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ABSTRACT

This paper examines the role of the third party (the IMF) in resolving sovereign default on external debt. We first show that the effects of third party intervention in debt negotiations are quite sensitive to the assumed enforcement mechanism for sovereign debt. The model is then adapted to an insurance crisis. The main result is that the unanticipated component of third party intervention can either intensify or mitigate the dead weight loss following default.

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1. Introduction

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[1] there are, in our view, equally plausible models that suggest such intervention is effective only under very stringent conditions.

As pointed out by Dooley (2000b) any prescription for crisis resolution must be motivated by a clear understanding of debtors' incentives to repay debt. In this paper, we focus on strategic behavior by debtors, what is sometimes called sovereign risk, renegotiation costs and third party intervention in negotiations that follow default.

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 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.

2. Sovereign Debt Models, Output Loss and Third Party Intervention

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 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

[1] Among many others see Sachs (1995), Miller and Zhang (1998), Bhattacharya and Miller (1999), Chari and Kehoe (1999), Fischer (1999), Giannini (1999), Rogoff (1999), Chui et al. (2000), Gavin and Powell (2000), Ghai et al. (2001).

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 would be designed to interfere with this efficient resolution of a bargaining game. The expectation of third-party (creditor country's government) intervention does not have real effects on output but does affect the supportable stock of debt.

In contrast, Miller and Zhang (1998) describe the inter-creditor conflict in the post default period as the crux of the problem. They draw upon Bartolini and Dixit's (1991) model to illustrate the role of the third party 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. 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 suggest 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.

3. Strategic Default

The literature briefly reviewed above has not explicitly considered strategic default as an important factor in sovereign debt markets. This is a potentially important omission and is the subject of the remainder of this paper. Bolton and Scharfstein (1996) develop 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.

In a trivial sense all sovereign defaults are strategic since, unlike a corporate debtor, countries are always solvent. However, we assume that a sovereign's power to tax is limited so that a solvent country can have an insolvent government. In this environment bad luck and strategic defaults are possible. Moreover, creditors' fear of 'cheating' by the sovereign determines the design of contracts.

The domestic credit markets differ from the international credit markets in that the lenders cannot seize the assets of the sovereign 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.

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 θ 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 the amount specified in the contract denoted by Rx.

The return in period 2 depends on what happens in the first period. 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 (with probability β), the creditors impose sanctions and the debtor loses all of the potential output, y. Alternatively, if the debtor agrees to pay to the creditor αy

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 $\alpha = 1/2$.[2]

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. Imposition of sanctions by the creditor is likely to lead to an inefficient outcome, since the debtor will no longer be able to fully utilize an investment opportunity. Lenders may not gain much either. One reason why they will 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[3]. In the next section we consider a special case in which the probability that renegotiation will fail is determined ex-ante by the design of contracts. In particular we explore the case where creditors pre-commit to impose losses by designing contracts that are costly to renegotiate.

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, β, 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 β 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, β is interpreted as the probability debt is restructured in some way after a failed renegotiation.

3.1 Design of Contracts

An optimal debt contract is defined as one that balances the two effects—that of deterring strategic defaults while at the same time minimizing the costs associated with liquidity defaults. 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:

[2]Endogenizing α doesn't significantly alter the results of the model. The important issue is how the second period output sharing will be enforced rather than the relative shares of the debtor and creditors.
[3]We suspect this is why trade sanctions are seldom observed. In contrast, the creditor can commit not to renegotiate by designing contracts so that they are costly to renegotiate.

Debtor has to pay Rx (Rx < x) when the return is x in period 1, otherwise with probability β, it faces sanctions if it defaults. When the return is 0 in period 1, the lender can impose sanctions with probability β_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 next section, outlining the model with incomplete contracts, these probabilities are assumed to be 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 β_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).

The credit ceiling $\overline{K_1}$ can be calculated from the lenders profit function as

(6) $\overline{K_1} = (y/2) - \beta\theta S + \beta\theta\,(y/2)$

3.2 Incomplete Contracts

However, a less than perfect world is characterized by incomplete information. 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 β, 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 β is given by

(4b) $$\beta = \frac{K-(y/2)}{\theta(y-S)-(y/2)}$$

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

The debtors' expected payoff could be written as:

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

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

We can calculate the debt ceiling under incomplete contracts as

(6b) $$\overline{K_2} = \frac{y}{2} - \beta\theta S + \beta\theta \frac{y}{2} - (1-\theta)\beta \frac{y}{2} = \overline{K_1} - (1-\theta)\beta \frac{y}{2}$$

Compared to the full information case, the creditors will lower their lending when they cannot distinguish between strategic and liquidity defaults. Thus the inefficiency in this model is reflected in output losses faced by the debtors as well as the lower level of sustainable debt.

