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# Rescue Packages and Output Losses Following Crises

Michael P. Dooley and Sujata Verma

## 5.1 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 limit the damage that follows financial crises by reassuring private investors, stopping runs, and limiting 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. Although 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.

The intuition behind doubts about the effectiveness of rescue packages is the possibility that output losses are built into international credit arrangements in order to preclude strategic default by debtor governments (Dooley 2000a). In our view, the mechanism that generates the loss in output is the inability of residents of the debtor to engage in domestic financial in-

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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, Ghai, and Haldane (2000); Gavin and Powell (2000); and Ghai, Hayes, and Shin (2001).

termediation while foreign debt is renegotiated. Moreover, international credits are *designed* so that creditors will find it difficult to coordinate debt restructuring following default.[2] The important implication is that coordination problems among creditors are the *feature* of the international monetary system that makes international lending possible.[3]

In a first best world, creditors would be happy to "switch off" the coordination problem if it was clear that default was unavoidable and independent of the debtor's behavior. Following a "bad luck" default, a long recession in the debtor country is clearly not in creditors' collective interest. However, we cannot imagine a contractual mechanism that would accomplish this that does not also eliminate the credibility of creditors' threats to impose the penalty following a strategic default. Following strategic default, a long recession in the debtor country is also not in creditors' interests. If creditors could switch off the coordination problem they would be left, following strategic default, with the threat of shooting themselves in the foot. The unhappy result is that creditors need to commit to punish even though the punishment benefits no one.

Can official lending mitigate this market failure? In the next section we show that this depends on the official sector's ability to act predictably and to commit not to rescue following strategic default. Although it is quite easy to set out a regime for official intervention that moves us toward a first best equilibrium, we have serious doubts that official lenders can, in practice, establish such a regime.

In the final section we evaluate rescue packages in the context of an explicit model of crises. We argue that the insurance model developed in Dooley (2000b) is an attractive vehicle for the analysis because it provides an explanation for surges in capital inflows followed by sudden stops. The model also provides a useful distinction between *crisis* and *default*. A *crisis* in this model is an anticipated asset exchange that generates a transfer from the official sector to the private sector. A *default* is a transfer that is smaller than expected.

As in all first-generation crisis models, a perfect-foresight assumption implies that default would never be observed because the crisis occurs at the point when the official sector's assets are just exhausted. Clearly there is no need to restructure remaining debt.

Uncertainty about the size of the insurance pool (bad luck) or the debtor's willingness to draw on and exhaust the pool (strategy) introduces the possibility of default. Default occurs when the expected value of the transfer exceeds the realized value at the time of crisis. In this event, some creditors that expect to be rescued are not, and debt must be renegotiated.

2. For an excellent analysis of the legal constraints on debt restructuring see Buchhiet and Lee (2001).

3. Diamond and Rajan (2000) use a similar argument to explain the role of short-term debt in sovereign crises.

The intriguing implication is that bad luck includes not only events such as crop failures that reduce the debtor country's ability to pay but also political events that affect the debtor country's access to, or willingness to draw upon, official rescue packages. Larger rescue packages almost certainly imply larger forecast errors for rescue packages and, in turn, larger average output losses following crises. Moreover, because output losses are related to forecast errors, losses should be unrelated to fundamentals prior to the crisis. Predictable crises generate unpredictable costs.

### 5.2.1 Sovereign Debt Models, Output Loss, and Third-Party Intervention

Bolten 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, in which the debtor is unable to pay, and strategic defaults, in which the borrower is able but unwilling to pay. Unless there is some penalty for default, like seizure of the borrower's assets, 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, because, unlike a corporate debtor, countries are always solvent. However, we assume that a sovereign's power to tax is limited, so a solvent country can have an insolvent government. In this environment, bad luck and strategic defaults are possible. Moreover, creditors' fear of cheating on the part of 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, by making contracts costly to renegotiate, lenders can discourage strategic default.

Consider 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 it needs 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), because the initial wealth is assumed to be zero. In the good state, the debtor may pay out zero (strategic default) or repay the amount specified in the contract denoted by $R_x$.

