

Governments Debt and Asset Management and Financial Crises: Sellers Beware

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I Introduction

A great deal of attention has recently been devoted to the question of why governments choose to incur debt rather than adjust tax rates or expenditures to balance the budget over arbitrary accounting periods or business cycles. Alesina and Perotti (1995), provides an excellent review of this literature and offers an evaluation of the success various analytical frameworks have had in explaining the cross section and time series behavior of debt in industrial countries since 1960. An important conclusion they draw from this literature is that governments' reactions to shocks to their fiscal balance depends on their ability to resolve conflict among interest groups over who should be taxed following an unexpected shock to expenditures or receipts. This political economy approach offers sensible explanations for both the timing of debt buildups for industrial countries and for the very different experience of countries that seem quite similar except for their ability to settle disputes.

While the theory helps explain why countries react to a fiscal shock by accumulating debt, it is of limited value in advising governments about how to avoid such shocks or their consequences. Some aspects of conflict resolution can be influenced by the government -- a balanced budget amendment is a popular example -- but such institutions change slowly and may be of very limited effectiveness. The degree of political and economic polarization that determines the costs associated with resolving conflict are largely exogenous with respect to policy.

In this paper we argue that developing countries do have some control over the terms on which conflict over distributive shares is carried out following a default on their internal and/or external debt. This implies that the developing countries have an important reason to be concerned about the composition as well as the net stock of debt. We first review the literature on debt management for industrial countries. The key difference in the experience of developing and industrial countries is that the former have recently defaulted on financial liabilities while the latter have not. The literature on industrial countries' debt management policy emphasizes the idea that the currency composition, maturity and indexation of the debt can affect the government's incentives to inflate away its value. Moreover, expectations concerning these incentives can influence the terms on which the government can borrow. A fundamental problem for the theory of debt management for developing countries is the conflict between the government's incentive to commit itself to repayment when it can do so and its incentives to avoid welfare losses if repayment becomes impossible. The literature on debt management policy for industrial countries abstracts from the second problem. Lucas and Stokey (1983) observe "Our analysis has focused exclusively on a situation ... in which there are no binding constraints on future taxes but in which government debt is fully binding. Our interest in this case does not arise from features which are intrinsic to the theory, since the theory sheds no light on why certain commitments can be made binding and others not, but because this combination of binding debts and transient tax

policies seems to come closest to the institutional arrangements we observe in stable, democratically governed countries. These institutional arrangements may be emerging in developing countries but are not yet fully established. Governments of developing countries need to reassure creditors that they will pay when they can. Otherwise there will be no credit and the both debtors and creditors are worse off. But when bad luck (for example an unexpected change in real interest rates or the terms of trade) makes default unavoidable, the sovereign should have planned ahead to avoid unnecessary costs in resolving the conflict that follows. Commitment is seldom absolute so the tradeoff between commitment and costs incurred when the government is forced to default on a commitment is quite general. For example, indexation provides commitment but by reducing the tax base for inflation, but requires a higher inflation rate if the government decides it has no alternative sources of revenue. The more subtle issue is that alternative ways to attain a given level of commitment may have very different costs in circumstances when a default is unavoidable. Moreover these costs are not internalized by marginal creditors so there is no easy market test for the optimality of alternative debt structures.. In this paper we argue that the role of debt management policies in maximizing welfare for countries that face some probability of an unavoidable default has not been properly evaluated.

The assumption that makes this type of model interesting is that which insures that conflict resolution generates dead weight losses for all the participants. In corporate finance models this is a static problem in which the salvage value of a firm's assets depends on the structure of debt. For sovereign debt it seems natural to model the dead weight losses that result from the passage of time during which the creditors and debtors argue about how losses should be allocated. During this interval the ability to utilize the productive asset acquired by issuing debt is impaired. Following Alesina and Drazen (1991) and Drazen and Grilli (1993) the coordination problem takes the form of a war of attrition. The dead weight losses associated with the conflict are related to the structure of the debt. The idea is that creditors' uncertainty about the attributes of other creditors generates delay in settlement. During this interval of time the asset acquired by issuing debt yields no return and depreciates.

In our view the most interesting aspect of sovereign debt is that once this conflict begins the only rule is that there are no rules. Where default is sometimes unavoidable, the structure of the government's financial debt determines the participants in the conflict over rescheduling the debt and their relative bargaining strength. This aspect of debt management policy becomes more important as the probability of unavoidable default rises. In some cases it will be optimal to limit self-interested bargaining by issuing only one type of debt that by conventional measures appears to be very costly to the government.