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.

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

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 that imposes an incentive constraint on the debtors' behavior so that the debtors would not prefer to default strategically. Any such contract will have a bias towards excess sanctions. As pointed out by Diamond (1993), the reason for this is that the lenders ignore the part of the future return of a project that accrues only to the debtor. This results in efficiency losses. The third party 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 need not make a transfer to any of the parties, but merely acts as an enforcer of contracts.

The debtor is assumed to have no initial wealth and borrows K for investment. The return in period 1 is x with a probability θ and 0 with probability (1−θ). 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, in the next stage borrower and lender may approach the IMF for resolution with a probability π. It is assumed that the IMF also cannot distinguish between strategic and liquidity defaults.[4] When the debtor is a sovereign nation, there are political problems in obtaining the correct

[4] Ghai, et al. (2001) assume that IMF has a signal (not necessarily correct) about the nature of default but not the lender.

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 impose sanctions with probability β. Alternatively the lender may roll over the debt to period 2.

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

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

The lenders' expected profits should be non-negative:

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

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

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

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

It can be shown that the optimum value of π is

$$\pi = \frac{\theta\beta(y-S) + (1-\beta)(y/2) - K}{\theta\beta(y-S) - \beta(y/2)} \tag{4c}$$

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

The debtors' expected payoff could be written as:

$$\theta x + y - K - (1-\theta)(y\beta) + (1-\theta)\beta\pi y \tag{5c}$$

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 the IMF can reduce the inefficiencies to the extent of the last term.

If π = 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 π takes the value closer to 1, since both the creditors and the debtors benefit by IMF intervention.

Calculation of the debt ceiling in this model yields

(6c)

$$\overline{K_3} = \frac{y}{2} - \beta\theta S + \beta\theta\frac{y}{2} - (1-\theta)\beta\frac{y}{2} + \beta\pi\{\frac{y}{2} - \theta(y-S)\} = \overline{K_2} + \beta\pi\{\frac{y}{2} - \theta(y-S)\}$$

This result shows that the effect of the IMF's intervention on the credit ceiling may be positive or negative depending on the sign of the last term. The IMF's role as an enforcer of contracts reduces output losses for the debtor but need not be bad news for the lenders either. We don't find a strong evidence of a tradeoff between reduced inefficiency due to contractual incompleteness and the amount of supportable debt.

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 the first best solution could be reached. There would be no sanctions in the bad state and the output loss could 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.

3.4 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. In the next model the costs of default are internalized. We now turn to the case where reputation is the main motive for repayment. Reputation is modeled as an asset[5] which has a present value of R in terms of the future foreign lending which is

[5] See Verma (2000).

available to it's owner. Each time the debtor defaults, there is erosion in its value by an amount Δ and every time the debtor repays, its value increases by Δ. We shall show that the case for intervention is weakened in the presence of reputational effects. It is assumed that the lenders cannot distinguish between the strategic defaults and the liquidity defaults and can only impose sanctions with a probability β.

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 $0 \leq S \leq y$.

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

We derive the optimum value of β as

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

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 has a lesser role since reputation 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 importance of IMF's role is reduced. 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.

We conclude from this analysis that the extensive debate on "reforming the international monetary system" has failed to address an important issue. Are international debt contracts enforceable by the threat of a loss in output or gains from trade or by the loss of reputation? 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. If this is the case, the IMF can play a useful role in mitigating output losses following a financial crisis if the Fund can tailor its intervention based on information about the reasons for default.

4.1 Insurance and Output Losses

The analysis presented above is easily adapted to evaluate insurance crises. The key addition to the model is that the official sector is expected to make an unconditional loan to the debtor at the time of crisis. Since the crisis is an anticipated asset exchange in this model, when payment by the debtor plus the insurance provided by the official sector is equal to that expected amount there is a crisis but no default. As in the models discussed above, payments plus insurance that are less than expected could be due to bad luck or strategic behavior. It follows that creditors must have some threat to insure that both debtors and the official sector do not choose strategic default. We assume the threat is "built in" to international debt contracts by making contracts difficult to renegotiate. Moreover, we assume that unresolved conflict between debtors and creditors is a tax on domestic financial intermediation in the debtor country. In this context intervention by a third party to mitigate the costs of renegotiation following bad luck defaults may be important for the reasons discussed in the previous section. But the part of the intervention that matters is only the unexpected component.