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, negotiations between the creditors and the debtor begin. We assume that structure of the debt determines the expected outcome of this negotiation. A rigid debt structure means that negotiations fail with a high probability, $\beta$. A flexible debt structure means that negotiation succeeds with a high probability and the debtor agrees to pay to the creditor $\alpha y$. For simplicity it is assumed that $\alpha = 1/2$.[4]

### 5.2.2 Design of Contracts

An optimal debt contract is defined as one that balances two effects—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:

> Debtor has to pay $R_x$ ($R_x < x$) when the return is $x$ in period 1; otherwise, there is renegotiation. These renegotiations are successful with probability $(1 - \beta)$ and result in the creditor's allowing a partial rollover of debt into the second period. When the return is 0 in period 1, the probability of a successful renegotiation is given by $1 - \beta_0$.

In period 1, the state of the world is determined. With probability $\theta$, good state occurs and the project return is $x$. With possibility $1 - \theta$, bad state occurs and 0 return is realized. The debtor moves next by deciding whether to repay or to default. In the case of a bad return, liquidity default is certain (because we have assumed zero initial wealth). In the case of a good return, the debtor may repay $R_x$ 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, third-period output is zero. The probability that renegotiation will fail can differ for the strategic default branch of the game and the liquidity default branch if there is full information.

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

$$\theta(x + y - R_x) + (1 - \theta)(1 - \beta_0)\frac{y}{2} \tag{1}$$

The lenders' expected profits must be nonnegative (assume the market interest rate is zero):

$$\theta R_x + (1 - \theta)(1 - \beta_0)\frac{y}{2} - K \geq 0 \tag{2}$$

4. Endogenizing $\alpha$ does not 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.

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

$$\beta\frac{y}{2} \geq R_x. \tag{3}$$

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

$$\beta_0 = 0 \quad \text{or} \quad 1 - \beta_0 = 1 \tag{4}$$

It can be shown that optimal value of $\beta_0$ is zero. This implies that renegotiation is always successful in the bad state of nature.

The debtor's expected payoff could be written as

$$\theta(x + y) - K \tag{5}$$

This represents the first best solution in terms of net present value of the project.

### 5.2.3 Incomplete Contracts

Because of incomplete information, lenders may not be able to distinguish between a strategic default and a liquidity default.

The contract may be specified as

> Debtor has to pay $R_x$ in period 1; otherwise, there is renegotiation. These renegotiations are successful with probability $(1 - \beta)$ and result in the creditors' allowing a partial rollover of debt into the second period. Alternatively, the renegotiations fail with probability $\beta$, and third-period output is reduced to zero.

Given this contract, the debtor's expected payoff is given by

$$\theta(x + y + R_x) + (1 - \theta)(1 - \beta)\frac{y}{2} \tag{1b}$$

The lenders' expected profits should be nonnegative:

$$\theta R_x + (1 - \theta)(1 - \beta)\frac{y}{2} - K \geq 0 \tag{2b}$$

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

$$x + y - R_x \geq x + (1 - \beta)\frac{y}{2} \tag{3b}$$

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

The results may be summarized as follows: Value of optimum $\beta$ is given by

$$\beta = \frac{K - \frac{y}{2}}{\theta y - \frac{y}{2}}, \tag{4b}$$

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

The debtor's expected payoff could be written as

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

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 (1996), from equation (5b) it can be seen that an arbitrary probability of a failed renegotiation, $\beta$, is preferable over designing a contract for which renegotiation always fails. The higher the probability of success of renegotiation, the lower are the expected efficiency losses.

Can rescue packages ensure a first best equilibrium? This is the question we explore in the next section.

### 5.2.4 A Model of Bargaining with Three Players: Debtors, Creditors, and the International Monetary Fund

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 debtor's behavior so that the debtor would not prefer to default strategically. Any such contract will have a bias toward unnecessary losses. 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. 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.

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, the debtor earns a return of $y$ in the second period. If there is default, the borrower and lender may approach the IMF for resolution, which succeeds with probability $\pi$. It is assumed that the International Monetary Fund (IMF) also cannot distinguish between strategic and liquidity defaults.[5] When the

5. Ghai, Hayes, and Shin (2001) assume that the IMF has a signal (not necessarily correct) about the nature of default, but not the lender.

