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## Commercial Banks, Default Insurance and IMF Reforms

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### Abstract

This paper discusses, in a very general way, a system of IMF insurance against sovereign default that could be offered to private lenders and banking groups. The system could overcome many of the current issues that plague the international private lending market, such as moral hazard on the part of private lenders, capital flight, and so on. How the insurance could be priced is also discussed in an appendix. Private lender membership in the IMF is also discussed. This would provide the IMF with some of the powers that central banks now have.

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# 1 Introduction

Many economists, following the onset of the East-Asian financial crisis in 1997, have called the actions of the International Monetary Fund (IMF) into question. Some advocate restraining the ability of the IMF to affect domestic policies (Feldstein (1998), or criticize the emphasis of the IMF on domestic monetary and fiscal policies (Sachs (1997)). Others recommend scrapping the IMF altogether due to the moral hazard problems that it creates by bailing out irresponsible sovereign debtors (Schultz, Simon and Wriston (1998), Schwartz (1998)). IMF stabilization programs have come under empirical attack from Hutchison (2001). Other criticisms of the IMF during the crisis can be found in Sachs (1998) and Radelet and Sachs (1998).

Supporters of the IMF's recent programs generally argue that the crumbling economies the IMF supports would have been far worse off without the help of the IMF. They also suggest that the IMF serves an important role as a lender of last resort. Supporters here are Krugman (1998) and Fischer (1999). Others (Masson and Mussa (1997)) advocate that the IMF should increase its surveillance powers and quickly disseminate this information to all parties to prevent unexpected crises.

This paper explores changing the role of the IMF so as to prevent financial crises, rather than to respond to them only after they have done their damage. A good survey on possible reforms of the world's financial system to prevent financial crises is Rogoff (1999). This paper does not recommend some of the far-reaching reforms suggested there (capital controls or taxes, a world central bank, fixed exchange rates, etc.), rather a change in the structure of the IMF to allow private banks to become IMF members is suggested here. In exchange for membership, private lenders would be able to purchase IMF insurance for their loans to sovereign governments, with certain conditions to be discussed later in the paper. One could argue that the idea is too invasive and that it is better to let unregulated world capital markets provide the ultimate discipline on irresponsible borrowers and lenders. Carrying the argument further, it would then seem logical to eliminate domestic central banks and deposit insurance systems in favor of free banking. In this light, IMF membership does not seem as radical as it might first appear.

In the next section, we review the standard arguments against IMF participation in international capital markets, focusing primarily on moral hazard issues. In the third section, we review solutions to the problem that have suggested various types of securities. In the fourth section, we outline quite generally how a system of IMF offered insurance on sovereign loans could work. The final section concludes by discussing the merits of requiring private banking groups who lend to sovereign borrowers to be members of the IMF.

## 2 Arguments against IMF participation

Moral hazard is the leading argument against IMF participation in sovereign loans. Believing that the IMF stands ready to provide funds to the sovereign in the event of a crisis, private lenders choose excessively risky investments that they would not otherwise make. Private loans are essentially leveraged against downside risk. This will cause interest spreads above LIBOR to become quite high, perhaps bringing on the crisis. Credit rationing is a distinct possibility since the spread may have to rise beyond the comfort level of lenders to reflect the increased risk (Stiglitz and Weiss (1981)). Mussa (2001) makes a convincing argument that the moral hazard argument of official financing is greatly exaggerated. First, official financing is usually only a small proportion of the necessary current account adjustments needed in the duration of a crisis<sup>1</sup>. It is up to the sovereign to absorb the majority of the painful adjustments needed. In addition, the measure of moral hazard is usually the amount of official financing needed in a crisis. This is incorrect for two reasons. First, the official financing must be repaid by the sovereign hence it is not a subsidy, as often thought. Second, the deadweight loss introduced by moral hazard is smaller the more competitive the private lending market, and is likely very small in the case of sovereign loans. Finally, private lenders have absorbed significant losses even with official participation<sup>2</sup>. Official financing is not a guarantee of zero loan losses.

