.

By contrast, when institutions are weak and neither offer acceptable settlements nor protect existing shares, everyone has an incentive to jockey for a greater share of the pie. Outcomes will be mediated by relative bargaining power than by pre-existing contracts.

Often, bargaining will break down. When a government does not have the institutional capacity to allocate the burdens of adversity among its citizenry, the temptation will be to spread it through the easiest means available, inflation. Hence nominal instability will accompany real instability in countries with weak institutions lending support to the view that while the proximate cause for inflation may be monetary expansion, inflation is always and everywhere a political phenomenon!

1.2. Evidence for the link between inflation and poor growth.

I want to establish two facts here, which are a little different from the work cited so far. First, I want to test whether the inflation “tax” is higher in downturns, and second, whether this phenomenon is particularly acute for countries with poor institutions. To check this, I have data on the value of the inflation tax, which is measured as $\Delta\text{CPI} / (1 + \Delta\text{CPI})$ where ΔCPI is the change

in the Consumer Price Index in the country over the year. This is computed every year from 1965 to 2002 for 165 countries. In Table 1, I present summary statistics and cross-correlations for the inflation tax, the standard deviation of the inflation tax computed over the preceding five years, the growth rate in GDP, and the quality of institutions measured by four different indices: government effectiveness, regulatory quality, rule of law, and control of corruption. In Figure 1, I plot the real growth of a country's GDP, averaged over 1980 to 1995 against average inflation tax over the same period, separately for countries with below median levels of government effectiveness and countries above median. The negative slope is steeper in the former, suggesting slower growth is correlated with more inflation in countries with weak institutions.

Rather than average correlations, we are interested in the time series patterns across countries. In Table 2 we use a panel of observations where the dependent variable is the inflation tax in a year in a country. In column (1), I estimate a random effects GLS model where the explanatory variables is a constant and the growth rate in GDP. The coefficient of the GDP growth rate is negative and highly significant suggesting periods of low GDP growth are when the inflation tax is highest. A standard deviation increase in the growth rate is associated with a reduction in the inflation tax by .0241, which is 20 percent of its sample standard deviation. In column (2), I include the index of government efficiency (the results with other institutional variables are qualitatively similar) and the interaction of GDP growth with the index. As the prior literature has found, countries with a better institutional environment tend to experience lower inflation tax. Particularly interesting is that the positive significant coefficient of the interaction term suggests, as predicted, that the inflation tax in countries with better institutions is less sensitive to growth. In column (3), we estimate the model including country fixed effects, and find no qualitative change in the coefficients of interest.

One problem with the estimated model is that we cannot tell the direction of causality. High inflation may, in fact, cause low growth, though why this should be more pronounced in countries with poor institutions is harder to say. Nevertheless, it is important to examine the effect

of the exogenous component of growth on the inflation tax. Typically, a country will be affected by similar exogenous shocks as its neighbors, if not directly, then via trade. So one plausible instrument for a country's i 's growth is EXTGROWTH, which is the weighted average growth of all other countries j , with each country j 's growth weighted by that country's log GDP and divided by the square of the distance between i and j . In column (4), we re-estimate the fixed effects model, using EXTGROWTH to instrument for growth. The coefficient of the interaction is now larger in magnitude and stronger in significance.

One could ask if this effect is special to small countries.² In column 5, we re-estimate the fixed effect instrumented regression separately for countries that are below the sample median in real GDP in 1999 (GDP sample median=9.182 billion \$US) and, in column 6, for countries that are above the median. While the magnitude of the interaction coefficient is about 50 percent larger for the smaller-countries sub-sample, it is estimated more precisely for the larger ones.

Finally, while we have instrumented for growth, we have not instrumented for institutional quality, the other element of the interaction. There is some controversy about what instruments are appropriate for institutions. Following Acemogulu et al. (2002), we use the log of a country's population density in 1500 (countries that had less of a native population were less likely to have an exploitative colonial structure imposed on them and have better institutions today) as an instrument for institutional quality in column (7). While we lose a number of countries, the coefficient of the interaction is still positive, large, and statistically significant.

The bottom line is that the inflation tax is higher when countries experience poor growth, and it is particularly high when those countries have poor institutions.³ Poor societies with weak institutions do not share the burden of distress well.

² Large countries may affect the growth of their neighbors. So there is a case for arguing the instrument is purer for small countries.

³ The fact that inflation is higher in bad times is not inconsistent with the finding in Kaminsky, Reinhart, and Vegh (2004) that policies in developing countries are pro-cyclical. While fiscal and monetary policies may indeed tighten in downturns, they may not tighten enough given the economy's institutions to avert generalized inflation.

1.3. Contractual Adaptation

If the country's underlying basic and narrow institutions do not permit a contingent, speedy, and predictable sharing of adverse economic circumstances, and the tendency of the government is to spread the burden along the path of least resistance, economic agents will take steps to protect themselves. But without a reliable and effective legal system, what can they do? Clearly the answer has to be to use instruments that depend in a very limited way on the legal system for enforcement.

One approach is to use inflexible, non-contingent contracts, whose violation is easily detected. For example, labor contracts in many developing countries effectively do not permit employees to be fired. This is seen as inefficient because it does not allow firms to react quickly to business conditions. Often, these prohibitions are ascribed to overly strong unions that hold the economy to ransom. But if courts are slow and corrupt, so that a worker who is wrongfully fired has no redress, perhaps the prohibition of firing—because violations are so easily and publicly observable and can be responded to through mass protests—is the only way to protect workers from arbitrary decisions by employers (also see Glaeser and Shleifer (2001)). Job tenure may also act as a form of social security because the government does a miserable job providing a safety net, and private insurance markets do not exist. Thus an inflexible contract can protect workers when the preponderance of bargaining power is with firms.

This is not to argue against reforming these contracts – they may outlive their initial usefulness as the legal system is reformed, and continue to be supported by vested interests. The arguments I have made may be trotted out as a defense long after they are valid.

1.3.1. Demandable debt

Interestingly, an extremely flexible financial contract may also be a form of protection. Consider a bank demand deposit. Essentially, a demand deposit has two features that make it virtually self-enforcing. First, the bank is required to honor the claim when it is presented at the teller window. If it is slow in doing so, or attempts in any way to renege, the news spreads

quickly since the refusal to honor a demand deposit is such a clear and incontrovertible event. Second, the bank honors withdrawals in the order they are presented until no more depositors want to withdraw or the bank fails. “Sequential service” implies that when depositors sense even the slightest hint of potential distress, they have a strong incentive to withdraw their money – if they do, at worst they have the trouble of re-depositing if the bank later turns out to be safe, if they don’t, they may end up penniless as the bank fails.

The two features ensure that the ordinary depositor has a fairly secure claim, supported by other depositors – the threat of a bank run plays the same role as the threat of a labor strike – if bank management reneges on the commitment to repay the deposit contract it will face a depositor run which will close it down. So except in the case where it absolutely cannot pay, bank management will honor deposit contracts. This may be one reason why banks are such an important component of the financial sector in emerging markets (see Calomiris and Kahn (1991), Diamond and Rajan (2001)).

The point is that anticipating little power over outcomes in downturns, weaker agents might demand contractual options that will help alter the status quo going in to those downturns. For labor, it is the option to keep a job, for depositors, it is the option to get their money. For the economy as a whole, however, the exercise of these options add to the difficulty of adjustment in downturns, exacerbating the problems created by institutional weakness.

In the rest of the paper, I will examine these problems further, specifically focusing on how demandable debt raises the risks of financing industry in emerging markets. But before I explore that, let me add two more ingredients.

1.3.2 Domestic Liability Dollarization

Because inflation is likely to explode in downturns – because inflation is a greater systematic risk in the financial sense in emerging markets – depositors will demand an extraordinarily high premium for holding inflation risk. This means that issuers who want to minimize expected debt service (perhaps because of short horizons or because they are liquidity

constrained) will opt to issue real instruments (see Caballero and Krishnamurthy (2001) for a related explanation and Ize and Levy Yeyati (2003) and Jeanne (2002) on other theories why inflation risk could lead to dollarization).