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 imposes a successful restructuring by buying the debt for $y/2$ and allows the debtor to retain $y/2$. Thus it has enforced a fair distribution of third-period output. If the IMF does not intervene, or if its intervention is unsuccessful, with the probability $1 - \pi$, then the renegotiation, as usual, fails with probability $\beta$.

Given this contract, the debtor's expected payoff is given by

$$\theta(x + y - R_x) + (1 - \theta)\left[\pi\frac{y}{2} + (1 - \pi)(1 - \beta)\frac{y}{2}\right] \tag{1c}$$

The lenders' expected profits should be nonnegative:

$$\theta R_x + (1 - \theta)\left[\pi\frac{y}{2} + (1 - \pi)(1 - \beta)\frac{y}{2}\right] - K \geq 0 \tag{2c}$$

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

$$x + y - R_x \geq x + \pi\frac{y}{2} + (1 - \pi)\left[(1 - \beta)\frac{y}{2}\right] \tag{3c}$$

The optimal contract maximizes equation (1c) subject to equations (2c) and (3c).

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

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

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

The debtor's expected payoff is

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

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 only if $\beta$ was not set at its optimal level.

If the IMF has information about the state of nature superior to that of the creditor, rescue packages are always welfare improving. It is easy to demonstrate in terms of the first model that if the IMF could distinguish between strategic and liquidity defaults then the first best solution could be easily reached. The incentive to default strategically would be reduced if the true nature of the debtor were revealed. There would be no sanctions in the bad state and the output loss would be eliminated.

### 5.3.1 Output Losses and Rescue Packages

We start our analysis of output losses with our understanding of the conventional wisdom. 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.

Calvo and Reinhardt, and many others, argue that financial crises in the 1990s are best understood in the context of 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 this section we develop quite a different model of crises.

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, Ghai, and Haldane (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 (2000b) 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. However, the reversal is not triggered by a change in expectations. Observed crises are anticipated asset exchanges designed to exploit government insurance.

The insurance/sovereign risk framework has two potential advantages over second-generation 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. However, although 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 cap-

ital inflows and anticipated reversals is 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 that 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 Reinhart. However, 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 patterns and intensities of output losses that have followed crises. The initial downturns in economic activity following recent crises in Asia have been quite similar. However, the cumulative loss in output has been, and is projected to be, much larger in Indonesia than in Korea. Moreover, the duration and cumulative size of output losses following the 1982 debt crisis were much larger than those of recent crises in Asia.

In our model the duration of recession depends on whether or not the anticipated *crisis* was also 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 important sources of insurance, forecast errors for their intervention at the time of crisis are crucial in determining whether 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. However, 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. Because this is a forecast error, it is unpredictable and is likely to have unpredictable real effects.

### 5.3.2 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. Because the government will often decide to devalue in order 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 (Cespédes, Chang, and Velasco 2000). Table 5.1 shows a simple regression of the loss in output

**Table 5.1 OLS Regression for Initial Severity of Crisis**

| Variable | Coefficient |
|---|---|
| Constant | –7.12*** |
| | (–2.92) |
| 1980s crises dummy | 1.13 |
| | (0.50) |
| Reversal of current account | –52.55** |
| | (2.69) |
| *N* | 20 |
| Adjusted $R^2$ | 0.19 |
| *F*-test for combined significance (probability) | 0.07 |

*Note:* Dependent variable: output cost for the first year following crisis (difference from potential output).Numbers in parentheses are standard deviations.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

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.

### 5.3.3 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 at which crises have been observed. We have quite a small set of observations of crises that might be useful in evaluating these conjectures. Unlike other empirical work on crises, ours has a single variable, a quite clear measure of when a crisis occurs, and a 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. Because 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 antici-

**Table 5.2 OLS Regression for Demand for Insurance**

| Variable | Coefficient |
|---|---|
| Constant | –894.50 |
| | (–0.12) |
| 1980s crises dummy | 3,605.46 |
| | (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) |
| *N* | 19 |
| Adjusted $R^2$ | 0.75 |
| *F*-test for combined significance (probability) | 0.00 |

*Note:* Dependent variable: rescue package following crisis.
*Significant at the 10 percent level.

pated, 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 nineteen crises against the stock and composition of external debt outstanding at that time. The results, reported in table 5.2, 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.