## 3 Approaches using securities

Some have argued that the apparent moral hazard problem created by IMF participation in sovereign lending markets can be remedied by changing the characteristics of loan contracts<sup>3</sup>. Essentially a loan contract is a form of a security. A literature has grown that recommends solving the moral hazard problem by offering varying types of securities. Some of these are well known and have been put into practice with limited success. Debt-equity swaps in the early eighties, and exit bonds or Brady bonds in the early nineties were attempts at developing new securities to alleviate debt problems. More recently, Buiter and Siebert (1999) have suggested an automatic rollover clause, with an attached fee to the sovereign, be written into loan contracts (called a UDROP by the authors). Miller and Zhang (2000) suggest allowing official institutions to sanction a payment standstill as an option clause in loan contracts. This would allow the sovereign to weather a temporary period of payments difficulties without going into formal default. Dornbusch (2001) dispenses with securities and advocates that countries prone to crises adopt a currency board or dollarize.

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<sup>1</sup>The five Asian crisis countries required a total current adjustment of \$122 billion over 1996-98. Official disbursements to the five countries amounted to \$51 billion.

<sup>2</sup>Over the 1997-2000 period, private bank losses on international loans have been estimated at \$60 billion (Eichengreen and Ruhl (2001)).

<sup>3</sup>The emphasis in this paper is on syndicated loans. Eichengreen and Ruhl (2001) consider the problems with IMF participation in sovereign bond markets.

Since most sovereign syndicated loans are already denominated in US dollars, this measure would have no effect on the stock of debt or debt service payments. The resulting reduction in currency risk may lower the market interest spread to the sovereign, however this is an empirical issue. Moral hazard, if it exists, may not be affected at all. The arguments to reform the IMF found later in this paper do not rely on the existence of moral hazard.

An optimal debt security would have to satisfy a number of conditions<sup>4</sup>. First, it would have to contain a rollover clause at a low cost to all parties (Eichengreen and Ruhl (2001)). This would make the IMF threat of non-participation in a default credible. Second, and contrary to the first condition, there would have to be some significant default cost to the borrower and lender in order to avoid the moral hazard problem. Third, it may have to contain a majority vote clause for rollover to prevent a single or small group of creditors from pursuing costly legal action in the hopes of gaining contracted terms at low cost. Whatever clauses concerning default and rollover the contract would contain, they would have to apply automatically. Finally, the security must facilitate the smooth operation of credit markets and maintain and encourage access for countries at a low stage of development.

Whether such a “super security” or set of complimentary securities exists that satisfies these conditions is difficult to assess. Certainly commercial banks and private financial institutions have been very adept at creating new types of securities and derivatives in equity markets, in response to profitable opportunities. This does not seem to be the case in sovereign debt markets, perhaps because such a set of securities or derivatives does not exist. If they did, they would be in use. The problem might be that the existence of the IMF does not necessitate such a security since the IMF always stands ready to provide funds at very low cost in the event of a default. This is the position we take in this paper.

Carrying through on the Baker and Brady initiatives, debt and debt service rescheduling (DDSR) agreements were largely successful in reducing the long-term debt stocks of some developing countries. Under a DDSR agreement, a debt-ridden sovereign is allowed to buy back a significant portion of its long-term debt at a market price that is far below the face value of the debt. The scheme usually requires the sovereign to use a combination of domestic financing and new international financing (typically provided by the IMF, the World Bank or the International Development Agency (IDA)) to finance the purchase, with U.S. Treasury bills that mature on the same date as the new financing to provide collateral. DDSR's conducted through the IDA reduced debt stocks of developing countries by approximately \$4.12 billion by the end of 2001<sup>5</sup>. More recently, debt swaps have been the instrument of choice to reduce long-term debt stocks. Short and medium-term bonds are exchanged for new long-term bonds, typically with five to fifteen year maturities and five-year grace periods where no interest is paid. Argentina carried out one of the largest debt swaps

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<sup>4</sup>These are not intended to be exhaustive, but are intended to cover the broad points.

<sup>5</sup>Source: Global Development Finance 2002, Washington: The World Bank, Appendix Table 2.1.

in history in June of 2002 by exchanging \$29.5 billion of domestic and external bonds for \$30.4 billion of new securities.