If there is high volatility in inflation (which usually accompanies a high inflation rate) in addition to weak institutions, inflation indexed instruments may not be attractive to the public. Uncertainty about the measurement of inflation, delays in producing an accurate estimate, and fears that measurement will be manipulated, can increase their risks. The natural way to issue real bonds is to denominate them in a foreign currency rather than to issue inflation indexed bonds. Thus suspicion about the official actions in a downturn lead quite naturally to domestic liability dollarization – approximately 40-45 percent of bank deposits in Europe, Latin America, and the Middle East are denominated in foreign currencies (see Nicolo, Honohan, and Ize (2003)).

1.3.3 Evidence on Liability Dollarization

What evidence do we have for this conjecture? Nicolo, Honohan, and Ize (2003) find that in a cross-section of countries, the extent of dollarization (dollar deposits to total deposits) is positively and significantly correlated with the log of inflation. However, when a proxy for institutional quality is included, inflation no longer enters significantly. The evidence is consistent with weak institutions driving inflation, which in turn leads to greater dollarization.

Again, however, we want to test a more nuanced version. We also want to see if there is a relationship between the sensitivity of inflation tax to growth (which we have seen, appears to reflect the ability of a country to cope allocate the costs of economic adversity) and the level of dollarization. We also want to see if the extent of dollarization is related to the volatility of inflation, over and above its correlation with the level of inflation. In Table 3, I present summary statistics and cross correlations. The extent of liability dollarization is measured by the ratio of foreign currency deposits to total deposits (FCDTD) in a country's banking system averaged over the 1990s, using the Nicolo, Honohan, and Ize (2003) data. The sensitivity of inflation tax to growth for a country (henceforth "SENSITIVITY") is the coefficient estimate on GDP growth in

a regression of the inflation tax on GDP growth for that country for the period 1965-2002. The standard deviation of inflation tax is measured for every period t by its standard deviation during the five years from $t-4$ to t ; then for the cross section we take the average of standard deviation over 1965 to 2002.

In Table 4, the dependent variable is liability dollarization in a country in the 1990s. In column (1) I include the sensitivity of inflation to GDP growth and a constant as explanatory variables. The coefficient estimate for the sensitivity is negative and significant. Since the sensitivity is typically negative (lower growth, more inflation tax), countries with a higher magnitude of the sensitivity have greater deposit dollarization as expected. In Figure 2, I plot the extent of dollarization against SENSITIVITY. As the graph suggests, the relationship is likely to be non-linear. So in column (2), I allow for a non-linear specification of sensitivity by including the square of sensitivity. The coefficient of the squared term is positive and strongly significant. Greater sensitivity again is correlated with greater dollarization. If sensitivity changes from 0 to its lower 1 percentile threshold (-0.029), dollarization increases by 33 percent, which is 140 percent of its standard deviation.

I check that this relationship persists even when we include the “usual suspects”. In column (3), I include the average inflation tax in the country, and in column (4) I add the standard deviation of the inflation tax. While the coefficients for the non-linear specification for sensitivity are positive and statistically significant in both columns, the coefficient for inflation tax is positive and significant only when included alone, but becomes insignificant when the standard deviation of inflation tax is included. The estimates for sensitivity are qualitatively similar if we include squared terms for inflation tax and the standard deviation of inflation tax (estimates not reported). Finally, in column (5), we include both the log of per capita GDP and the index of legal restrictions on dollarization compiled by Nicolo, Honohan, and Ize (2003), which is available for only 83 of the countries, and find qualitatively similar results.

One should not read too much into these last few “kitchen sink” regressions since sensitivity, inflation tax, and the standard deviation of the inflation tax measure various aspects of the same thing. All I want to show the reader is that both sensitivity and the standard deviation of inflation tax seem to be correlated with the extent of dollarization as predicted by the earlier discussion, and seem to capture something more than just the level of the inflation tax, which the prior literature has identified.

The evidence thus far is consistent with the following conclusions: Countries with weak institutions have greater sensitivity of inflation to growth. In countries with higher sensitivity, investors have a higher demand for real deposits. Because inflation is also very volatile, they may prefer deposits denominated in foreign exchange rather than deposits that are indexed.⁴

1.4. Aggregate Dollar Constraints/Sudden stops

Let us now add the final ingredient to the “model”. Since emerging markets with the weakest institutions for conflict management (and the most divided societies) have the hardest time spreading the burdens of distress, they are also likely to have the most difficulty raising resources to continue to service external debt. The tendency of some countries to default repeatedly (Reinhart, Rogoff, Savastano (2003)) may reflect the weakness of their capacity to manage economic adversity than any inherent lack of honesty on the part of their governments. But this means that these countries are likely to face aggregate constraints on external borrowing sooner than other countries. Since in periods of adversity, creditors will reduce their expectations of what the country will be able to repay, they will also reduce what they are willing to lend. Such a “vertical” constraint on dollars the country can borrow (Caballero and Krishnamurthy (2000,2001)) or sudden stop (Calvo and Reinhart (2000)), will interact with liability dollarization to produce unfortunate consequences we now document.

⁴ There is a sense in which this argument runs counter to the “Original Sin” thesis (for example, see Hausman, Eichengreen, and Panizza (2002)) because I attribute financial fragilities to weak institutions rather than to other factors like country size. But Hausman et al. (2002) focus on the currency denomination of public debt rather than on the currency denomination of bank debt. For another view of institutional explanations of financial system fragilities, see Mody (2004).

II. Consequences: Overshooting, Liquidation, and Contagion

Now that we have the ingredients, dollarized bank deposits and the possibility of aggregate constraints on borrowing, let us sketch the consequences.

2.1. The Sources of Dollar Shortage

In the normal course, dollar depositors will want to withdraw some of their deposits. The reasons for this can range from normal liquidity needs (such as importing foreign goods) to good dollar investment opportunities outside the country. Clearly, if their bank has fewer dollar reserves than the amount of withdrawals, it will buy dollars on the market. Summing across banks, there will be an aggregate demand for dollars, which will have to be met out of the country's reserves, dollar repatriation by exporters, and, if necessary, additional external borrowing. It does not really matter which domestic entity (government or banks) does the external borrowing since the aggregate available pool of dollar resources will determine whether the aggregate domestic demand can be satisfied.

Problems arise when the aggregate demand exceeds the aggregate supply (not including borrowing) and the country has difficulty borrowing the shortfall. One such situation is one where the economy is booming but the (fixed) exchange rate is overvalued. Exporters may not earn enough and, far from bringing foreign exchange into the country to repay loans, may seek to draw down their deposits to continue operations. Importers may have a huge demand for dollars because foreign goods appear cheap. When added to the normal liquidity needs of depositors, the demand may be so high that it even exceeds the willingness of foreign investors to lend the shortfall. Another situation is when the excess demand is relatively small but the economy is in a bad way or the government has over-borrowed, so foreign investors are unwilling even to lend meager amounts of extra dollars needed. In fact, the government can contribute to the private sector dollar shortage by adding its own external financing needs.

Regardless of how the dollar shortage emerges (and we will shortly see some examples), the dollarized banking system can exacerbate it (see Diamond and Rajan (forthcoming) for a

detailed model). Since the banks have issued a non-renegotiable promise to pay dollars, they either have to convince their own depositors not to withdraw by hiking the interest rates paid on dollar deposits or they have to attract dollars away from other banks in the spot market. Higher rates may quell some depositor demand, but it will leave a core liquidity demand that cannot be deterred with higher rates. If this still exceeds the available dollars, the banks will compete with each other for scarce dollars. Given that a bank fails if it does not come up with the needed dollars, it will be willing to pay what it takes for additional dollars. But there is an overall shortage so banks can competitively drive each other into failure.

Short banks will sell non-dollar spot assets and long term assets for dollars. Thus the exchange rate (dollars per domestic currency) will tend to fall and interest rates (both for long term dollar assets and for long term domestic currency assets) will rise. In principle, because the quantity of dollar demand and supply cannot adjust readily, these prices can move very far from any notion of fundamental value. Both the exchange rate and the interest rate can overshoot during the scramble for dollar liquidity.