### 5.3.4 Supply of Insurance

The anticipated stock of insurance, however, is quite difficult to measure directly. Although 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 interna-

tional 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 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 because 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. Thus, 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 5.3 reports the results of a regression of measured insurance pools previously discussed 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 twenty-six observations, alternative approaches are not feasible. The results reported in table 5.3 suggest that the gross domestic product (GDP) of the debtor country is by far the dominant determinant of the size of rescue packages.

### 5.3.5 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

**Table 5.3 OLS Regression for Supply of Insurance**

| Variable | Coefficient |
|---|---|
| Constant | 15,879.69* |
| | (1.90) |
| 1980s crises dummy | –14,662.71 |
| | (–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) |
| $N$ | 26 |
| Adjusted $R^2$ | 0.73 |
| $F$-test for combined significance (probability) | 0.00 |

*Note:* Dependent variable: rescue package following crisis (RESCUE2).
***Significant at the 1 percent level.
*Significant at the 10 percent level.

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. However, 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. Because we do not know which relationship is more likely to be correct, we take the sum of the supply and demand error as our measure of default.

Our model suggests that, other things being 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 in which insurance is equal to or greater than its expected value.

The regression in table 5.4 is the same as in table 5.1 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. However, 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 5.4 OLS Regression for Initial Severity of Crisis**

| Variable | Coefficient |
|---|---|
| Constant | –6.79** |
| | (–2.62) |
| 1980s crises dummy | 0.87 |
| | (0.32) |
| Reversal of current account | –56.91** |
| | (–2.28) |
| Forecast error | 1.33 |
| | (0.42) |
| *N* | 16 |
| Adjusted $R^2$ | 0.16 |
| *F*-test for combined significance (probability) | 0.18 |

*Note:* Dependent variable: output cost for first year following crisis. Numbers in parentheses are *t*-statistics.

**Significant at the 5 percent level.

**Table 5.5 OLS Regression for Prolonged Cost of Crisis**

| Variable | Coefficient |
|---|---|
| Constant | 0.78 |
| | (1.37) |
| 1980s crises dummy | 0.25 |
| | (0.49) |
| Forecast error | 0.36 |
| | (0.72) |
| Reversal of current account | 0.25 |
| | (0.06) |
| *N* | 12 |
| Adjusted $R^2$ | 0.07 |
| *F*-test for combined significance (probability) | 0.88 |

*Note:* Dependent variable: output cost for four years following crisis. Numbers in parentheses are *t*-statistics.

Table 5.5 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.

## 5.4 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. However, 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.

## Appendix

### LHS

- Output cost for first year—difference from potential output measured as the average over the 5 preceding years (source: *International Financial Statistics* [IFS]).
- Rescue package—data for 1982 debt-crisis countries is cumulative flows (Net Flows/Official Creditors) for 1982–90 from the World Bank's *World Debt Tables* 1989–90. Other data from Dooley (2000).
- Output cost for four years following crisis—cumulative output loss over the four years following the crisis as a fraction of the precrisis year's output (source: IFS).

### RHS

- Bond stocks outstanding—gross portfolio bonds (source: DRS).
- Equity—estimate of stock of portfolio equity (source: Lane and Milesi-Ferretti)
- Foreign direct investment (FDI)—estimate of stock of inward direct investment (cumulative flow adjusted for relative price variations; source: Lane and Milesi-Ferretti).
- Forecast error—the demand error minus the supply error in the rescue package estimation equations.
- Foreign exchange reserves—at precrisis year (source: IFS).
- GDP—at year of crisis (source: IFS).
- Openness—sum imports and exports over GDP (source: IFS).
- Private loans—stock (source: World Economic Organization).
- Reversal of current account—change in the current account from the precrisis year to the year following the crisis (source: IFS).
- Short-term debt—stock (source: DRS).

