Beginning with the financial crisis in Mexico in 1992, rescue packages consisting of loan commitments from industrial countries and international organizations have become an important ingredient in crisis management. Rescue packages are designed to reassure private investors, stop runs and limit contagion to other countries. The motivation for rescue packages is the belief that the real costs of crises can be reduced by quick and decisive action. While there are plausible theoretical models of crises that suggest this is an effective policy reaction there are, in our view, equally plausible models that suggest such intervention is effective only if it is a surprise. Since the official sector cannot hope to surprise the private sector consistently, rescue packages cannot continue to be an effective response to financial crises.

In the next section we review some of the literature on the role that third parties such as the IMF and other official creditors might play in mitigating output losses following crises. We then develop more carefully a class of models that focuses on strategic default and punishment technologies in evaluating the role of official lending. Finally we propose a specific version of this model and confront the data. We find some support for the model but are well aware that with only a few observations of crises spread over considerable time periods and across dissimilar countries the ability to discriminate among models is quite limited.

Sovereign Debt Models, Output Loss and Third Party Intervention:

This section explores the role of the third party in crisis resolution following a default on its external debt by the debtor country. A clear understanding of the process through which renegotiation progresses following a default is at the crux of how the losses associated with financial crisis may be mitigated.

In their seminal paper on sovereign debt negotiations Bulow and Rogoff (1989) argued that constant bargaining between the debtors and creditors both over current payment and a schedule of future repayments is a feature that distinguishes sovereign debt renegotiations from one-time domestic bankruptcy negotiations.
In their model the penalty for default is assumed to be trade sanctions which prevent the debtor country from maximizing the gains from trade. The lenders will lend as long as the net present value of the future repayments plus the seizures equal the market rate of return. The motivation for the risk-neutral debtor to borrow is not consumption smoothing but they borrow since their discount rate is assumed to be more than the world interest rate. This means that the debtor country will never pay "upfront" to prevent trade interference by the creditor in the future. The contract will have to be renegotiated every period.

The design of renegotiation is that neither party makes a take it or leave it offer, instead they take turns at making the offer. Within this framework, the Bulow-Rogoff model does not have any real output losses since the debtors and creditors reach rescheduling agreements immediately. The important insight from our point of view is that, as long as the effective threat is trade sanctions, there is no good reason to believe that international debt contracts will be designed to interfere with this efficient resolution of a bargaining game. In the final section of this paper we explore the idea that the only effective sanction available to creditors is enabled by contracts that are costly to renegotiate. The expectation of third-party (creditor country's government) intervention does have real effects but the effect is not on output but on the supportable stock of debt.

Miller and Zhang (2000) describe the inter-creditor conflict in the post default period as the crux of the problem. However, as they rightly point out the behavior of the creditors

depends on the institutional framework. In the absence of international bankruptcy procedures, the creditor race for repayment characterizes the post default scenario. While unilateral standstill by the debtor country, endorsed by Krugman, is an option, lending by the IMF is an easier way out. However, if IMF intervention is anticipated, then it will give rise to moral hazard problems.

They first consider a framework where the creditor has only limited power to inflict punishment for default on the debtor, then the debtor's willingness to pay rather than ability to pay matters. The authors rule out strategic defaults/moral hazard by debtor citing the example of East Asian and Latin American borrowers who suffered a loss in output, preferring to repay than to default. Once strategic default is ruled out, creditor's moral hazard, especially if IMF intervention is anticipated, can be definitely predicted.

Bertolini and Dixit's ( need reference ) model can illustrate the role of the third party, e.g. the Paris Club, when the debtor faces a severe liquidity crunch. If the third party intervention is unanticipated, then the reduction in debt values puts the burden on the creditors. If the third party intervention is fully anticipated, the creditor may charge the debtor upfront for ex post debt write down. Alternatively, if the debtor waives sovereign immunity, an asset-grabbing race among the creditors can lead to all around losses.

To stem these losses, the third party, i.e. the IMF, can play the role of lender of last resort. If anticipated, this can lead to investors' moral hazard, in terms of poor monitoring of its loans, as well as debtors' moral hazard. It is shown that such lending by the IMF is unsustainable without real transfers by the IMF to bail out the creditors.

Alternatively, the IMF can play the role of a bankruptcy court and authorize payment standstill. It doesn't make any transfers and facilitates debt restructuring between the creditors and the debtors. With sovereign immunity the IMF would be successful in protecting the debtor's interests. However, without sovereign immunity the standstills could trigger retaliatory creditor action, absent official endorsement of the standstill.
The authors believe that both roles of the IMF can be complementary so that in the initial phases of liquidity crisis the IMF lends to the debtor, but followed by the debt reduction/standstill if needed.