Real decisions will be affected during this scramble, with lasting consequences. Let us go systematically through them.

2.2. Real Consequences

The first place banks will look for additional dollars is amongst those who generate them and those who use them. Exporters will be squeezed, in an attempt to get them to speed up their own dollar receipts and hasten repayment of dollar borrowings to banks (on average, across emerging markets approximately 30 percent of domestic loans made by banks are denominated in foreign currency (see IMF (2004))). To raise these amounts quickly, exporters will sell finished goods inventories at steep discounts, and reduce near-term sales prices. They will shelve exports that are highly import intensive, and abandon longer term projects, especially those that require capital goods imports.

Clearly, all these actions will impair the economy's medium run ability to export and thus its ability to generate dollars in the future. The weaker a country's institutions, the greater will be the discount banks place on a future dollar generated by an exporter relative to a current dollar (foreign investors will be willing to lend less against the future), and the greater the long-run destructive consequences of a scramble for dollars.

Not only will these effects be seen in the tradeable sector, but also in the non-tradeable sector. As domestic interest rates rise (because long run domestic assets are being sold for dollars), more and more domestic projects will have to meet an impossible hurdle rate and be shelved.

As bank assets fall in value, some banks, typically the one with the greatest asset liability currency mismatch (though see later), will become insolvent. This will trigger a generalized run on the banks' assets, causing even those who had no desire to withdraw to add to dollar demand.⁵ The horizon of failing banks will be even shorter, causing them to be even more indiscriminate in the squeeze they put on borrowers. Even projects that could produce substantial dollar revenues in the near term may be sacrificed for the immediate need – for example, banks may stop offering working capital loans and export credit even if these are essential for the exporter to generate revenues. As a result, the aggregate pool of dollars available over the near term could fall as banks fail, and the aggregate excess demand for dollars could increase, putting pressure on other banks.⁶ This form of contagion could imperil the entire banking system.

To summarize: When bank depositors demand repayment in dollars but the economy cannot generate enough dollars to repay them, the consequences can be very serious. Domestic dollar interest rates will rise to draw in dollars and choke off depositor demands. But if there is a

⁵ Note that if the exchange rate is fixed but there are no capital controls, domestic currency depositors have an even greater incentive to withdraw (and convert) than dollar depositors because they will fear a devaluation.

⁶ Clearly a bank that fails will refuse to honor some of its dollar depositors. The unsatisfied demand of these depositors will reduce aggregate demand. Therefore the effect of bank failure on the excess demand for dollars depends on whether supply falls faster than demand. See Diamond and Rajan (forthcoming) for conditions under which this is true.

core group of depositors who absolutely want to withdraw dollars, and a limit to which outsiders are willing to lend to the country, the country's banking system can be faced with an excess demand for dollars that cannot be met. If so, other asset prices will fall precipitously as banks scramble to capture enough dollars from the common pool to save themselves. Domestic currency interest rates will spike up, while the exchange rate will plummet. Banks will squeeze borrowers, and aggregate activity will fall. Some banks may become insolvent and such failures could be contagious. Of course, in any such model, we could get multiple equilibria, where outside lenders impose a sudden stop, which leads to the dollar shortage, which leads to bank actions that reduce future dollar receipts, which justify the stop. But we do not need to appeal to multiple equilibria to explain crisis – a spike upwards in dollar demand or downwards in dollar supply, coupled with a “normal” demand for liquidity are sufficient to produce the effects.

Consider now how this “model” differs from earlier work. In a comprehensive survey, Frankel and Wei (2004) attempt to distinguish between the three “generations” of crisis models on the basis on their explanation of why the crisis occurs:

“ Whose fault is the crisis? Generation I says domestic macroeconomic policy, Generation II says volatile financial markets, and Generation III says financial structure. In neutral language, the explanations are, respectively, excessive macroeconomic expansion, “multiple equilibria,” and moral hazard. In finger-pointing language, the respective culprits are undisciplined domestic policymakers, crazy international investors, and crony capitalists.”

The “model” in this paper is related to the third generation models in that it focuses on structural problems associated with lending to emerging markets. But crises are not necessarily caused by willful misbehavior. Instead, they stem from adverse liquidity shocks that jolt a system that is necessarily rigid, given the institutional inadequacies of the economy. Put another way, better regulation and supervision may not necessarily eliminate the possibility of a crisis. What is really needed is deep rooted institutional reform: susceptibility to crises in my framework ultimately lie not in an incentive problem but a collective action problem.

2.3. Related Literature

The paper that is most closely related to this one is Calvo, Izquierdo, and Mejia (2004), who also focus on a link between sudden stops, dollarization, and banking crises. In their paper, sudden stops lead to a devaluation – in order to maintain external balance -- which then causes problems in the dollarized banking system as a result of liability mismatches. In other words, macro-causes have micro-consequences. In my model, the channel is not the need to maintain external balance but bank liquidity. The sudden stop creates a dollar shortage, which leads banks to dump assets, causing the exchange rate (and interest rates) to overshoot fundamentals, which then creates balance sheet problems for the banking system. Micro-causes aggregate up to have macro-consequences.

While I think both explanations have merit, there are differences. For instance, to the extent that a devaluation gives exporters the ability to earn more (expansionary devaluation), there is no reason for it to hurt a dollarized banking system – since banks typically make dollar loans (see Nicola et al. (2003)). But to the extent that the capacity to earn dollars does not translate into current dollars, there is a liquidity mismatch, and banks could still go under in my framework.

2.3. Some Examples

Consider some examples.

*Argentina (2001)*⁷

By end 2000, the Argentinian banking system had approximately \$72 billion in foreign currency denominated assets and approximately the same amount in liabilities. By most standards, it seemed to have matched exposures. But \$25 billion of its assets were government securities, issued by a government that was increasingly strapped for financing. Another \$41 billion were foreign currency denominated loans and securities issued by Argentinian corporations, who clearly did not have the ability to repay quickly given that exports amounted to only \$ 31 billion. And of the liabilities, \$ 48.5 billion were foreign currency deposits.

⁷ This section relies heavily on IMF (2004)

In this fragile situation depositor runs could start for two related reasons. If the government could not draw in more external resources to meet its own external debt service needs or its new borrowing requirements, it would severely constrain the anticipated available dollar pool. The banking system's liquidity needs would compete with the government's needs, pushing up interest rates and perhaps lead to a devaluation.⁸ A second rationale could be that, given the extensive bank holdings of government assets, a government default could render banks insolvent (though see below).

Depositor runs started in 2001. Bank liabilities fell by \$24 billion (approximately 9 percent of GDP). In fact, Argentina lost more dollars as a result of the bank run than as a result of the inability of the government to access external markets to meet financing needs. Interestingly, the fall in domestic currency denominated deposits was far greater than the fall in foreign currency deposits, suggesting depositors feared a devaluation, perhaps resulting from the liquidity shortage, more than a bank default. Since bank holdings of government debt could not be reduced (in fact, they increased), the run was financed by curtailing private lending (\$ 12 billion), running down bank liquid assets (\$ 5 billion) and borrowing from the central bank (\$ 9 billion).

Ultimately, the entire banking system was affected, deposits were frozen then loans and deposits were "pesified" at different rates. The consequences are still being dealt with. The point to take away is that a government may affect the dollarized domestic banking system simply by crowding out access to dollars .

Uruguay (2002)

Uruguay had almost the reverse set of events – liquidity problems in the banking sector caused a crisis, a devaluation, and problems for the government, which had to restructure debt.

Let us examine how this happened.

⁸ Though not necessarily a default by dollar borrowers. For instance, Bleakley and Cowan (2002) find that the negative balance sheet effects of devaluation are outweighed by the competitiveness gains for a sample of Latin American firms.

Uruguay also has a highly dollarized banking system – bank deposits were about 90 percent of GDP in end 2001, and 90 percent of these deposits were dollar denominated. About half these deposits were held by non-residents, typically Argentines.