**Country Cases**

1982: Argentina, Bolivia, Brazil, Chile, Costa Rica, Dominican Republic, Ecuador, Jamaica, Mexico, Peru, Uruguay, Venezuela
1994: Mexico
1997: Indonesia, Korea, Malaysia, the Philippines, Thailand
1998: Argentina, Brazil, Turkey

## References

Bartolini, Leonardo, and Dixit, Avinash. 1991. Market valuation of illiquid debt and implications for conflicts among creditors. *IMF Staff Papers* 38 (4): 828–849.

Bhattacharya, Amar, and Marcus Miller. 1999. Coping with crises: Is there a silver bullet? In *The Asian financial crisis: Causes, contagion, and consequences,* ed. Pierre-Richard Agénor, Marcus Miller, and David Vines. New York: Cambridge: Cambridge University Press.

Bolten, Patrick, and David Scharfstein. 1996. Optimal debt structure and the number of creditors. *Journal of Political Economy* 104 (1): 1–25.

Buchheit, Lee C., and Mitu Gulati, G. 2000. Exit consents in sovereign bond exchanges. *UCLA Law Review* 48 (1): 59–84.

Bulow, Jeremy, and Rogoff, Kenneth. 1989. A constant recontracting model of sovereign debt. *Journal of Political Economy* 97 (February): 155–178.

Calvo, Guillermo A. 1998. Capital flows and capital-market crises: The simple economics of sudden stops. *Journal of Applied Economics* 1 (1): 35–37.

Calvo, Guillermo A., and Carmen Reinhart. 2000. When capital flows come to a sudden stop: Consequences and policy options. In *Reforming the international monetary system* ed. P. Kenen, M. Mussa and A. Swoboda, 175–201. Washington, D.C.: Brookings Institution.

Cespedes, Luis Felipe, Roberto Chang, and Andres Velasco. 2000. Balance sheets and exchange rate policies. NBER Working Paper no. W7840. Cambridge, Mass.: National Bureau of Economic Research, August.

Chari, V. V., and Patrick Kehoe. 1999. Asking the right questions about the IMF. *The Region* 13:2–26. Minneapolis, Minn.: Federal Reserve Bank of Minneapolis.

Chui, Michael, Prasanna Ghai, and Andrew Haldane. 2000. Sovereign liquidity crises: Analytics and implications for public policy. Bank of England Working Paper no. 121. London: Bank of England, September.

Diamond, Douglas W. (1989) Reputation acquisition in debt markets. *Journal of Political Economy* 97:828–841.

———. 1993. Seniority and maturity of debts. *Journal of Financial Economies* 33: 341–68.

Diamond, Douglas W., and Raghuram G. Rajan. 2000. Banks, short term debt, and financial crises: Theory, policy implications, and applications. NBER Working Paper no. W7764. Cambridge, Mass.: National Bureau of Economic Research, June.

Dooley, Michael P. 1995. A retrospective on the debt crisis. In *Exchange rate policy and interdependence,* ed. Peter Kenan, Princeton, N.J.: Princeton University Press.

———. 2000a. Can output losses following international financial crises be

avoided? NBER Working Paper no. 7531. Cambridge, Mass.: National Bureau of Economic Research, February.
———. 2000b. A model of crises in emerging markets. *The Economic Journal* 110 (460): 256–72.
Fischer, Stanley. 1999. On the need for an international lender of last resort. *Journal of Economic Perspectives* 13 (4): 85–104.
Gavin, Michael, and Andrew Powell. 2000. Should international lender of last resort (LOLR) lending be privatized? Universidad Torcuato Di Tella. Mimeo.
Ghai, Prasanna, Simon Hayes, and Hyun Song Shin. 2001. Crisis costs and debtor discipline: The efficacy of public policy in sovereign debt crisis. Bank of England Working Paper no. 136. London: Bank of England, May.
Giannini, Corzio. 1999. Enemy of none but a friend to all? An international perspective on the lender of last resort function. IMF Working Paper no. WP/99/10. Washington, D.C.: International Monetary Fund, October.
Miller, Marcus and Lei Zhang. 2000. Sovereign liquidity crises: The strategic case for a payments standstill. *Economic Journal* 110:335–62.
Rogoff, Kenneth. 1999. International institutions for reducing global financial instability. *Journal of Economic Perspectives* 13 (4): 21–42.
Sachs, Jeffrey. 1995. Do we need an international lender of last resort? Frank Graham Lecture, Princeton University. 20 April.
Verma, Sujata. 2000. The architecture of international capital markets: Theory and evidence. Ph.D. diss., University of California, Santa Cruz.