Lerrick and Meltzer (2003) propose that the IMF should stand ready to provide a cash support bid during the restructuring phase of a DDSR. This would guarantee a minimum price that the sovereign could receive for its debt in order to purchase the debt from its private creditors. The plan would insure a healthy market for the defaulted debt and prevent panic and contagion effects. To qualify for the scheme, the sovereign would be required to declare default on its debts. We agree with the need for a long-term debt reduction strategy to insure the solvency of debt-ridden LDCs, however debt reduction schemes are too slow to react to sudden financial crises. The problem is getting private creditors to agree to a significant write-down of their loan portfolios, particularly if the crisis is viewed as a temporary liquidity crisis by lenders. In addition, declaring outright default is a rare occurrence in sovereign lending markets and can result in being cutoff from future private financing. Sovereign borrowers may be reluctant to declare default if the crisis is a temporary one.

## 4 Insurance, who pays, and the premium

An insurance program has been suggested by Soros (1998) who argues that sovereign debtors purchase insurance from the IMF, or some new international debt institution, which pays out in the event of default. Babbel (1996) suggested that private markets should develop options contracts on sovereign debt to allow private lenders to hedge against default risk. Private financial markets have been reluctant to do this.

This paper suggests that private lenders, rather than the sovereign debtor, purchase the insurance from the IMF for several reasons. First, while sovereign debtors do not pay formal insurance premiums currently, they suffer tremendous costs in the event of an IMF intervention in the form of conditionality arrangements attached to bailouts. These usually take the form of tax increases, spending reductions, restrictive monetary policies, trade liberalization, floating exchange rates, and recently in South-East Asia, banking reforms. The intentions of such conditions are to strengthen and correct the sovereign's balance of payments and economy. Empirical studies suggest that there are success stories (Eke and Kutan (2005)), but also many failures (Edwards (2005)). After all this, the sovereign still owes the IMF the money. Second, the required payment of an insurance premium by the sovereign could lead to market failure. Higher risk debtors would be required to pay higher premiums, which may contribute to the eventual onset of a default. Low risk debtors may object to paying an insurance premium. The only debtors willing to pay the premium would be those debtors most likely to need the insurance. Insurance could not be offered profitably. Finally, the IMF currently provides bailouts without any insurance premium, so why would sovereign debtors be willing to pay a premium? As Rogoff (1999) points out, the promise not to bail out uninsured loans may not be credible. The system suggested in this paper formalizes the London Club

mechanism of bringing the sovereign borrower and private lender together to negotiate a new arrangement with IMF intermediation.

The price of IMF insurance, the insurance premium, could be deduced using the standard theory of options pricing. Insurance purchased by the banking group can be thought of as a European put option<sup>6</sup> which gives the holder the right to sell the loan to the IMF in the event that the sovereign defaults at the terminal date of the insurance contract. An annual insurance contract could be offered to the banking group for loans that have not yet matured. A simple formula for the premium is derived in the appendix to this paper. The premium per dollar of loan would be increasing in the loan rate and the percentage of IMF coverage and decreasing in the size of the deductible the banking group would assume. The deductible would be necessary to discourage moral hazard behavior on the part of the lender<sup>7</sup>. Ideally in a competitive lending market, the premium (option value) would just equal the normal risk spread above LIBOR since any risk to the private lender is eliminated through the insurance. A positive deductible would lower the premium. The insurance premium would fall as the loan contract approached maturity since less principal and interest is owing.

Alternatively, the insurance premium could be modelled as an American put option which can be exercised at any time during the course of the loan contract. This would require only one premium payment when the loan contract is signed. We ignore this case since most insurance contracts are not structured this way.

## 5 Insurance and commercial bank membership in the IMF

This section outlines how a system of commercial bank membership in the IMF could work. The discussion is purposely broad – it does not consider the internal structure of the IMF or its system of procedures. Not all commercial banks would be required to join the IMF in order to qualify for insurance. Only the lead bank in each banking group need join, or perhaps a majority of the banks putting up the largest shares of the loan package. Cross-default clauses insure that if the sovereign defaults to the one bank in the group, it automatically defaults to all banks in the group and the insurance pays out.

As the appendix shows, requiring private lenders to purchase IMF insurance would not leave any profit for them. To provide insurance, the IMF or the sovereign borrower must provide some sort of additional payment to the lender in the event of default, beyond the insurance payment of principle and interest owed. If a deductible is applied to the lender, the additional payment must be even larger. A number of solutions are possible. First, the IMF could simply

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<sup>6</sup> A European option cannot be sold in secondary markets before it matures. An American option can be resold.