As the Argentines saw their Argentinean deposits frozen, they started withdrawing from Uruguayan banks. This was a pure liquidity need, which could have been met by Uruguay's domestic holdings of liquid foreign currency assets. However, anticipating a shortage, Uruguayan residents also began withdrawing deposits. The currency depreciated precipitously as over 45 percent of the foreign currency deposits were withdrawn in 2002, prompting further concerns about bank solvency. The government declared a bank holiday to stop the run, and was eventually successful in reopening the banking system with the help of a Stand By Arrangement from the IMF and rescheduling deposits in the banking system.

As a result of the depreciation, public debt, which was largely foreign currency denominated, ballooned from about 45 percent of GDP by end 2001 to 100 percent of GDP by end 2002, so eventually it had to be restructured. Thus liquidity problems in the banking sector led to problems for the government in servicing public debt. Let us now turn to Korea.

South Korea (1997-98)

It is generally accepted that the proximate reason for the Asian financial crisis was a decline in export growth, especially in key areas like semi-conductors, caused by weakening demand in importing partners, and an appreciation in the real exchange rate as the dollar (to which many Asian currencies were implicitly pegged) strengthened against the yen. While this was the trigger in Korea, it was compounded by a banking system that had issued a significant amount of short term external debt and thus was susceptible to the liquidity shock stemming from the real external sector. Contrast this with the liquidity shock in the case of Argentina, which was a result of the government losing access to external borrowing, while in the case of Uruguay, it was withdrawals by Argentinean depositors who had lost access to their domestic deposits.

I will not describe the details of the crisis, which resembled in many ways what I have described above (see IMF (2002, 210) and IMF (1999, 188) for details). Korean banks initially started facing difficulties in mid 1997. The government announced a guarantee of foreign borrowings by Korean banks and the central bank attempted to help foreign branches and subsidiaries of Korean banks roll over their foreign currency borrowings. But this depleted reserves, leaving the central bank with little to fight domestic bank runs. Even though the guarantee had been announced, the government simply did not have the necessary dollars. The won fell sharply.

In early December, the IMF announced a Stand-By Arrangement with Korea equivalent to \$ 21 billion, with additional financing from others of \$ 37 billion. Yet this massive package was not enough, and the won continued dropping. It was only when foreign private banks agreed to maintain their exposure to Korean banks by exchanging their inter-bank loans for short term government guaranteed bonds, and when the IMF accelerated disbursement of the loan, that pressure on the won abated. In terms of our framework, the shortage was eliminated by reducing dollar demand and increasing dollar supply and thus alleviating pressure on both the exchange rate and the interest rate.

Interestingly, in the case of Korea, a liquidity crisis was averted because the government had spare borrowing capacity and could draw in dollars (with some help from the IFIs and developed country governments), which it then lent out to the banks. This leads us more generally to the question of interventions.

III. Interventions

Let us recapitulate what happens if no intervention takes place. Obviously, the only way to eliminate a dollar shortage is to increase supply or reduce demand. If dollar depositors who seek to withdraw are not tempted to stay in the bank by higher dollar interest rates (for the same reason, perhaps, that higher interest rates do not draw fresh foreign investors in), then banks will start competing for scarce dollars. Since a bank has to satisfy every one of its withdrawing dollar

depositors in order to stay in business, it will be willing to pay any feasible price if it is falling short. This is why prices can deviate so far from fundamentals – the bank essentially faces a classic short squeeze where it has to deliver a specific asset in short supply, so it is willing to sell all other assets, almost regardless of price.

Dollar-short banks will sell both long term liquid domestic assets as well as short term domestic assets to raise dollars (assuming they have already run down long term foreign assets, which would have a liquid external market). The exchange rate will fall while domestic market interest rates will rise.

Ultimately, however, given that dollars cannot be manufactured domestically, some banks will have to fail. That could ease the shortage if the banks that fail are the most illiquid, and can clearly be isolated from the rest. But these banks will fail only after asset prices have, in general, become quite depressed. Surviving banks will also experience the depressed prices and thus have only a thin margin of capitalization. It is quite possible that they could also be run. Of course, if bank failures or closures do not ease the dollar shortage, the shortage itself could spread contagion, as we have seen. Thus doing nothing has potential costs, one of which is a possible meltdown of the system.

3.1. Ex Post Intervention by Country Authorities

3.1.1. Dollar (foreign liquidity) infusions

Clearly, the ideal intervention in the face of a dollar shortage would be to supply dollars or convince dollar demanders to voluntarily hold off pressing their claims. If the government has plenty of reserves, spare borrowing capacity, or support amongst international financial institutions, these dollars could be sold into the banking system thus alleviating pressure. Similarly, if the government can use moral suasion (or local currency guarantees) to persuade potential withdrawers to stay in, it reduces the dollar shortage. However, we have defined a liquidity shortage as one when the government itself has too few resources (or moral suasion) to contribute. So let us turn to other interventions.

3.1.2. Recapitalization

The authorities can recapitalize specific banks by offering them additional domestic assets or guarantees (backed by domestic assets). Often, what is termed “liquidity support” are simply loans by the central bank to distressed banks without adequate collateral backing the loans – in short, they are partial recapitalizations.

While targeted recapitalizations can prevent specific banks from failing, there is an aggregate dollar gap that has to be closed somehow. Unless other banks are allowed to fail, the aggregate dollar demand cannot be satisfied. This implies that a bank recapitalization without any attempt to bridge the dollar gap only forces other, potentially healthier, banks to fail. A blanket recapitalization or guarantee of all banks simply allows all banks to bid more for dollars (that is, it increases the interest or exchange overshooting) without reducing the eventual extent of bank failures. This is why it is best to close down some banks and thus resolve the dollar shortage before offering indiscriminate guarantees.

Recapitalizations do increase the value that is paid for scarce dollars. If there is an under-incentive to hold dollar reserves up front (see Caballero and Krishnamurthy (2001)), then the anticipation of recapitalizations can improve incentives to hold dollars.

3.1.3. Monetary Policy

The monetary authorities could be accommodative and buy long term domestic assets in exchange for domestic reserves (or do the opposite). Monetary accommodation will reduce the extent to which the burden of adjustment falls on the interest rate, and increase the downward pressure on the exchange rate. If not reversed later, it will increase inflationary pressures.

However, the proximate effect will be to shift the burden amongst banks – the survival chances of banks with relatively more holdings of long term domestic assets will improve, while the chances of those with more dollar liabilities will weaken. Whether the new pattern of failure improves the overall dollar shortage depends on whether the newly failing banks subtract more dollar liquidity in failing than the banks that would fail absent the intervention.

The choice between an interest rate defense (keeping the interest rate high) and an exchange rate defense (keeping the exchange rate low) in this simple framework amounts to which defense will allow the banking system to come through the dollar shortage with the minimum long term damage. The choice between the two defenses is really a choice between selecting two different sets of banks for failure. The longer term effects of the chosen defense on the exchange rate and the interest rate will depend on the damage the choice does to the real economy – through the extent of bank failure and the damage the failing banks' clients sustain-- and not per se on the defense that is picked. I am, of course, abstracting from any issues of credibility here, though it would be hard to unambiguously relate monetary authority credibility gains to a particular form of defense.

Before proceeding to other interventions, we should note that the monetary authority also has the ability to select banks that will fail by allocating its limited foreign exchange reserves only to some banks (i.e., at a subsidized price) and not to others. While such an intervention is fraught with political difficulties (who will be chosen and will the process be transparent), it ultimately is an optimization problem where regulators allocate scarce resources to minimize the overall cost of bank failures. Thus it is not dissimilar in consequence to other interventions.

3.1.4. Forced conversion/suspension of convertibility/capital controls.

Finally, consider even stronger interventions which violate the rights of the depositors. These include forced conversion into domestic currency at a pre-determined (typically below market) rate, the freezing of foreign currency deposits, and the imposition of capital controls. Clearly, these interventions can be implemented only by the country authorities and not by the banks alone.

While these interventions do solve, to differing extents, the problem of dollar shortage, they do so at the expense of a substantial loss in future credibility. Moreover, it is not clear that they can be implemented effectively and for the long term. For instance, capital controls tend to leak, and the longer they are in place, the more they leak. So the authorities had better be

confident that the liquidity shortage is temporary, else the breathing space these measures gives them will not be enough to rectify the problem, and the problem will return with a vengeance with the added difficulty that the authorities then have no credibility.