## Comment

Andrew Powell

Michael P. Dooley and Sujata Verma have written a truly fascinating paper (henceforth referred to as DV), which contains many interesting ideas and which is a valuable contribution to the spawning literature on "private-sector involvement" and the role of the private sector, governments, and the multilaterals in crises. In fact, there are really two papers. First, there is a theoretical part that outlines a role for a third party (the International Monetary Fund [IMF]) in a model with the possibility of both liquidity and strategic default. Second, there is an empirical part that attempts to test the "insurance view" of crises following Dooley (2000) and earlier papers by Calvo, Krugman, and McKinnon and Pill, among others.

The theoretical part of the paper develops a specific model of sovereign debt in which there is an information asymmetry in that if the debtor defaults the lender does not know if the default was for liquidity (ability to pay) or "strategic" (willingness to pay) reasons. The approach is taken from Bolton and Sharfstein (1999), hereafter BS. The BS approach has the tremendous advantages of simplicity and tractability, and DV achieve interesting results very quickly. However, in the application of the BS model

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to the case of sovereign debt, there do appear to be a couple of issues worth discussing.

In BS, lenders can liquidate a defaulting corporate, and there is some probability of obtaining the residual value of the firm's assets (let us refer to this probability as β). Dooley and Verma suggest that in the case of default lenders can sanction borrowers, and the residual value of the firm's assets is analogous to the market value of restructured debt. In the text, DV refer to the BS probability (β) as the restructured value of the debt (β in the latter's model). In the equations, however, they appear to use β as a probability. Perhaps they have in mind that β is the probability that debt is restructured in some way after a failed negotiation, and *S* is then the utility of that outcome, including whatever was the market level of restructured debt. With this interpretation, the $(1 - \beta)$–type terms in the equations make more sense. (These comments refer to an earlier draft, and the authors have taken up this suggestion.)

Another issue is that if borrowers are to avoid sanctions then there is some negotiation procedure, and they simply share half of the project's output with lenders ($\alpha = 1/2$), and sanctions are lifted. However, surely α is also endogenous. Suppose the failed negotiations imply a 20 percent write-down of the debt. Why would borrowers share a penny more of output than absolutely necessary to make lenders better off, given that alternative? In other words, it looks like α should be specifically linked to the write-down value of the debt. (The authors claim in footnote two that endogenizing α does not significantly alter the results. However, equation 4 shows clearly the optimum β, and hence the expected efficiency loss of equation 5b depends on α.)

These comments raise a more general issue as to whether the BS approach is really applicable in the international debt markets. The Incentive Compatibility constraint is designed to rule out "strategic defaults," but in an important sense all sovereign defaults are strategic. One view might be that default occurs when the present value of future output, net of debt repayments with a high debt level (and possibly higher interest rates), is less than that with a lower debt level achieved through a debt reduction and net of the short-run costs of that reduction due to trade or financing disruptions. A second approach can take place when revenues have fallen so much that it becomes politically more costly to continue to service the debt than to seek some type of renegotiation. These, then, are examples of strategic defaults, although they may occur when the ability to pay has also been reduced substantially.

Let me now turn to the role of the IMF. Dooley and Verma focus on one potential and hitherto ignored role of the IMF in the literature, namely, as an enforcer of contracts. In essence, in the event of default, the IMF says with probability π that the second-period output should be shared fifty-fifty. In terms of the model, this adds some extra probability to the default

state's being resolved more efficiently and hence reduces the inefficiency due to contractual incompleteness. It is interesting that there is an optimal value of $\pi$, or, in other words, it appears to be optimal for the IMF to intervene unpredictably. In a further addition to the model, the authors claim that in a world where contracts are supported by reputation contracts and not "gunboat" diplomacy, then the role of the IMF as the enforcer of contracts may be redundant.