Both the Bhattacharya and Miller (1999) and Miller and Zhang (2000) add standstills as an alternative to induce creditors to rollover credits and thus avoid losses from liquidation and IMF programs.

Another suggestion for reform of the institutional structure consists of changing the design of the contract to include the possibility of ex-post bail-ins or the collective action clauses to which we turn next. In the absence of any collective action clauses, renegotiations are costly and time consuming. Yet, making renegotiations easier ex ante is likely to encourage debtors to default on their repayments and hence reduce the amount the lenders are willing to lend or increase the cost of borrowing. Stretching the argument a bit further, is willingness to include collective action clauses a signal of a low creditworthiness of the borrower?

Eichengreen and Mody (2000) finds bonds governed by U. K. law as being more renegotiation-friendly than those governed by U. S. law. Their data consists of 2619 emerging market bonds for the 1991-98 period, where 1160 of the bonds are governed by U. K. law, 840 by U S law, and the rest by other laws. They find that spreads for the bonds subject to U. K. law are lower than those subject to U. S. law thus rejecting the proposition that collective action clauses tend to increase the cost of borrowing.
They further distinguish between types of borrower—East Asian borrowers are assumed to be more credit worthy than Latin American and Eastern European borrowers. They find that more creditworthy borrowers tend to issue more frequently under UK law and

are subject to lower spreads then the less creditworthy borrowers. The implications of this finding on the second issue are less clear-cut, especially in view of the evidence that both the highest rated borrowers and the lowest rated borrowers (categorized by Investor country credit rating) issued more bonds governed by U. K. law relative to U. S. law.
The authors argue that including collective action clauses in the less creditworthy borrowers is indicative of moral hard problem and high cost of borrowing, while collective action clauses in the more creditworthy borrowers is indicative of not moral hazard but of easy restructuring facilitating lower cost of renegotiation!

Thus the authors support the inclusion of collective action clauses in the design of contracts as a viable way of cutting the deadweight loss associated with financial crisis without the intervention of the third party. The framework used by them implicitly is reputational rather than direct sanctions in the post default scenario since they refer to market access as follows -"only the most creditworthy borrowers come to the market when global financial conditions tighten."

Dell'Ariccia et al. (2000) explore empirically the evidence on moral hazard contrasting the experience of Russia with those of the Mexican and the Asian countries in the post-crisis period. They find strong evidence consistent with the presence of moral hazard. While the basic methodology used is a regression model of spread determination, as was used by Zhang (1999) to analyze the Mexican 1995 bailout, this empirical study is much broader in scope. The Russian default of 1998 is a better case study of moral hazard since it was characterized by the absence of a bailout contrary to expectations. They find that the Russian crisis was followed by a significant increase in spreads in many of the emerging market countries, more so for countries with weak fundamentals. Further, investors seem to have paid more attention to individual country characteristics in the post-crisis period, indicated by large increases in cross-sectional dispersion of spreads.

One of the significant empirical papers by Gupta et al. (2000) presents evidence on output response during currency crisis. They consider 280 cases of currency crises across 125 countries between the 1970s and 1990s. They show that in over 40 percent of the cases currency crises were accompanied by an expansion of output. The growth rates were higher in the 1990s compared to the 1970s, as the contraction in output was less severe in the 1990s for those cases where crisis led to a recession.

Using multivariate regression analysis they show that the most important factors explaining expansion in output are the presence of capital and current account restrictions in the pre-crisis period and higher sensitivity of exports to devaluation. The factors casing a contraction in output are high illiquidity of the country prior to the crisis, high private capital it received prior to the crisis and a higher increase in real debt burden.

**Strategic Default**

In this section we develop the idea that predicted effects of bailouts are quite sensitive to the assumed structure of the game between debtors and creditors. In the final section we focus on a special case that seems to us to be promising. The key assumptions are the assumed punishment technology and the assumed ability of any of the parties involved to condition the punishment on the reasons for default. This second consideration suggests to us that a useful model should consider the possibility that strategic default is an option for debtors.

Bolton and Scharfstein (1996) presented a model of bargaining between the debtors and the creditors in the context of domestic credit markets. They distinguish between two kinds of defaults: liquidity defaults, where the debtor is unable to pay, and strategic defaults, where the borrower is able but not willing to pay. Unless there is some penalty for default, like seizing the borrower's asset, the lenders will not lend fearing strategic

defaults. The distortion in this model is the inability to condition penalties for nonpayment on the reason for nonpayment. Bad luck defaults are observable but not verifiable.