<sup>7</sup> The simple analogy is throwing a rock through your own window if you own house insurance if you would like a new window. In our case, moral hazard is investing in excessively risky loans in order to earn potentially high returns.

sell the insurance (the put option) below its option value. The discount applied to the price of the insurance could be determined by the past lending behavior of the private lender, the perceived credibility of the sovereign borrower, and perhaps, the asset position of the lender. This could also depend upon the financial resources available to the IMF at the time. Second, the sovereign borrower could make a minimum co-payment to the private lender in the event of default, which is far less than the contracted amount owed, but nevertheless large enough to induce the lender to buy insurance. This “seizable collateral” could take the form of reserves, equity or bonds<sup>8</sup>.

A more complex solution would require private lenders to maintain reserves with the IMF, just as official creditors do. The IMF could then invest the reserves to earn a rate of return above LIBOR, and share the proceeds with the private lenders. Profits from insurance premiums could also be used to pay a return on reserves. The rate paid on reserves could be set by the IMF to achieve the same purposes as a bank rate paid by a domestic central bank and need not be at or above LIBOR. The combination of the reserve rate and the payout on IMF insurance effectively raises the rate of return to IMF membership above LIBOR in the event of default. It would require some careful managing by the IMF, but it would give the IMF a portion of the powers of a central bank that it seems to desire. By manipulating the reserve rate, employing drawdowns and redeposits, and other central bank type measures, the IMF could exert a discipline upon private lenders to discourage moral hazard and guide capital flows that it now lacks, and at the same time, make it profitable for private lenders to buy IMF insurance through put options. It would have to be worked out to what extent IMF operations would interfere or compliment domestic central bank operations.

There is a possibility that non-IMF private lenders could free ride on private lenders who have paid for IMF membership. In the event of default, a sovereign borrower still owes the remaining debt service to the IMF, with the private lender exercising the put option and leaving the arrangement. If the IMF offers concessional terms or an extension of the maturity to the sovereign borrower, non-IMF lenders benefit since the likelihood of non-payment to them is reduced. If this free riding is pervasive enough, the market for IMF membership and insurance might collapse. One possible solution is to require the sovereign borrower to recognize the preferred status of IMF member loans. Non-IMF member lenders would have secondary status as creditors in the event of default. If the sovereign could be convinced to deal with IMF member banks first, only the capital loans of lower productivity and return will remain for non-IMF banks.

Moral hazard has often been linked with the causes of financial crisis in the last two decades (Rogoff (1999)). Private lenders have, in some cases, effectively received IMF insurance payments at no cost to them. The bailouts in Mexico, Indonesia, Thailand, Korea and Russia are good examples. The Mexican crisis in 1995 saw the approval of a \$17.8 billion IMF package. The outbreak of

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<sup>8</sup>This option is distasteful as it smacks of corruption.



the Asian financial crisis in 1998 saw the IMF approve a \$20.9 billion package for Korea, \$11.2 billion to Indonesia and \$4 billion to Thailand. In August of 1998, the IMF approved an \$11.2 billion loan to Russia, which augmented a \$9.2 billion loan given in 1996. The argument is that the presence of imminent partial or full insurance by the IMF (and other official institutions) promotes irresponsible lending by private lenders who search for the highest investment return with only limited downside risk.

Moral hazard is not likely with private lenders being IMF members. In order to buy IMF insurance, the loan portfolios of private members could be heavily scrutinized by IMF officials. Any indication of irresponsible lending could be punished by withdrawing IMF insurance with no hope of IMF assistance in the event of default. All parties would be aware of the IMF policy and could only violate it at risk of future IMF punishment. Punishment could also take the form of reserve manipulation by the IMF if members were required to hold reserves with the IMF.

The combination of IMF membership, insurance, reserve requirements for private members and preferred status of IMF-member private lenders, sets a more global framework for the IMF than current IMF practice of micro-managing crises. The end result for the IMF-sovereign borrower relationship is little changed from current practice. In the event of default, the IMF currently provides financial assistance to the borrower, usually as a large proportion of the amount in arrears. The sovereign borrower then works out a payment schedule with the IMF and tries to negotiate with its private creditors. A large portion of the IMF funds makes it back to the private lenders to alleviate debt service difficulties. This system leaves open the possibility of corruption and just how much of the arrears are actually alleviated in the long run. Recent evidence has shown that a large portion of IMF assistance to Russia since 1998 has illegally made its way out of Russia to the accounts of unscrupulous individuals. The proposed system above insures that all IMF monies reach private creditors so that private arrears are fully eliminated. Of course, the sovereign still must work out a repayment schedule with the IMF, but this could be at concessional terms.