3.2. Ex ante intervention by country authorities.

Thus far we have discussed measures that could be taken in the face of a crisis. Consider now measures that could be taken by an economy attempting to bullet-proof itself against a crisis.

3.2.1. Reserves

One way to bullet-proof an economy is for the authorities to build foreign reserves. Of course, there are costs to holding reserves and to building them, including the fiscal costs and possible distortions in the exchange rate. Furthermore, it is possible that the level of dollarization in the economy increases as reserves, and confidence, grow. As a result, the authorities may lose all control over monetary policy and the transmission mechanism. Building a moderate amount of reserves is clearly warranted, but the welfare effects of building a hoard large enough to buffer most crises are ambiguous.

A second question that arises with reserves is whether the country should use them to prepay debt. In other words, is spare debt capacity not the same as holding reserves, and less costly to boot? For the riskiest countries though, prepaying debt may be dominated by holding reserves: spare debt capacity is less fungible than reserves, and may also disappear in a crisis. Also, by prepaying debt, the country loses the option to force a restructuring, which may be valuable in times of stress.

3.2.2. De-dollarization and shifting dollarization

Given the risks associated with dollar shortages, some countries, including Mexico and Bolivia in 1982 and Peru in 1985, have opted to ban dollarization. But if the proximate cause, monetary instability, is not eliminated, investors will demand significantly higher interest rates to hold domestic currency deposits, and some may simply take the money out of the country.

Consistent with this, countries that today have significant restrictions on dollarization, such as Brazil, Colombia, and Venezuela, have particularly high loan spreads (see IADB (2004)).

Also, domestic currency depositors are not passive. With less-than-effective monetary authorities, banks could be subject to stress even if they only issue domestic deposits. For instance, suppose the authorities maintain an overvalued but fixed exchange rate. Fearing an eventual return to equilibrium, depositors have an incentive to withdraw and convert into foreign currency. This puts enormous stress on the banking system, forcing it to pay high interest rates to keep depositors in, with the level of interest rates being determined by the degree of overvaluation rather than more typical determinants like the return on investment and expected inflation. As described earlier, domestic currency depositors were prominent in the Argentinean bank runs in 2001.

The point is that dollarization is not necessarily an aberration in the environment which gives birth to it. Instead, it may be a reasonable adaptation. As Savastano (1996) and Balino et al. (1999) document, the consequence of banning dollarization in Mexico, Bolivia, and Peru was typically a severe contraction of intermediation which was reversed in Bolivia and Peru only when dollar deposits were allowed again. Similarly, Nicolo, Honohan, and Ize (2003) show that economies with high inflation tend to have more monetary depth with dollarization than without.

Rather than banning liability dollarization, authorities may want to focus on removing distortions that lead it to be used in excess, such as the issuers not internalizing all the risks. More useful, of course, is to focus on changing the underlying conditions that lead to dollarization, a point I will touch on shortly.

Before concluding this section, note two points. First, the transition from an economy with liability dollarization to one where dollarization is banned implies either violating existing dollar contracts and prohibiting new ones, or shifting dollar liabilities to another domestic entity. The Brazilian government essentially took the latter route by taking on the dollar liabilities of its banking system – through the issuance of dollar denominated bonds to banks in 1998. As a result,

even though the real depreciated substantially in 1998-99, the banks were relatively immunized. Of course, government debt ballooned as a result.

From a theoretical perspective, it can be welfare-improving for the government to take on the dollar liabilities of the banking sector. When individual banks fail during a dollar shortage, we have seen they can worsen the aggregate shortage. When the government takes over the liabilities of the banking sector, these failures are eliminated, so the dollar shortage need not be as severe. Against this, one should weigh the increased moral hazard if the government is expected to step in every time banks anticipate trouble.

Second, as argued above, with a fixed exchange rate and full convertibility, even domestic currency denominated liabilities may become a source vulnerability. This suggests that the choice of exchange regime is not without consequence (also see, for example, Burnside, Eichenbaum and Rebelo (2001b) or Edwards (2004)). But unfortunately, the very institutional requirements needed to maintain a monetary anchor with a floating exchange rate regime may be missing in countries where fixed exchange regimes create vulnerabilities. Therefore, there are trade-offs involved in the choice of exchange regime, and as suggested by Calvo and Mishkin (2003), it may be more useful to focus on changing the underlying institutions rather than on choosing a specific regime.

3.2.4. Institutional reform

The root cause of deposit dollarization, we have argued, is weak basic institutions for conflict management. The more proximate causes are inadequate fiscal and monetary institutions. Of course it easier (though not easy) to reform these narrow institutions than reforming basic institutions. But without reforming the deeper basic institutions, which typically requires deep-rooted political change, how successful can reform of narrow institutions be? We do not know much about the process of institutional reform other than some countries like Chile, Mexico, and South Korea have improved their basic institutions over a relatively short time, aided by good policies and rapid economic growth. Understanding what ingredients in this mix are essential, and

what simply are coincidental, is a topic of ongoing research on which, hopefully, researchers will have more to say in the near future. For now, let us turn to the role the international financial institutions can play.

3.3. What can IFIs do?

Clearly, the international financial institutions can provide the technical support that will help countries adopt good policies and improve their narrow institutions (such as their fiscal framework or their inflation targeting framework). They can also provide the bilateral and multilateral economic surveillance that can alert countries to possible sources of shocks. The International Monetary Fund does all this. The million dollar question, of course, is should IFIs lend in such situations.

3.3.1. “Liquidity” Loans

A dollar shortage seems precisely the kind of temporary need that certain IFIs were set up to meet. By creating a common reserve pool of dollars, the IFIs can substitute for costly reserve hoarding by countries.

The most persuasive case for lending is when the IFI alleviates what is essentially a market-driven short squeeze on the country. It tides the country over its temporary exchange shortage, preventing more destructive domestic sector real adjustment, and gets repaid once the reasons for the temporary need vanish (e.g., exports recover).

The difficulty, of course, even with this simple scenario is that the ultimate cause for a dollar shortage has to be that the country loses access to international markets. Thus the IFI has to make the judgment call of whether the loss of access is because of irrational/ rational uncoordinated behavior by market participants, or whether it stems from genuine fears. If the former, most observers would argue that the IFI should act as a lender of last resort. The only remaining concern would be whether this role creates bad incentives for market participants, for the government, and for banks – the issue of moral hazard – which I will come to in a moment.

If however the adverse shock precipitating the dollar shortage reflects a genuine institutional infirmity in the country – for instance that the government has no fiscal discipline, has reached borrowing limits, and thus is shut off from international capital markets – matters become more difficult. It may well be that the country could undertake reforms that would help it regain access. In this case the country is illiquid but solvent contingent on undertaking reforms. But solvency will not be restored until the markets gain confidence that the reforms are irreversible. This implies that the lending may well not be temporary.

Given that the alternative is a banking system crisis coupled with a need to restructure public debt, both of which will set back the country's economy considerably, it may well make sense to lend even when reforms are highly probable but not fully assured. The IFI bears some risk here that it will not be repaid, but it does so in the larger interest of the member country facing distress (and it should impose conditionality as well as charge an adequate premium for the risk).

The problem critics have is with the assumption that the IFI has a better ability to gauge willingness to reform than market participants. Two arguments have been put forward to justify this. First, the IFI may have better information about the country. This may have been true in the past, but given the development of financial markets, I see little reason to believe it to be true today. Second, the IFI may have a better sense of its own ability (and willingness) to coax the reform process forward, and may in fact have to show some success (or put its money at stake) before the market is persuaded. The IFI may also be able put in place incentives for the country to reform. I find the second argument more persuasive but one should not rule out the possibility that the IFI has an incentive to find a role for itself where none exists.