We use the framework developed by Bolten and Scharfstein to explore how the IMF's intervention changes the bargaining game between the creditors and the debtors. The domestic credit markets differ from the international credit markets in that the lenders cannot seize the assets of the debtor. However, it is assumed that by making contracts costly to renegotiate or by trade sanctions, the lenders can prevent the debtor from gaining the returns from that asset. L is the liquidation value of the asset and it is assumed to be zero so that scrapping the asset earns nothing.

This is a three period model with the periods being denoted by 0, 1 and 2. For simplicity, it is assumed that the (risk-neutral) debtor's wealth is zero (the results hold true even if positive initial wealth is assumed) and they need to borrow amount, K, to finance an investment project. The returns on the investment are uncertain in period 0 but are realized in period 1. In the first period, investment gives a return of x in a good state and a return of 0 in the bad state. The respective probability of the two states occurring is given by $\theta$ and (1- $\theta$). After the return is realized, the debtor has to choose between repaying the debt and defaulting. In the bad state the debtor will be forced to default (Liquidity Default), since the initial wealth is assumed to be zero. In the good state the debtor may pay out zero (Strategic Default) or he may repay Rx .

The return in period 2 depends on what happens in the first period. The models of domestic credit markets assume that the lenders have the legal right to liquidate the assets, if they choose to do so. Hence, $\beta$, the creditors' share of the residual value of the asset following default, is interpreted as the probability that lenders will be permitted to liquidate the firm's assets.

In the international credit markets, however, the interpretation of $\beta$ is different. The lenders legal right to liquidate the assets is not well defined. At most, they may be able to prevent the use of the asset by the debtor through legal means or other threats, for example, by preventing imports into the debtor country. Thus in the international context, $\beta$ is interpreted as the market value of restructured debt following default and renegotiation. The incentives to pay following default could be a fear of trade sanctions. Or it could be the fear of a loss in output as financial intermediation in the debtor country is disrupted by unresolved disputes among debtors and creditors.

The return in period 2 is y if the debtor continues with the project after paying back the debt. As soon as the debtor declares default, renegotiations between the creditors and the debtors begin. If the negotiations fail, the debtor loses all of the potential output, y. Alternatively, if the debtor agrees to pay to the creditor $\alpha$y out of remaining output in the second period, the creditor agrees to lift sanctions or reduce the contractual value of the debt. For simplicity it is assumed that $\alpha$ =1/2.

Imposition of sanctions by the creditor is likely to lead to an inefficient outcome, since the debtor would no longer be able to fully utilize an investment opportunity. Lenders may not gain much either. One reason why they would still impose sanctions is that it acts as a threat against non-repayment. This may be problematic since the creditor needs to commit to punish even when it is not in its ex-post interest to do so. In the next section we consider a special case in which the probability that relegation will fail is determined ex ante by the design of contracts. In particular we explore the case where creditors precommit to impose losses by designing contracts that are costly to renegotiate.

DESIGN OF CONTRACTS: A complete contract specifies payments contingent on all possible states of the world. We first outline such a contract. It is assumed that both borrower and lender have complete information about the state of the world. So the lender can distinguish between liquidity and strategic defaults. The contract is specified as follows:

*Debtor has to pay Rx (Rx < x) when the return is x in period 1, otherwise with probability b, it faces sanctions if it defaults. When the return is 0 in period 1, the lender can impose sanctions with probability $b_0$. Alternatively, renegotiations result in the creditor allowing a partial rollover of debt into the second period.*

In period 1, the state of the world is determined. With probability θ, good state occurs and the project return is x. With probability 1-θ, bad state occurs and 0 return is materialized. The debtor moves next by deciding whether to repay or to default. In the case of a bad return, liquidity default is certain (since we have assumed zero initial wealth). In the case of a good return, the debtor may repay Rx out of the return x, or may default and repay nothing, keeping the entire return for itself.

Next, there is renegotiation. If it is successful, both parties agree to share the third period output. If it is unsuccessful, the creditor imposes sanctions. In case of a strategic default, the debtor's payoff in the second period is still positive, and is denoted by S--even if the creditor imposes sanctions--to denote positive returns from investing the first period returns. The probability with which the creditor follows an attack strategy differs for the strategic default branch of the game and the liquidity default branch, if there is full information. In the model with incomplete contracts these probabilities are the same.