How well would IMF membership satisfy the conditions for an optimal private security outlined in the first part of the paper? The rollover clause is automatically built into an insurance system. The lender is paid off at zero cost (less the deductible) and the IMF assumes the loan. The sovereign must still pay the IMF, but at agreeable terms. IMF loans are almost always paid off on time currently, so this should not change. Moral hazard would be avoided since all banking group loans would require the IMF seal of approval before qualifying for IMF insurance. The requirement of a deductible on the insurance payout would also discourage IMF member banks from unscrupulous loan activities. Moral hazard could still be a problem with non-IMF banks, but these may be small in both size and number. Costly legal action by a minority of banks in the banking group would be impossible since the insurance payout is automatic without legal recourse. Finally, the insurance system would lower loan spreads

to near zero and discourage credit rationing<sup>9</sup>, facilitating the smooth operation of international loan markets.

These reforms would not reduce the moral hazard problem on the part of sovereign borrowers below what it is in the currently existing system. In the event of a default, the IMF pays off the insurance contract and receives the loan contract. It must then set up a loan rescheduling, possibly with conditions, in order to recover its loss. This is not much different from the current system in which the IMF loans funds to the sovereign borrower in order to meet its immediate principal and interest payments. The only difference is that a step in the transfer of funds is eliminated (sovereign borrower to private lender). The IMF insurance then serves to internalize a positive externality: the seemingly free bailouts that private lenders do not pay for in the current system. This should lead to a more efficient level of lending and allocation of world capital.

The system outlined here does not suggest a return to a fixed exchange rate system, commodity standard or other Bretton Woods type policies that interfere with the ability of domestic governments to manage their own economies. A system of IMF insurance has many benefits and few costs, beyond startup costs. Moral hazard on the part of private lenders, if it exists, would be eliminated in the sovereign syndicated loan market. Interest spreads above LIBOR would fall reflecting greater confidence and stability in the system. Credit rationing may disappear. Poor countries in desperate need of financial assistance to meet crises and to develop would have more ready access to credit markets. Contagion might be short-circuited. Many positive spin-offs might result from the system.

## 6 Appendix: The Price of IMF Insurance

Loan insurance can be treated as a put option purchased by the private lender from the IMF. If the loan turns out to be non-performing in the future, the IMF pays out the insurance by purchasing the loan from the lender. If the loan turns out to be a healthy one, the option is not exercised. The price of the put option can be computed in a straightforward manner using a simple one-period model. The model does not provide an accurate option price, but does provide general results. For the case of a European option, default can occur only at end of the first period of the option contract, hence the put option has a maturity of one period. So the full insurance coverage requires the purchase of a series of one-period European put options until the loan contract matures.

The private lender agrees to lend  $L$  dollars to the sovereign at the start of period one, with repayment being made over  $T$  years using straight interest. The contracted competitive loan rate is  $\rho$ . At the end of period one, the loan can return two possible values:  $((1+\rho)L/T)$ , the contracted principal plus interest owing, or  $\bar{\gamma}(1+\rho)L$ , if the IMF optimal value for the subsidy,  $\gamma$ , is greater than or equal to its upper bound  $\bar{\gamma}$ . For any  $0 < \gamma < \bar{\gamma} < 1$ , the IMF covers the shortfall

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<sup>9</sup>Easton and Rockerbie (2006) show that the higher the proportion of the loan covered by the IMF insurance, the lower the loan spread and the more elastic the loan supply curve.

in the loan so that the private lender still receives  $(1+\rho)L$ . If  $\gamma \geq \bar{\gamma}$ , the lender only gets  $\bar{\gamma}(1+\rho)L$ , since the IMF does not subsidize any further.

If the option is not exercised at the end of period one (the good state), it is discarded, and a new option contract is purchased at the start of period two. At the end of period two, the loan returns  $((1+\rho)L/T)$  in the good state, or

$$\bar{\gamma} \left(1 - \frac{1}{T}\right) (1 + \rho) L \quad (1)$$

in the bad state (since the first period payment has already been received). In general, for any period  $t$  during the loan contract, the good state returns  $((1+\rho)L/T)$  and the bad state returns

$$\bar{\gamma} \left(1 - \frac{t}{T}\right) (1 + \rho) L \quad (2)$$

for any  $t \leq T$ .