A final situation where IFI lending may be warranted is when the country's public debt is too high given its underlying fundamentals, so it cannot borrow, but it also faces an immediate dollar shortage as a result, which affects its banking system. Rather than stand back and watch the banking system implode, the IFI may want to offer a bridge loan targeted at the banking system,

to be repaid when the country regains market access after restructuring its external public debt. This is again a form of liquidity lending but compounded by the problem that the public debt problem renders the loan long term.

All this, however, raises two questions. First, does IFI intervention distort incentives among participants? Second, are there better ways to provide assurance of liquidity support to member countries?

3.3.2. Incentive Distortion and Tough Love

At least three types of incentive distortions are possible: (i) An unwillingness on the part of countries to take adequate precautions or to avoid excessively risky situations (ii) an unwillingness on the part of investors to take all risks into account, knowing they will be “bailed out” (iii) an unwillingness on the part of domestic corporations and banks to insure themselves adequately.

Reams and reams have been written on the issue of moral hazard and I have little to add. Some argue that country moral hazard is not an issue because finance ministers and central bank governors lose their jobs in a financial crisis. Others argue that investor moral hazard is not a problem because investors lose their shirts in a crisis. These arguments are reasonable but miss the point. No finance minister will take an action that he thinks will create a crisis for sure. But at the margin, concerned about budget deficits, he may prefer to borrow cheaply in dollars than borrow more expensively and for a longer term in domestic currency. He will be more likely to do so if he knows the IFI will help if things go wrong. At the margin, interventions do distort incentives to take risk.

The question is how much. Unfortunately, the empirical evidence does not offer a reasonable indication of magnitudes (see Jeanne and Zettelmeyer (2004) for an excellent exposition of the issues). My reading of the current consensus is that country and investor moral hazard is small in most situations but in a few it could be really big. We need more research identifying circumstances where moral hazard is really a problem.

What seems clearer is that domestic corporations and banks may have too little incentive to prepare themselves for possible shocks, knowing that there are ways they can force the system to share it with them. But this then is a case for better domestic regulation and supervision rather than limiting IFI intervention.

In sum, then, the moral hazard rationale against IFI intervention may well exist in some cases but we need to be able to identify those cases better. If these cases are indeed few in number, as a reasonable judgment would suggest, then it may well make sense to accept the risks of inducing moral hazard through intervention while trying harder to identify when it is a mistake.

If, however, the reasons for dollarization lie primarily in poor institutions rather than in gaming – a collective action problem than an incentive problem -- the greater concern, should not be about distorting individual incentives but about altering collective actions. Sometimes external discipline forces a country to reform in ways and at a speed that the domestic constellation of political forces will simply not allow if left to its own devices. Would it be better for a country that repeatedly falls back on IFI support to instead experience “tough love” – a period of sharp pain that forces domestic forces to compromise and effect much needed reform?

This is a difficult question, in part because we simply do not understand the political economy of deep institutional reform or of crisis well. Clearly, if there was an assurance that the pain would be short and borne by those best able to absorb it, that the country would undertake genuine reforms, and that the future would be much brighter, this is certainly an argument worth considering. But what if the pain is prolonged, the economy degenerates into warring factions, and much of the pain is borne by weaker sections of society? Again, further research is needed here. What seems unquestionable is that if this route is chosen, there is a need to apply steady external pressure long before a crisis, even conditioning the extent of crisis assistance on compliance so that there are no surprises.

3.3.3. A better way to intervene?

The IMF typically lends only when the member country is experiencing conditions of distress. Since intervention, let alone adequate assistance, is not assured, and the political considerations of large shareholders as well as the economic situation of the member country can affect these decisions, countries face uncertainty – which reduces the effectiveness of intervention in warding off the crisis. Moreover, countries fear that they will be forced to accept unwarranted conditionality even if assistance is forthcoming, because they really have no alternatives in a moment of crisis. These are understandable concerns: countries with a strong policy regime seem to want insurance, not uncertain loans, laden with further uncertainty about conditions.

The difficulty is in making this distinction. IFIs have been in the business of lending, so they want some assurance that the funds that will be drawn down will be returned. On the other hand, genuine insurance involves a distinct possibility of loss by the insurer under some circumstances. In return, the country pays a premium up front. Of course, the right contract would limit the pure transfers from the insurer to the country to only those few circumstances where it is welfare improving, while minimizing transfers in all other circumstances. Such a contract would also result in a low actuarially fair up front premium.

Ideally, therefore, it would seem IFI support should be there for a country that experiences adverse shocks beyond its own control and where external funds can make a genuine difference, while it should be withdrawn if the country deliberately alters its own circumstance for the worse or if external funds will not help. An unconditional guarantee of assistance cannot distinguish between these situations. Unfortunately, it is equally infeasible to write a reasonable contingent contract, in part because of the difficulty of specifying conditions up front – for example, does the assassination of a presidential candidate constitute circumstances beyond the country's control?

Among the possible set of second best contracts are (i) pre-qualification (a country has a claim on the IFIs if it follows good policies – but who decides if the policies are good) (ii) arbitration panel (an independent panel decides if the country's call for assistance meets the

criteria laid out for insurance – but what ensures the panel is sufficiently well informed or beyond influence), and (iii) mutual insurance (a country builds its claim by setting aside a portion of its reserves into a common pool – it has a claim on that pool only if it has been meeting its quota in the past and this serves as an objective measure of its past good behavior). All these approaches are worth exploring further.

Conclusion

I examine liquidity or dollar shortages in dollarized economies in this paper and explore how they precipitate and exacerbate crisis. Unfortunately, the easy solution – ban liability dollarization – does not seem appropriate. Liability dollarization is a response to institutional infirmities. It will not diminish unless those infirmities are fixed. In the meantime, we have to, as Guillermo Calvo says, learn to “live with dollarization”.

In particular, this means stepped up regulation and supervision up front to ensure that dollarization does not become excessive. It also implies the government has the responsibility to maintain a reasonable fiscal position so it does not crowd out liquidity, and to maintain adequate reserves. It means developing tools for crisis resolution that recognize the nature of the problem – a dollar shortage driven banking crisis has to be dealt with in a different way from a banking crisis driven by bad loans. IFIs can play a role in all this, but the precise way to circumscribe that role has to be worked out.

Finally, we have to pay more attention to deep-rooted institutional reform. Giving central banks more independence and adopting inflation targeting frameworks are good steps, but if not accompanied by serious fiscal reform are unlikely to persuade the public to forego dollarization.⁹ It may not be surprising that the level of dollarization has increased over the 1990s despite a fall in inflation, perhaps because monetary reforms still lack credibility. Fiscal reform itself may be

⁹ I agree in many ways with the analysis in Goldstein and Turner (2003), who also focus on institutional reform as a way of dealing with dollarization. However, I think it will be more difficult than they seem to suggest.

difficult unless political reform creates better basic institutions for allocating burden sharing in the economy. This suggests much work needs to be done.

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Table 1. Institutions, Growth and Inflation in a panel of 165 countries, 1965-2002

1a. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	CV
Inflation Tax	4902	0.098	0.120	-0.323	0.846	1.226
St. Dev. of Inf.tax	4859	0.042	0.044	0.000	0.365	1.050
Inflation	4902	14.871	34.683	-24.430	547.534	2.332
St. Dev. of Inflation	4859	8.289	19.453	0.018	206.265	2.347
Real GDP growth	6428	3.521	5.896	-84.380	59.860	1.675
Government Efficiency	165	0.062	0.907	-1.827	2.370	14.612
Rule of Law	165	0.075	0.939	-1.830	2.210	12.493
Quality of Regulation	165	0.110	0.809	-2.593	1.957	7.372
Control of Corruption	165	0.057	0.946	-1.610	2.390	16.559

1b. Pairwise Correlation Coefficients

(a star indicates significance at 5% or less)

	Inf.Tax	Std(Inf.Tax)	Inflation	Std(Inflat.)	GDP growth	Gov.Eff.	Rule Law	Qual. Reg.	Con. Corrp.
Inflation Tax	1								
St. Dev. of Inf.tax	0.4528*	1							
Inflation	0.8763*	0.3863*	1						
St. Dev. of Inflation	0.5467*	0.8021*	0.5947*	1					
Real GDP growth	-0.2360*	-0.0876*	-0.2327*	-0.1150*	1				
Government Efficiency	-0.2052*	-0.3235*	-0.1563*	-0.1931*	0.0485*	1			
Rule of Law	-0.2270*	-0.3500*	-0.1727*	-0.2151*	0.0377*	0.9401*	1		
Quality of Regulation	-0.1603*	-0.2862*	-0.1325*	-0.1691*	0.0415*	0.8662*	0.8478*	1	
Control of Corruption	-0.2103*	-0.3382*	-0.1585*	-0.2044*	0.0319*	0.9485*	0.9463*	0.8002*	1

Notes: Inflation tax is $\pi/(1+\pi)$, with π the annual CPI inflation.