Given this contract, the debtors' expected payoff is given by:

(1) $\theta (x + y - Rx) + (1-\theta)(1-\beta_0)(y/2)$

The lenders' expected profits should be non-negative:

(2) $\theta Rx + (1- \theta)(1-\beta_0)(y/2) - K \geq 0$

The payments must satisfy an incentive constraint to rule out strategic defaults:

(3) $x + y - Rx \geq x+(1-\beta)(y/2)+ \beta S$

where S denotes the utility of the debtor from paying out 0 when the return is x and the lender imposes sanctions. Assume that $0 \leq S \leq y$.

The optimal contract maximizes (1) subject to (2) and (3): The results can be summarized as follows:

(4) $\beta_0=0$

It can be shown that optimal value of $\beta_0$ is zero. This implies that imposition of sanctions is ruled out in the bad state of nature.

The debtors' expected payoff could be written as:

(5) $\theta x + y - K$

This represents the first best solution in terms of Net Present Value of the project (when there is no loss in output due to sanctions).

However, a less than perfect world is characterized by incomplete contracts. The lenders may not be able to distinguish between a strategic default and liquidity default.

Then the contract may be specified as:
*Debtor has to pay Rx in period 1, otherwise with probability $b$, the lender can impose sanctions.*

Given this contract, the debtors' expected payoff is given by:

(1b) $\theta (x + y - Rx) + (1-\theta)(1-\beta)(y/2)$

The lenders' expected profits should be non-negative:

(2b) $\theta Rx + (1- \theta)(1-\beta)(y/2) - K \geq 0$

The payments must satisfy an incentive constraint to rule out strategic defaults:

(3b) $x + y - Rx \geq x+(1-\beta)(y/2)+ \beta S$

where S denotes the utility of the debtor from paying out 0 when the return is x and the lender imposes sanctions. Assume that $0 \leq S \leq y$.

The optimal contract maximizes (1b) subject to (2b) and (3b):

The results may be summarized as follows:

Value of optimum $\beta$ is given by

(4b) $$b = \frac{qy - (y/2) - K}{qS - (y/2)}$$

which will be a feasible solution as long as $\beta \leq 1$.

The debtors' expected payoff could be written as:

(5b) $x + y -K - (1- \theta)\beta y$

The first three terms represent the net present value of the project and the last term is the expected efficiency loss due to sanctions, arising due to contractual incompleteness.

As pointed by Bolten and Scharfstein, from 5b it can be seen that an arbitrary probability of liquidation, $\beta$, is preferable over designing a contract that lenders always liquidate with a probability 1. In the international context, the uncertainty about the outcome of renegotiations following default is captured by $\beta$. Interestingly, this uncertainty reduces the efficiency losses, compared to when the lender imposes sanctions with a probability one when he cannot distinguish between the strategic and liquidity defaults.

How can the IMF intervene in the bargaining game between the debtors and the creditors so that a first best solution is obtained? This is the question we explore in the next section.

*A Model of Bargaining with Three Players: Debtors, Creditors and IMF*

IMF as a facilitator of renegotiations: In terms of the model outlined above, in the presence of informational asymmetries, there will be a bias of the debtor to default strategically. The lenders may still lend if they can design a contract which imposes an incentive constraint on the debtor's behavior, so that the debtors would not prefer to default strategically. Any such contract will have a bias towards excess sanctions. As pointed by Diamond (1993), the reason for this is that the lenders ignore the part of the future return of a project which accrues only to the debtor. This results in efficiency losses. The third party (henceforth the IMF) intervention can be welfare improving if it can help facilitate renegotiations regarding the sharing of the third period output while at the same time allowing the debtor to reap these returns. Notice that in this role the IMF doesn't make a transfer to any of the parties, but merely acts as an enforcer of contracts.

The extensive form of the game is illustrated in Figure 3. The game is played in two stages. The debtor is assumed to have no initial wealth and borrows K for investment. The return in period 1 is x with a probability $\theta$ and 0 with probability $(1- \theta)$. The debtor decides whether it will repay the creditor or default. In a bad state there is a liquidity default. If there is repayment, then the project ownership remains with the debtor who earns a return of y in the second period. If there is default and the lender is unable to distinguish between a strategic default and a liquidity default. Then, in the next stage, borrower and lender may approach the IMF for resolution with a probability $\pi$. It is assumed that the IMF also cannot distinguish between strategic and liquidity defaults. When the debtor is a sovereign nation, there are political problems in obtaining the correct information about the returns. The creditor as well as the IMF faces this problem of verification of returns. The IMF allows the debtor to continue with the project, but enforces that the two parties' share the final period output y. If the IMF doesn't intervene, with the probability $1-\pi$, then the creditor may imposes sanctions with probability $\beta$. Alternatively the lender may rollover the debt to period 2.