The put option gives the private lender the right to sell the first period proceeds of the loan to the IMF if the loan is non-performing. This will only occur in the bad state. In the good state, the private lender is paid the owed amount, whether from the sovereign (no arrears) or the IMF (positive arrears), the lender does not care. What will the lender pay for this option at the start of period one? The approach used here follows the standard binomial tree approach used in option pricing. A good review is Baxter and Rennie (1996). The value of a portfolio composed of a risky loan and a riskless bond gives the price of the put option if the portfolio duplicates the payoffs from the put option. Suppose a riskless bond can be purchased which pays an interest rate  $r$  (LIBOR in our model). The loan pays a rate of return  $\rho = r + s$  where  $s$  is a risk spread above LIBOR.

The possible states of the world at the end of each year are limited to only a good state and a bad state. If the good state is revealed at the end of period  $t$ , the full interest and principle owing is repaid  $((1+\rho)L/T)$  and the option has zero value since it will not be exercised. If the bad state is revealed, the borrower defaults. The lender receives no payment from the sovereign borrower, then exercises the option and receives a ‘‘topping up’’ of  $\bar{\gamma} \left(1 - \frac{t}{T}\right) (1 + \rho) L$  from the IMF<sup>10</sup>  $\bar{\gamma}$  then the ‘‘topping up’’ is only  $\gamma \left(1 - \frac{t}{T}\right) (1 + \rho) L$  so the option has a value of  $\bar{\gamma} \left(1 - \frac{t}{T}\right) (1 + \rho) L$ .

The cost of the portfolio at the start of period one is

$$V = \phi s_0 + \psi B_0 \quad (3)$$

where  $\phi$  is the number of units of the loan  $L$  to purchase for the portfolio,  $\psi$  is the number of units of a riskless bond to purchase,  $s_0$  is the initial price of the loan ( $s_0 = L$ ), and  $B_0$  is the initial bond price ( $B_0 = 1$  for convenience). If the good state is revealed at the end of the period  $t$ , the portfolio is worth

<sup>10</sup>If  $\gamma < \bar{\gamma}$  then the topping up is only  $\gamma \left(1 - \frac{t}{T}\right) (1 + \rho) L$ .

$$\phi s_1 + \psi B_0(1+r) = f(1) \quad (4)$$

while if the bad state is revealed, the portfolio is worth

$$\phi s_2 + \psi B_0(1+r) = f(2) \quad (5)$$

where  $s_1$  and  $s_2$  are the realized returns from the loan in the good and bad states respectively.

This gives us two equations (10 and 11) in two unknowns,  $\phi$  and  $\psi$ . Solving for the unknown's gives

$$\phi = \frac{f(1) - f(2)}{s_1 - s_2} \quad (6)$$

$$\psi = \frac{f(1) - \phi s_1}{(1+r)} \quad (7)$$

We can now solve for the optimal  $\phi$  and  $\psi$ .

$$\phi = \frac{(1+\rho)L/T - 0}{0 - \bar{\gamma}(1 - \frac{t}{T})(1+\rho)L} = -\frac{1}{\bar{\gamma}(T-t)} \quad (8)$$

$$\psi = \frac{0 + \frac{1}{\bar{\gamma}(T-t)}\bar{\gamma}(1 - \frac{t}{T})(1+\rho)L}{(1+r)} = \frac{L(1+\rho)}{T(1+r)} \quad (9)$$

The optimal portfolio strategy is to sell forward  $\phi$  units of the loan (since  $\phi < 0$ ) and buy  $\psi$  units of the bond at the start of period one. At the end of the first period, the bonds are sold to buy back the loan. This strategy will provide an identical return at the end of period one as the put option.