The standard deviation of inflation and of the inflation tax for year t is calculated over the 5 year period from t-4 to t.

Growth is measured as the annual growth rate of real GDP.

The indicators of the institutional environment are measured by their respective averages over the years 1996, 1998 and 2000.

Sources: Inflation and GDP figures are from the IMF's World Economic Outlook 2004 database.

Institutional indicators are from Kaufmann, Kraay and Matruzzi's 2003 Governance Matters III database.

Table 2. Determinants of Inflation Tax in a panel of 165 countries, 1965-2002

Dependent Variable: Inflation Tax

	RE/GLS	RE/GLS	FE	FE/IV	FE/IV	FE/IV	FE/IV	FE/IV2
			Fixed Effects	Instrument for Growth	Small Country	Large Country		Instrument for Inst and Growth
	1	2	3	4	5	6		7
Explanatory Variables:								
Constant	0.1191 *	0.1209 *	0.1114 *	0.1388 *	0.164 *	0.1133 *		0.1351 *
	(0.0064)	(0.0062)	(0.0015)	(0.0048)	(0.0143)	(0.0055)		(0.0072)
Real GDP Growth Rate	-0.0041 *	-0.0048 *	-0.0047 *	-0.0224 *	-0.0225 *	-0.0227 *		-0.0185 *
	(0.00025)	(0.00035)	(0.00035)	(0.002)	(0.0025)	(0.0047)		(0.0055)
Government Efficiency		-0.0323 *						
		(0.0067)						
Growth*Institutions		0.0015 *	0.0014 *	0.019 *	0.0298	0.0189 *		0.0232 *
		(0.0005)	(0.0005)	(0.0031)	(0.0185)	(0.0056)		(0.0104)
Number of observations	4895	4895	4895	4753	2133	2620		2916

Notes: Standard deviations in parentheses below the estimated coefficients.

One star indicates significance at 5% or less (most being significant at <1%); two stars indicate significance at 10% or less.

Columns 1 and 2 report the estimates of random effects GLS regressions; columns 3 to 7 those of fixed effects.

In columns 4, 5 and 6 we instrument the growth rate and the interaction of growth with institutions, by the "external" growth rate and its interaction with institutions. For every country i , and every year, the "external" growth rate is calculated as the average of every other country's $j \neq i$ growth rate weighted by the ratio of log GDP to the square of the distance between country j and country i .

In column 7, we instrument the growth rate, institutions and the interaction of growth and institutions, by the "external" growth rate, the log of population density in 1500 (see Acemoglu, Johnson and Robinson(2002)), and the interaction of "external" growth with the log of population density.

In column 5 we report estimates for the subsample of countries for which real gdp in US\$ in 1999 is below the sample median (small countries), while in column 6 we report estimates for the subsample of large countries, those with real gdp in 1999 above the sample median.

Sources: Inflation tax and GDP growth series based on annual CPI and real GDP series from IMF's World Economic Outlook 2004 database.

Government Efficiency indicator: Kaufmann, Kraay and Mastruzzi (2003) Governance Indicators Database.

Log of population density in 1500: Acemogulu, Johnson and Robinson (2002)

Table 3. Growth, Inflation and Dollarization

3a. Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max	CV
Foreign Currency Deposits as % of Total Deposits	91	28.013	23.523	0.143	91.556	0.840
Inflation Tax	165	0.106	0.089	-0.017	0.567	0.842
St. Dev. of Inflation Tax	165	0.048	0.035	0.008	0.171	0.726
Sensitivity of I.Tax on Growth	165	-0.004	0.009	-0.045	0.017	-2.050

3b. Pairwise Correlations

(a star indicates significance at 5% or less)

	FCD/TD	Sensitivity	Inf. tax	SD(Inf.tax)
Foreign Currency Deposits as % of Total Deposits	1			
Sensitivity of I.Tax on Growth	-0.3718*	1		
Inflation Tax	0.5581*	-0.4819*	1	
St. Dev. of Inflation Tax	0.6807*	-0.5419*	0.7159*	1

Notes: Foreign Currency Deposits as a percent of Total Deposits for each country is the average of available observations over 1990 to 2001.

Inflation tax and its standard deviation for each country is the average for the period 1965 to 2002.

The sensitivity of inflation tax on growth is the estimated coefficient of growth as a regressor on inflation tax as the dependent variable.

The regressions were estimated by country for the period 1965 to 2002.

Sources: For Foreign Currency Deposits/Total Deposits, Nicolo, Honohan and Ize(2003)

Inflation tax and GDP growth calculations were based on annual CPI and real GDP series in IMF's World Economic Outlook 2004 database.

Table 4. Determinants of Liability Dollarization**Dependent variable: 1990-2001 Average Foreign Currency Deposits as % of Total Deposits**

	1	2	3	4	5
Explanatory Variables:					
Constant	22.274 *	21.841 *	10.376 *	5.463 **	36.524 *
	(2.757)	(2.620)	(3.241)	(3.185)	(13.678)
Sensitivity of Inflation Tax to Growth	-825.455 *	76.571	503.957 **	642.425 *	562.946 **
	(218.45)	(343.75)	(315.45)	(290.51)	(295.163)
Square of Sensitivity		42065.290 *	38858.820 *	28381.340 *	25407.530 *
		(12787.4)	(11323.33)	(10653.91)	(10528.39)
Inflation Tax			110.697 *	31.704	25.837
			(21.886)	(27.384)	(29.260)
Standard Deviation of Inflation Tax				317.068 *	272.092 *
				(74.958)	(77.690)
Log of Per Capita GDP					-3.559 *
					(1.634)
Legal Restrictions on Dollarization					-3.108 **
					(1.695)
Number of Observations	91	91	91	91	83

Notes: Estimates based on a cross section of 91 countries except for column 5, where availability of legal restrictions limits the sample to 83.

The standard deviations are in parentheses under the estimated coefficients. One star indicates significance at 5% or less, two stars at 10% or less.

The sensitivity of inflation tax to growth is for each country the estimated coefficient of the growth rate of real gdp as regressor

on the inflation tax as dependent variable; the regressions for the estimation of sensitivity have been estimated for each country separately for the period 1965 to 2002.

Square of Sensitivity is the square of the above variable.

Inflation tax and its standard deviation are measured here by their averages over 1965-2002.