Given this contract, the debtors' expected payoff is given by:

(1c) $\theta (x + y - Rx) + (1-\theta ){\pi(y/2) + (1-\pi)(1-\beta)(y/2)}$

The lenders' expected profits should be non-negative:

(2c) $\theta\ Rx + (1-\theta ){\pi(y/2) + (1-\pi)(1-\beta)(y/2)}-K \geq 0$

The payments must satisfy an incentive constraint to rule out strategic defaults:

(3c) $x + y - Rx \geq x + \pi(y/2) + (1-\pi){(1-\beta)(y/2) + \beta S}$

The optimal contract maximizes (1c) subject to (2c) and (3c):

It can be shown that the optimum value of $\pi$ is

(4c) $$\pi = \frac{qb(y-S)+(1-b)(y/2)-K}{qb(y-S)-b(y/2)}$$

which will be a feasible solution as long as $\pi \leq 1$.

The debtors' expected payoff could be written as:

(5c) $\theta x + y - K - (1-\theta)(y\beta) + (1-\theta)\beta\pi(y-y/2)$

The first three terms represent the Net Present Value of the project. The fourth term is the expected efficiency loss due to contractual incompleteness. The intervention of theIMF can reduce the inefficiencies to the extent of the last term.

If $\pi = 0$ , then the solution will lead to greater divergence from the first best.

The rationale for this result is that when the true nature of the default is not known and the IMF can credibly enforce the contract, the bias towards excess sanctions can be reduced. Then $\pi$ takes the value closer to 1, since both the creditors and the debtors benefit by IMF's intervention.

Alternatively, if a multilateral agency has more information about the state of nature than the creditor, then that can be welfare improving. It is easy to demonstrate in terms of the model that if the IMF could distinguish between strategic and liquidity defaults then first best solution can be reached. There would be no sanctions in the bad state and the output loss will be eliminated. Thus it would be in the interest of the debtor nation also. The incentive to default strategically would be reduced if the true nature of the debtor were revealed.

An interesting case is when with asymmetrical information, there is self-selection by the debtor itself, and it is to this case we turn to in the next sub-section.

*Reputation-Based Debt Contracts*

In the above models it has been assumed that the IMF can impose a penalty on the debtor nation if it defaults.. We next turn to the case where reputation is the main motive for repayment. Reputation is modeled as an asset[1] which has a present value of R in terms of the future foreign lending which is available to it's owner. Each time the debtor defaults, there is erosion in its value by an amount $\Delta$ and every time the debtor repays, its value increases by $\Delta$. We shall show that the reputational effects make the intervention of a third party, the IMF in this context, irrelevant. It is assumed that the lenders cannot distinguish between the strategic defaults and the liquidity defaults and can only impose sanctions with a probability $\beta$.

Given this contract, the debtors' expected payoff is given by:

(1d) $\theta (R + \Delta + x + y - Rx) + (1-\theta)\{R-\Delta-(1-\beta)(y/2)\}$

The lenders' expected profits should be non-negative:

(2d) $\theta\ Rx + (1-\theta)(1-\beta)(y/2)-K \geq 0$

The payments must satisfy an incentive constraint to rule out strategic defaults:

(3d) $R + \Delta + x + y - Rx \geq R-\Delta + x + (1-\beta)(y/2)+ \beta S$

where S denotes the utility of the debtor from paying out 0 when the return is x and the lender imposes sanctions. Assume that $0 \leq S \leq y$.

[1] See Verma (2000).

The optimal contract maximizes (1d) subject to (2d) and (3d):

We derive the optimum value of β as

(4d) $$b = \frac{K - 2\Delta q - (y/2)}{q\{(y/2) - S\} - \{(1-q)(y/2)\}}$$

which will be a feasible solution as long as $\beta \leq 1$.

The debtors' expected payoff could be written as:

(5d) $\theta x + y - K - (1-\theta)\beta y + (R + 2\Delta\theta - \Delta)$

The first three terms represent the Net Present Value of the project and the fourth term is the expected efficiency loss. The last term represents the reputational effects and is positive.

Comparing equations 5c and 5d, we can see that when reputation is a motive for debt repayment, the third party is redundant since it has a similar effect of neutralizing the efficiency losses and achieving the first best solution.