I have one doubt regarding the basic result, which, in fact, stems from Dooley (2000)! Making the ex post resolution more efficient and in particular less costly for the borrower will surely reduce the amount of debt that can be supported in this model. In the model, rearranging the incentive constraint (eq. [3]) shows that $Rx$ must be less than something to do with the returns of the project and the inefficiencies due to contractual incompleteness. In the model it appears that $K$, $y$, and $R$ are all exogenous, but if $R$ is set such that the IC is just met, $K = R$, and $y(K)$, then it looks to me that there may be a trade-off for borrowers. On the one hand, the introduction of the IMF reduces the inefficiencies of the contractual incompleteness, but on the other hand it reduces the amount of debt and hence the potential project returns. (The authors have now taken up this suggestion and find that the credit ceiling depends on IMF intervention in an interesting way as illustrated in equation 6c.)

The IMF obviously plays multiple roles, and a second role, hinted at in the paper, is that of addressing the information asymmetry directly—in other words, considering the IMF not as a contract enforcer but as an auditor. This is the focus of a recent paper by Gay, Hayes, and Shin (2000). In this paper, there is a very similar trade-off to that just described, which is their reference to the IMF as "whistle blower" versus the IMF as "fireman." In their setup, the IMF is generally bad for lenders, because the fireman reduces the ex post cost of resolution and hence reduces the stock of debt that can be supported in equilibrium—following Dooley (2000)—and this unambiguously reduces lenders' welfare. However, for borrowers the IMF may be a net benefit, because improving the information available to lenders reduces the inefficiency of the information asymmetry, and this can outweigh the costs of the lower level of debt.

Gay, Hayes, and Shin (2000) also consider an IMF that acts unpredictably (in a manner they refer to as "case-by-case"), but in their setup they conclude that this will make lenders better off and may make borrowers worse off relative to the regime in which the IMF follows a specific policy rule. It is in effect an intermediate model between a no-IMF model and the full-IMF model. This contrasts with the DV result in which having an unpredictable IMF as enforcer may actually be the optimal policy. Of course, the IMF is doing different things in the two cases, so perhaps this is not too surprising.

The IMF clearly has other roles, too, apart from that of enforcer or auditor. Specifically, the IMF also provides money or promises of money. This role can protect borrowers against coordination problems between lenders. If the IMF offers standby arrangements, then this may prevent costly self-fulfilling-type runs. This is the approach taken by Gavin and Powell (1999). However, the price for such liquidity protection may be moral hazard, thus allowing borrowers or lenders to take greater risks, actually making more fundamental-type runs more likely. Gavin and Powell argue that private sector standbys (contingent facilities) might also provide countries with the same type of liquidity protection and that, if these are correctly priced (i.e., with no information problems), then these may even serve to reduce moral hazard.

To sum up this first part of the paper, DV provide an application of BS to the sovereign debt market and show that within that context the IMF may have an interesting role to play. Although some aspects of the model appear to sit uneasily with the sovereign nature of these markets, the result is intuitive and would probably carry over to other models of strategic default.

Let me now turn briefly to the second part of the paper. Curiously the theoretical model behind the second part of the paper does not appear to be fully consistent with that in the first part of the paper. In the first part of the paper, a crisis occurs when, with a specific probability, there is a bad outcome and debt cannot be renegotiated. In the second part of the paper, a crisis occurs when the demand for insurance just meets the supply. The source of this uncertainty is then different; it is related to how much the insurance is available.

Entering into this second framework, table 5.2 regresses the size of rescue packages on a set of variables. It is not clear how the variables are specified (everything in US$?), and the only variable that is significant is bond stocks outstanding at the time of the crisis. However, bonds outstanding might have as much to do with supply as it has to do with demand (if debt finance has been used to build up reserves, or if multilaterals care more about big countries due to contagion effects, etc.). It might be better to have the dependent variable specified as a percentage of something (gross domestic product [GDP]?) and the other variables expressed either as share variables (e.g., bonds, total liabilities, etc.) or perhaps even as growth variables. Table 5.3 has the same dependent variable, and the only variable that is significant is the GDP at the time of the crisis. Because I would suggest scaling the rescue variable by GDP, this might make this variable insignificant anyway!