The price of the European put option is determined by the value of the portfolio at the start of period  $t$ .

$$V = \phi s_0 + \psi(1+r) = -\left(\frac{1}{\bar{\gamma}(T-t)}\right)L + \frac{L}{T}(1+\rho) = \left(\frac{\frac{\bar{\gamma}(1+\rho)}{T}(T-t) - 1}{\bar{\gamma}(T-t)}\right)L \quad (10)$$

It is easiest to show how the insurance premium declines over time when the IMF fully insures the loan ( $\bar{\gamma} = 1$ ) and we begin at the start of the first period ( $t = 0$ ). Equation (8) then reduces to  $(\rho/T)L$ . After subtracting the lenders marginal cost of funds,  $r$ , the price per dollar of loan is just the annual risk spread  $s$ . The loan would still be made at rate  $\rho$ , but the insurance would

eliminate any risk for the lender and any profit. If a deductible is set as a percentage of the value of the loan, this would serve to reduce  $\bar{\gamma}$  and cause the insurance price to fall, leaving profit for the lender, but at the cost of exposure to risk. The insurance premium in the last period of the loan ( $t = T-1$ ) with full coverage is  $((1 + \rho) / T) - 1$  which is easily shown to be less than the insurance premium in the first period. The insurance premium declines over the course of the loan because the total principal and interest owing are declining each period, so there is less to lose in the bad state.

## 7 References

- Babbel, David F. (1996). Insuring Sovereign Debt Against Default. *World Bank Discussion Paper* 328.
- Baxter, Martin and Andrew Rennie (1996). *Financial Calculus: An Introduction to Derivative Pricing*. Cambridge, Mass.: Cambridge University Press.
- Buiter, W. and A. Siebert (1999). UDROP: A Small Contribution to the New Financial Architecture. *International Finance*, 2, 227-247.
- Rockerbie, D. and S. Easton (2006). The Effectiveness of Loan Guarantees and Information in Reducing Loan Spreads. In N. Columbus (ed.), *Financial Institutions and Services*. New York: Nova Science Publishers, Inc., 285-303.
- Dornbusch, R. (2001). Fewer Monies, Better Monies. *NBER Working Paper* No. 8324.
- Edwards, M. (2005). Investor Responses to IMF Program Suspensions: Is Noncompliance Costly? *Social Science Quarterly*, 86(4), 857-73.
- Eichengreen, B. and C. Ruhl (2001). The Bail-In Problem: Systematic Goals, Ad Hoc Means. *Economic Systems*, 25, 3-32.
- Eke, B. and A. Kutan (2005). IMF-Supported Programs in Transition Economies: Are They Effective? *Comparative Economic Studies*, 47(1), 23-40.
- Feldstein, Martin (1998). Refocusing the IMF. *Foreign Affairs*, March-April, 1-8.
- Fischer, Stanley (1999). On the Need for an International Lender of Last Resort. IMF mimeo.
- Hutchison, M. (2001). A Cure Worse than the Disease? Currency Crises and the Output Costs of IMF-Supported Stabilization Programs. *NBER Working Paper* No. 8305.
- Krugman, Paul (1998). The Indispensable IMF. *New York Times*, May 15.
- Lerrick, Adam and Allan Meltzer (2003). Blueprint for an International Lender of Last Resort. *Journal of Monetary Economics*, 50, 289-303.
- Masson, Paul R. and Michael Mussa (1997). The Role of the IMF: Financing and its Interactions with Adjustment and Surveillance. *IMF Pamphlet Series* No. 50, 1997.
- Miller, M. and L. Zhang (2000). Sovereign Liquidity Crisis: The Strategic Case for Payments Standstill. *Economic Journal*, 110, 335-362.

Mussa, M. (1999). Reforming the International Financial Architecture: Limiting Moral Hazard and Containing Real Hazard. In D. Gruen and L. Gower (eds.), *Capital Flows and the International Financial System Conference Proceedings*, Federal Reserve Bank of Australia.

Radelet, Steven and Jeffrey D. Sachs (1998). The East Asian Financial Crisis: Diagnosis, Remedies, Prospects. *Brookings Papers on Economic Activity*, 0(1), 1-74.

Rogoff, Kenneth (1999). International Institutions for Reducing Global Financial Instability. *NBER Working Paper Series* No. 7265.

Sachs, Jeffrey D. (1998). The IMF and the Asian Flu. *American Prospect*, 0(37), March-April, 16-21.

Schultz, George P., Simon, William E., and Walter B. Wriston (1998). Who Needs the IMF? *Wall Street Journal*, February 3.

Swartz, Anna J. (1998). Time to Terminate the ESF and the IMF. *NBER Working Paper* No. 48.

Soros, George (1998). *The Crisis of Global Capitalism*. New York: Public Affairs Press.

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