Finally, the first best solution will be obtained if

$$(1-\theta)\beta y = R + 2\Delta\theta - \Delta$$

Thus it has been shown that in the presence of reputation-based debt contracts, the IMF doesn't have a significant role to play. If the country is very motivated to repay, even if there is informational uncertainty about the true nature of default, the debtor will not prefer to default strategically, but will default only when it gets a bad outcome.

The extensive debate on redefining the role of the third party, the IMF, has thus far failed to address an important issue. The assumption about whether contracts are enforceable by the gunboat technology or whether they are reputation-based is critical. This affects the conclusions about the role that the IMF can play in reducing welfare losses associated with financial crisis. It has been argued in the literature that both reputation and ability to penalize debtors matter. Then the IMF can play a useful role in mitigating output losses following a financial crisis.

Insurance and Output Losses

Our understanding of the real effects of financial crises is quite limited. In a series of important papers Calvo and Calvo and Reinhart have argued that recent crises have generated relatively large output losses for two reasons. First, they argue that for emerging markets the magnitude of capital flow reversals has increased over time. Sudden stops of capital inflows require sudden "improvements" in the current account balance. They argue persuasively that it is difficult to imagine how such a dramatic change in real transfers can be accomplished without a short-run decline in output. These effects are more severe if the country faces quantitative restrictions on borrowing following the crisis. Moreover, they argue that emerging markets have become more vulnerable to reversals of capital flows, and associated changes in relative prices (nominal exchange rate depreciation), because of dollarization of liabilities.

These explanations for increasingly large output losses following financial crises in the 1990s are consistent with second generation models of crises that focus on multiple equlibria. Such models suggest that crises are triggered by shifts in private expectations that are unpredictable. It follows that an unanticipated shock to financial markets can have economically important real effects.

In the context of multiple equlibria models it is quite sensible to evaluate government intervention as a way to reduce or eliminate the coordination failures among creditors that generate unnecessary output losses. For example, using an open economy version of a Diamond-Dybvig bank run model Chui et al. (2000) provide a framework for evaluating crisis-avoidance policies. In particular, increasing liquidity (including rescue packages) relative to debt reduces the probability of both fundamentals and belief driven crises, and significantly improves welfare.

In this section we explore the idea that a specification of the model developed above can provide a more complete analysis of the size and duration of output losses following crises. Moreover this alternative framework suggests quite different implications for policy. The model presented in Dooley (2000) suggests that the *timing* of crises and the *scale* of capital inflows leading up to a crisis are the anticipated outcome of private investors' incentives to exploit a pool of government insurance. The insurance model *defines* the crisis as a reversal of private capital flows. What Calvo and Reinhart call a sudden stop. But the reversal is not triggered by a change in expectations. The idea is that observed crises are anticipated asset exchanges designed to exploit government insurance.

Our analysis also suggests that the initial or short run decline in output is related to the magnitude of the real transfer associated with the crisis. Because the capital inflow is insured, credit to residents of the emerging markets is subsidized during the capital inflow phase. Since residents know this is a temporary distortion of real interest rates they consume now knowing that repayment will be partially or entirely assumed by the government. The resulting explosion of external debt comes to a sudden stop when the stock of insurance is exhausted.

Investors cannot count on a bailout unless the government has strong incentives to exhaust its liquid assets at the time of the crisis. The model explored in Dooley (2001) suggests that the *composition* of the capital inflows leading up to a crisis is designed to provide the needed incentives to pay. In effect, contractual arrangements between residents and nonresidents are designed to protect foreign investors from strategic default.

The insurance/sovereign risk framework has two potential advantages over alternative models in accounting for output losses. In any consistent accounting framework the impact effect on output of a crisis is related to the size of the swing in private capital inflows and the associated swing in the current account balance. But while alternative models that we are aware of take the initial vulnerability of the country as exogenous, the insurance model suggests that the increase in the scale of capital inflows and anticipated reversals are related to growth in the availability of insurance.

In order to exploit insurance domestic banks and nonresident investors must participate in a credit boom in the debtor country. Even if residents of the emerging market know that a crisis is likely in the future they will be willing to borrow at rates that are subsidized by the expected insurance. Moreover they will be tempted to consume now when real interest rates are low so that part of the capital inflow supports a current account deficit.

It follows that capital inflows generated by insurance will distort real consumption and production decisions before the crisis and these distortions will have to be reversed following the crisis. In this regard our explanation for the initial output loss is identical to that suggested by Calvo and Reinhardt. But it also follows that the initial output losses following crises have grown as bailout packages have grown.