However, if it remained significant, this might be interpreted as a kind of too-big-to-fail result. As the text considers issues related to the supply of government guarantees, perhaps some indicators of such things should be included, for example (a) type of deposit insurance in place, (b) the extent

of public banks, (c) historical experience in allowing banks or other companies to fail, (d) bankruptcy procedures, and so on.

The results of tables 5.4 and 5.5 appear more interesting. The forecast error of the amount of insurance is proxied by the sum of the supply and demand error from the previous regressions. This raises issues about whether coefficients may be biased and also about units. It would be better to have this error expressed as a percentage and not in US$.

To conclude, this is an interesting paper. It is really a story of two quite different and not necessarily consistent parts. I suspect that the authors could extend both, thus making a fascinating research program.

### References

Dooley, Michael P. 2000. Can output losses following international financial crises be avoided? NBER Working Paper no. 7531. Cambridge, Mass.: National Bureau of Economic Research, February.

Gavin, Michael, and Andrew Powell. 1999. Should international lender of last resort lending be privitized? Universidad Torcuato Di Tella. Mimeo.

Gay, P., S. Hayes, and H. Song Shin. 2001. Crisis costs and debtor discipline: The efficiency of public policy in sovereign debt crises. Mimeo. London School of Economics.

## Discussion Summary

*Robert P. Flood* inquired why governments end up in this insurance business. Shouldn't the IMF prevent them from providing insurance? He also noted that Michael Dooley's crisis theory is unique—different from the first- and second-generation crisis models, because in those there is no transfer.

*Morris Goldstein* noted that the IMF is able to affect negotiations between creditors and debtors: an example of that is the "lending into arrears" policy. He also remarked that the former Compensatory Financing Facility (CFF) lending window in the IMF discredits the notion that the IMF cannot differentiate between liquidity (bad luck) and strategic default.

*John McHale* asked why, in this theory, real output costs are inevitable, and what the channels are through which this loss comes about.

*Martin Feldstein* asked whether there were any examples of commercial banks' using denial of trade credits as a punishment tool.

*Andrew Berg* noted that an important class of creditors is the Paris club and that the IMF does monitor Paris club discussions between debtors and creditors.

*Edwin M. Truman* suggested that Peru in the 1980s is the closest case to strategic default. He also noted that there were gainers from the precrisis

period—for example, through overvalued exchange rate—and these should be accounted for in this output loss accounting.

*Vincent Reinhart* suggested that if the story is accurate then maybe the IMF should have no access to capital.

*Barry Eichengreen* inquired whether the theory is consistent with previous statements by Dooley that the IMF should not condition its lending on observable characteristics.

*Peter Kenen* suggested that "strategic default" is a loaded term and may be used here inaccurately. He also noted that the devaluation and the rapid loss of reserves might be channels for output loss in developing countries.

*Martin Eichenbaum* then noted that the size of the domestic insurance pool and the definition of strategic default are tied together, and it is unclear how to differentiate between them. In response, Feldstein noted that in the Asian crisis, a lot of the international debt was private, and therefore, at least theoretically, it could be a crisis of insolvency—even though the Asian governments ended up taking over these bad debts.

*Michael P. Dooley* responded that, in practice, governments cannot roll over debts using their future tax receipts as collateral, because the high interest rates they are facing at the time of the crisis will make the present value of those future taxes very small.

In response to Flood's question, Dooley noted that, historically, governments did go into insurance when there were some big institutional changes with unanticipated consequences. Liberalization, for example, meant that looting was possible, as long as there was no effective supervision. In Korea, the government did not understand how much it needed to regulate, for instance. He also stated that although the IMF can affect the balance of power in negotiations, it can only do good if it has superior information on the nature of crisis. What, uncomfortably, comes out of this theory, Dooley further suggested, is that the IMF should not get involved at all if it cannot monitor domestic financial markets. He added that governments of developing countries could not credibly commit to not bailing out once a crisis hits.

He concluded that the investors cheat the government, which gets money from the IMF to pay those investors. The workers, in turn, pay for these loans. Thus, during crises, there is a real transfer from workers (taxpayers) to investors and financial institutions.