Our understanding of the real effects of financial crises is quite limited. In a series of important papers Calvo (1998) and Calvo and Reinhart (2000) 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 equilibria. 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 equilibria 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.

The insurance model presented in Dooley (2000a) 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 framework suggests quite different implications for policy.

Our analysis also suggests that a decline in output is related to the magnitude of the real transfer associated with crises. 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 insurance unless the debtor government and the official lender have strong incentives to make payments to creditors at the time of the crisis. The model explored in Dooley (2000b) 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. 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.

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 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 anticipated *crisis* also was an unanticipated *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, forecast errors for 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. But 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 unpredictable real effects.

4.2 The Initial Decline in Output.

The loss in output following default reflects 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 (Cespedes et al. 2000). Table 1 shows a simple regression of the loss in output in the year following the crisis and the swing in the current account in the year before the crisis and the year following the crisis. The results provide a solid baseline in that the real adjustment in the external balance generates a severe initial downturn in economic activity. From here we can evaluate the additional effects that might be associated with financial variables and default.

4.3 Output and Default

To test the idea that 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 a 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, that is the demand for insurance, is that the government will determine which assets are to be protected at the time of the exchange. This will, in turn, reflect the ability of different classes of creditors 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 seniority for exchange.

Different types of external liabilities have had clearly different returns preceding crises and this makes our story plausible. 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 2 provide some support for the model. Each category of external debt can be interpreted as a demand for insurance. As anticipated, portfolio investment seems to be insured relative to equity and direct investment. However, the negative relationship between short-term claims and the demand for insurance is clearly inconsistent with the model.

4.4 Supply of Insurance

The anticipated stock of insurance, however, is quite difficult to measure directly. While the stocks 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. Dooley (1995) argues 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. Our working hypothesis is that the expected package in 1982 was 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.

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 3 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 3 suggest that the GDP of the debtor country is by far the dominant determinant of the size of rescue packages.

4.5 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 t_0. Our theory suggests that at t_0 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 a larger initial decline in output and a relatively slow recovery following a crisis that involves default relative to a crisis where insurance is equal to or greater than its expected value.

The regression in Table 4 is the same as in Table 1 except that the insurance forecast error is added. As discussed above, the swing in the current account is the most important determinant of the initial decline in output. But the forecast error for insurance is also positively correlated with the output loss. The regression coefficient is small relative to its standard error, but given the difficulty in measuring the demand for and supply of insurance it may not be surprising that this relationship is not precisely estimated.

Table 5 reports the results for a regression of cumulative output losses against the swing in the current account and the forecast errors for insurance. The swing in the current account loses much of its explanatory power, a result consistent with the idea that for a given transfer quick adjustment probably shortens the duration of the output loss. In contrast the insurance forecast error is little changed, it remains positive but small relative to its standard error.

5 Concluding Remarks

Financial crises have important real costs and identifying policies that could reduce these costs is a priority. In this paper we argue that predictions for the effects of third party interventions are quite sensitive to models of sovereign debt. In particular, if concern about strategic default is central to the design of international debt contracts, and we cannot imagine that it is not, intervention by the official sector in negotiations between sovereign debtors and their private creditors is problematic. Our analysis suggests that anticipated and unconditional lending at the time of crisis is rational to avoid the costs of default that are built into contracts. But the expectation that insurance will be provided subsidizes capital inflows that precede crises and, in turn, intensifies the current account reversals and output losses that follow. Moreover, uncertainty about the size and distribution of insurance can generate unpredictable defaults that intensify and prolong losses in output.

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Table 1

OLS regression for initial severity of crisis

Dependent Variable: output cost for the first year following crisis (difference from potential output).

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

Table 2

OLS regression for demand for insurance

Dependent Variable: rescue package following crisis

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

Table 3

OLS regression for supply of 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 4

OLS regression for initial severity of crisis

Dependent Variable: output cost for first year following crisis

Variables	Coefficients (t statistics)
Constant	-6.79** (-2.62)
80s crises dummy	0.87 (0.32)
Reversal of current account	-56.91** (-2.28)
Forecast error	1.33 (0.42)
Number of observations	16
Adjusted R^2	0.16
F – test for combined significance (probability)	0.18

Table 5

OLS regression for prolonged cost of crisis

Dependent Variable: output cost for four years following crisis

Variables	Coefficients (t statistics)
Constant	0.78 (1.37)
80s crises dummy	0.25 (0.49)
Forecast error	0.36 (0.72)
Reversal of current account	0.25 (0.06)
Number of observations	12
Adjusted R^2	0.07
F – test for combined significance (probability)	0.88