Second, the insurance/sovereign risk analysis offers an explanation for the very different duration of output losses that have followed crises. The initial downturn in economic activity following recent crises in Asia have been were quite similar. But the cumulative loss in output has been, and is projected to be, much larger in Indonesia as compared to Korea. Moreover the duration in output losses following the 1982 debt crisis were much more persistent as compared to recent crises in Asia.

In our model the duration of recession depends on whether or not the *crisis* also was a *default*. An insurance crisis is simply an asset exchange between the government and private investors. A default occurs when the government is unwilling or unable to provide the expected insurance payments. . Because the IMF and creditor governments are an important source of insurance, the nature of their intervention at the time of crisis is crucial in determining whether or not default occurs and, in turn, the real effects of the crisis.

Thus, liquidity and rescue packages are important, a result consistent with a variety of econometric work. The empirical measure of default is the difference between the expected and realized demand for and supply of insurance at the time of the crisis. Since this is a forecast error it is unpredictable and is likely to have real effects.

The Initial decline in output.

The loss in output following default will reflect several factors. Clearly the model suggests that following any crisis private capital inflows will fall to zero and, if the debtor country was using capital inflows to finance net imports, there will have to be an immediate and probably costly real transfer to nonresidents. Since the government will often decide to devalue to help facilitate the needed real transfer several other channels for contraction of output will also come into play. If the government does not devalue the same transfer must be made but now it will have to be accomplished by changes in domestic incomes and prices. (See Velasco et al.) Table 3 shows a simple regression of the loss in output in the year following the crisis and the change in capital inflows in the year before the crisis and the year following the crisis. The results are pretty convincing.

Measuring the stock of insurance

To test the idea that the duration of output losses are related to default we must first measure the gap between expected and realized values for the insurance pool and for claims on that pool at points in time where crises have been observed.

We have a quite small set of observations of crises that might be useful in evaluating these conjectures. Unlike other empirical work on crises we have a single variable and quite clear measure of when a crisis occurs and a much less clear measure of how long it lasts. The onset of a crisis is the point in time at which private investors begin to exchange claims on residents of the debtor country for international assets. The exchange, however, might stretch over several years as liabilities mature.

The primary source of uncertainty concerning the stock of insured assets is that the government will determine which assets are to be protected at the time of the bailout. This will, in turn, reflect the ability of different classes of creditors' relative ability to disrupt output in the event of default. Since the government will determine relative places in line, information from one crisis is of limited help in anticipating the outcome in the next crisis. The model suggests that ex ante rates of return should be systematically related to the expected bailouts. Moreover different types of external liabilities have had clearly different returns preceding crises.

The anticipated stock of insurance, however, is quite difficult to measure directly. While the stock of international reserves seem to be a predictable source of insurance, investors can never be sure that the government will exchange all these assets. The usual assumption that the government will exhaust its reserves is not consistent with the data. Moreover, published reserve stocks have often turned out to be much larger than net reserves because of forward exchange and other derivative commitments undertaken before the crisis.

Another important source of uncertainty about the stock of insurance is that in many cases a quantitatively important share of the anticipated insurance pool comes from new loans by creditor governments and international organizations. At the time of crisis it is likely that a rescue package is assembled that consists of loans from several sources. It follows that investors must evaluate the expected net increase in credit from all official sources for several years into the future. Put another way, they must guess whether or not the debtor government will be willing and able to borrow from the IMF and other official lenders to pay them off when their claims mature.

For crises after 1990 we assume that announced rescue packages are an unbiased estimate of the resources investors expect to receive from the government. A problem with this interpretation is that rescue packages are seldom followed by official credits of similar magnitude. This has led many observers to doubt the importance of insurance for creditor behavior. Our view is that announced rescue packages are important since they oblige the official sector to lend if alternative adjustment measures do not provide the funds needed to liquidate private debt as it matures. In practice the single largest alternative source of funds has been the current account surplus that has followed most crises. So we view the package as creditor governments' commitment to underwrite an adjustment effort.

The 1982 crises present a more difficult conceptual problem. Rescue packages announced in 1982 were limited to bridge loans that were very small and very short term. In Dooley (1996) I argue that commercial banks expected their own governments to bail them out and that the bailout eventually came but much more slowly than expected. If we consider the whole crisis period from 1982 to 1989 we see that official credits were

eventually quite substantial. One hypothesis is that in 1982 private investors had the amount of the bailout right but were surprised by the very slow disbursement. The data in Table v reflect this assumption. Here the expected package in 1982 is equal to the present value of the official capital flows actually observed through 1989. It follows that at the time of the crises in the early 1980s it was likely that investors were surprised by the announcement that the present value of the rescue package was almost nil. As time passed and governments provided loans to debtor countries the initial default was reversed.