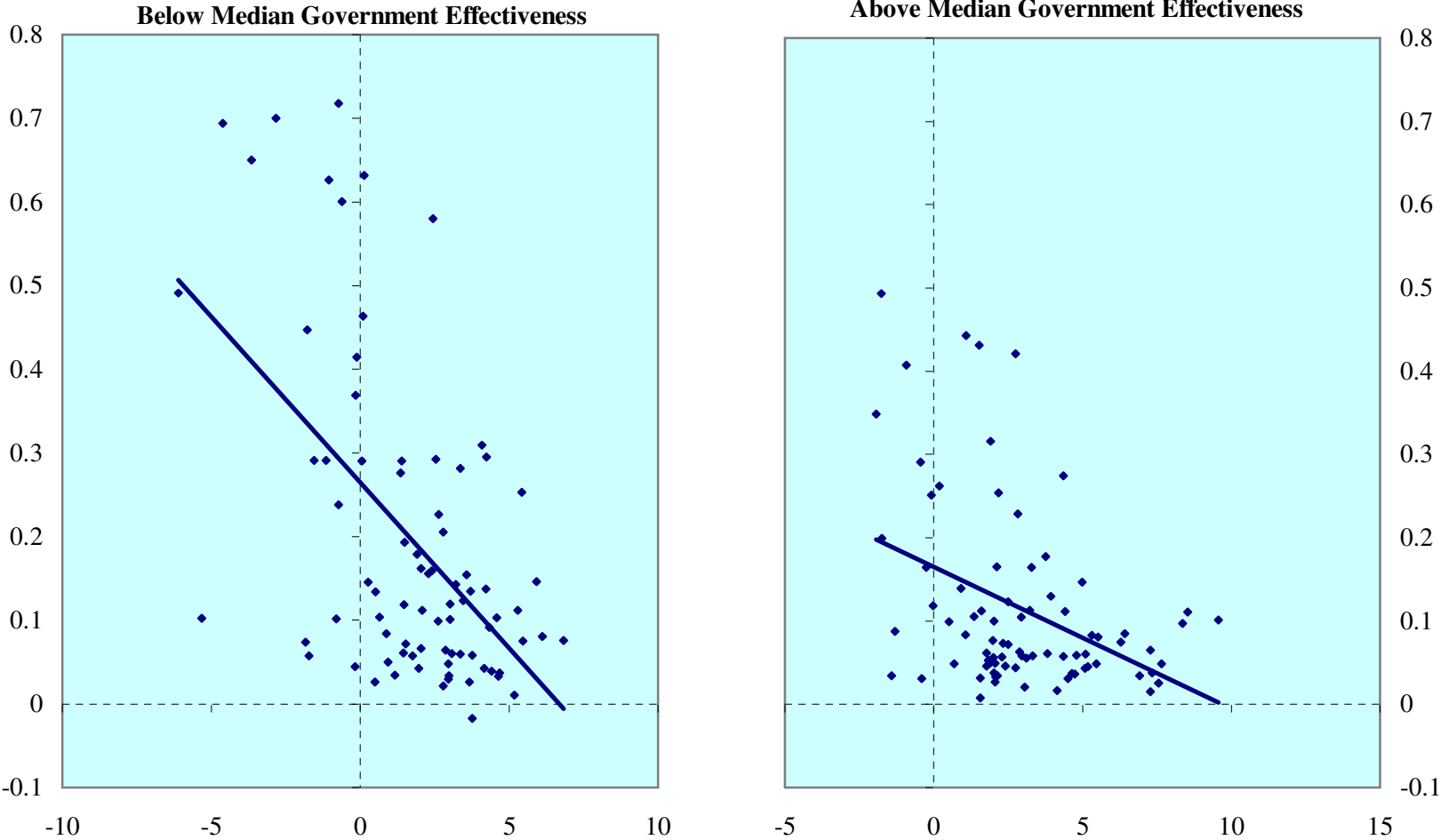
The measure of legal restrictions on dollarization (0-5, 0 meaning no legal impediments) is based on IMF's Exchange Arrangements and Restrictions for 2001.

Sources: Inflation tax, sensitivity of inflation tax to growth, standard deviation of inflation tax: calculations based on CPI and real GDP

series in IMF's World Economic Outlook, 2004 database. Log of per capita GDP, World Bank World Development Indicators, 2004.

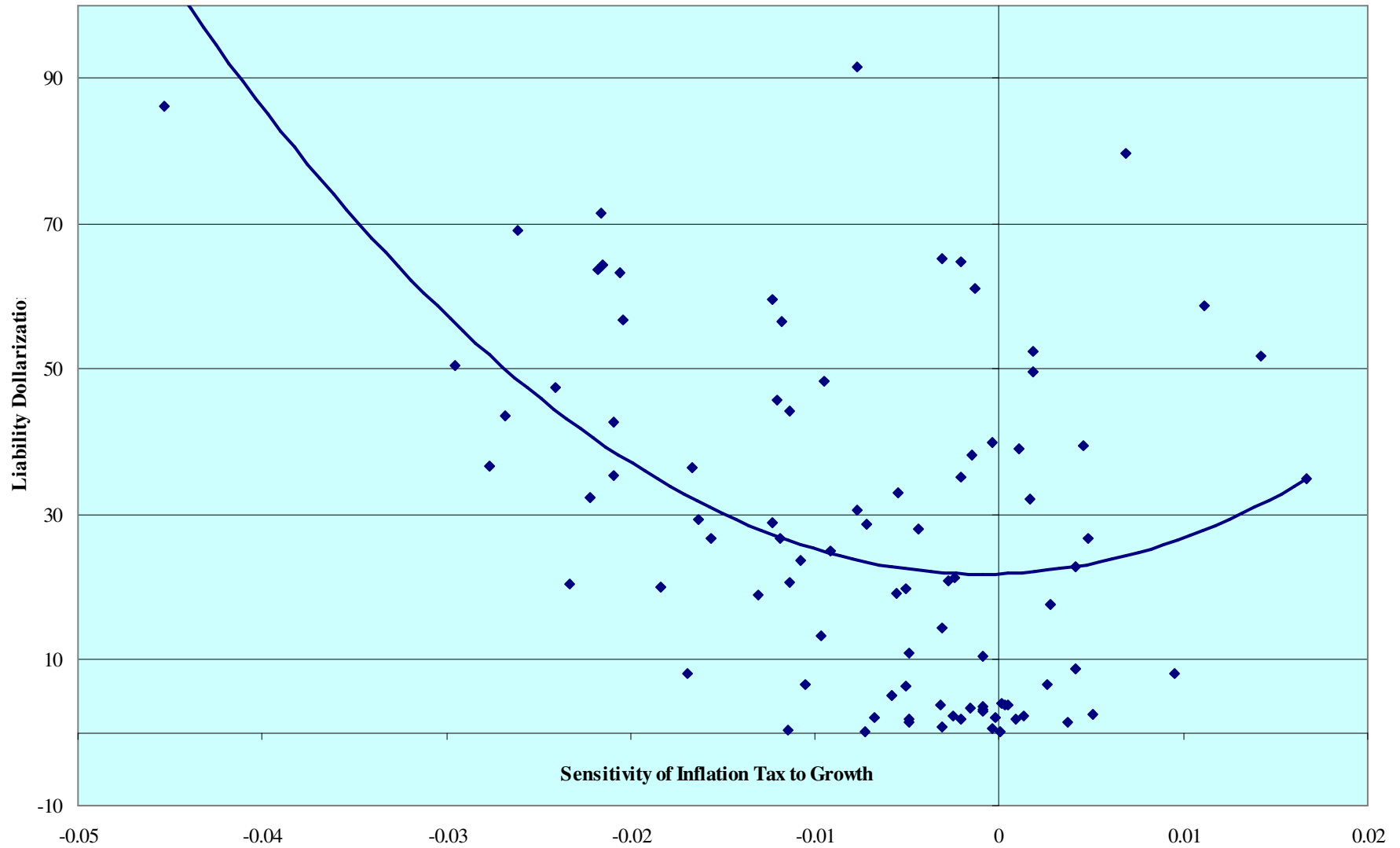
Foreign currency deposits as % of total deposits, and index of legal restrictions on dollarization: Nicolo, Honohan and Ize(2003).

Figure 1. Real Growth and Inflation Tax when Institutional Quality is Below and Above its Median



Note: Real growth, on the horizontal axis, is measured for each country as the average over 1980 to 1995 of the annual growth rate of real GDP. Inflation tax, $(\pi/(1+\pi))$, with π the annual CPI inflation, on the vertical axis, is each country's average inflation tax over 1980 to 1995. In the left (right) panel I group those of the 165 countries in the sample for which government effectiveness (average value for 1996,1998 and 2000 as in Kaufmann et al (2003)) is below (above) the sample median.

Figure 2. Dollarization as a Function of the Sensitivity of Inflation Tax to Real Growth



Note: The sensitivity of inflation tax to growth is the estimated coefficient of the real gdp growth rate as regressor on inflation tax as dependent variable; regressions by country were based on 1965-2002 samples. Liability Dollarization is measured as the ratio of foreign currency deposits to total deposits in percent; for each country we take the average for the period 1990-2001