Measuring the expected demand for insurance

If crises are anticipated, the anticipated stock of insurance at the time of crisis should be related to the stock *and structure* of private claims on the country at the time of crisis. To test this idea we regress the stock of insurance observed at the beginning of 17 crises against the stock and composition of external debt outstanding at that time. The results reported in Table 1 seem sensible. Each category of external debt can be interpreted as a demand for insurance. As anticipated, equity claims are not a claim on insurance while short-term debt is almost fully covered.

Measuring the expected supply of insurance

Investors must guess about the ability and willingness of the government to use its assets and lines of credit at the time of crisis. Table 2 reports the results of a regression of measured insurance pools discussed above against easily observed characteristics of the debtor country. By using the whole sample we are assuming investors used information they did not have but with only 17 observations alternative approaches are not feasible. The results reported in Table 2 suggest that the GDP of the debtor country is by far the dominant determinant of the size of rescue packages.

Measuring the forecast error.

The model suggests that a crisis observation occurs when the expected demand for insurance is just equal to the expected supply. It follows that we can examine the "forecast error" associated with the demand and supply for insurance for each crisis. Suppose we observe a crisis at time T0. Or theory suggests that at T0 the expected demand for reserves was equal to the expected supply. But because both demand and supply are estimated with error it is quite possible that our estimates of demand and supply will not be equal when crises are observed. There are many potential sources for such errors. If the demand curve was correct an insurance pool less than the estimated demand would imply a positive default. If the supply curve was correct an insurance pool greater than estimated supply would imply no default. Since we do not know which relationship is more likely to be correct we propose to take the sum of the supply and demand error as our measure of default.

Our model suggests that, other things equal, the *default* generated by the shortfall of insurance will interfere with financial intermediation as long as the default persists. We should expect to see relatively slow recovery following a crisis that involves default relative to a crisis where insurance is equal to or greater than its expected value. We have not yet attempted to measure the duration of default so, as a first pass at the data, assume that the size of the initial default is a proxy for size and duration. Table 4 reports the results for a regression of cumulative output losses against the forecast errors for insurance discussed above. There is not much support for the theory at the moment.

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## Table 1

## OLS regression for demand for insurance

Dependent Variable: rescue package following crisis (RESCUE2)

| Variables | Coeffic |
|---|---|

| | ients |
|---|---|
| Constant | -894.50<br>(-0.12) |
| 80s crises dummy | 3605.46<br>(0.44) |
| Bond stocks outstanding at time of crisis | 2.07*<br>(2.15) |
| Equity | 0.95<br>(-1.50) |
| Foreign direct investment | 0.09<br>(0.23) |
| Private loans | 0.11<br>(0.27) |
| Short term debt | -0.17<br>(-0.37) |
| Number of observations | 19 |
| Adjusted $R^2$ | 0.75 |
| F – test for combined significance (probability) | 0.00 |

**. Because the IMF and creditor governments are an important source of insurance the nature of their intervention at the time of crisis is crucial in determining the real effects of the crisis. Thus, liquidity is important, a result consistent with a variety of econometric work.**

**Table 2**

**OLS regression for supply for insurance**

Dependent Variable: rescue package following crisis (RESCUE2)

| **Variables** | **Coefficients** |
|---|---|
| **Constant** | **15879.69*** (1.90)** |
| **80s crises dummy** | **-14662.71 (-1.94)** |
| **GDP at year of crisis** | **0.07*** (2.69)** |
| **Foreign exchange reserves (t-1)** | **-0.02 (-0.50)** |
| **Openness (ratio of imports and exports to GDP)** | **-67.03 (-0.48)** |
| **Number of observations** | **26** |
| **Adjusted $R^2$** | **0.73** |
| **F – test for combined significance (probability)** | **0.00** |

**Table 3**

**OLS regression for severity of crisis**

**(conditional on current account reversal)**

Dependent Variable: rescue package following crisis (RESCUE2)

| Variables | Coefficients |
|---|---|
| Constant | -7.12*** (-2.92) |
| 80s crises dummy | 1.13 (0.50) |
| Reversal of current account | -52.55** (2.69) |
| Number of observations | 20 |
| Adjusted $R^2$ | 0.19 |
| F – test for combined significance (probability) | 0.07 |