Market yields consistent with a zero profit condition for risk neutral creditors are not a useful measure of the cost of alternative credits to debtors. A creditor group that will impose significant costs on the debtor following a default will offer credits on what seem to be relatively attractive terms. But that same group might impose relatively large dead weight losses on all the participants in the rescheduling that follows an unavoidable default. Since there is no reason for the tough creditor to internalize the dead weight loss imposed on others following a default, the terms

offered the creditor are not a useful guide to debt management policy. This is a particularly interesting result because results drawn from familiar models of debt management for industrial countries imply that debt offerings that are welfare improving also minimize the government's debt service cost. The task for the debt manager is to identify a set of efficient debt structures and then choose the best structure given the probability that an unavoidable recontracting will occur.

The difficulty of evaluating the welfare implications of alternative debt structures is illustrated by the substitution of dollar-indexed, short-term debt (tesobonos) by the government of Mexico for short term domestic currency debt (cetes) in the months leading up to the December 1994 crisis. The existing literature on debt management would emphasize the fact that by indexing the liability the government altered its incentives to inflate and devalue the currency. Thus, the probability that a default in the form of inflation and devaluation would be optimal was reduced. Our model emphasizes a different aspect of the same policy. The substitution of tesobonos for cetes changed the nature of the rescheduling exercise that followed the 1994 crisis. This recontracting in this case was resolved quickly by forceful intervention by official creditors. In retrospect, the issue of tesobonos was a very good idea if the decision of official creditors, in this case the US government and international organizations, to lend quickly and in large amounts was due to their unwillingness to fight a long costly war with a well organized and powerful group of holders of tesobonos.

If the US government had not responded quickly the holders of tesobonos still might have expected full present value repayment following a long war of attrition with the debtor and other creditors. But in this case the same apparently cheap debt would have turned out to be very costly to the debtor. This is an illustration of the idea that it is not possible to evaluate the contribution of a debt instrument, or a type of creditor, to the expected costs of resolving a default without a clear idea of how this type of creditor will interact with other creditors and the debtor following a default

II Debt management in industrial and developing countries

Setting out a theory of optimal asset and liability management for governments of developing countries is a challenge. There are at least two reasons why we cannot take analytical tools developed for debt management policy in industrial countries "off the shelf" and apply them to emerging economies. First, if we ignore default there is little agreement in the literature about the optimal level of debt, what type of debt government should issue and what role, if any, government should play in financial intermediation. Second, even if we could agree upon the "right" model for industrial countries there are good reasons to believe that the uncritical application of the model to emerging markets, where default is an option, would be a mistake.

The experience of industrial countries is also an uncertain guide. Industrial countries have followed very conservative debt management policies. As financial innovation has changed the nature of private financial markets, industrial country governments have, for the most part, chosen to continue to issue fixed interest securities and to hold a very narrow range of financial assets,

often comprised of securities issued by other governments. Industrial countries have also been cautious in acquiring contingent liabilities in the form of guarantees of private debt. An important exception is deposit insurance but even here they have been careful to control the risk associated with such commitments. There might be very good reasons for this conservative approach but it might also be the case that debt management "rules of thumb" were developed in an era when international and derivative markets were quite limited; inertia might account for debt managers' apparent lack of imagination.

Debt management policies for governments of emerging markets are less constrained by tradition and the presumption that the government should avoid the more exotic corners of the financial markets. In fact, participation in a richer set of debt management techniques seems natural in an environment in which hedging activities and risk management are seen as a responsibility of any economic entity with significant assets and liabilities.

While industrial countries have not deviated much from a traditional approach, economists have discussed a number of theoretical arguments for welfare-improving departures from the conventional policies. In order to begin to build a framework for evaluating the options for developing countries we can build on an understanding of lessons drawn from this literature. Some of the important papers in this literature are cited in the references; in this paper only a few of the arguments that seem to be important for emerging markets are highlighted.

The story that emerges from this literature is that optimal debt management policies can, in principle, mitigate distortions to first best competitive equilibria. If distortions differ across countries so will the implied debt management policy. Recent contributions to the literature emphasize the possibility of self-fulfilling expectations and these models suggest quite different implications for debt management. Economists have a difficult time in considering more than one distortion at a time. This paper develops the idea that losses in output that follow government default is the distortion that "should" dominate debt management policy in emerging economies. The reader should remember that there is little in the way of empirical evidence that would allow a ranking of distortions according to the welfare losses they generate or the ability of debt management policy to amplify or mitigate these losses.

III Overview of debt management policy and plan of study

Debt management policy regulates three distinct characteristics of a government's balance sheet. These are the government's net worth, its stock of gross debt and gross assets, and the composition of its assets and liabilities. Changes in the net worth of the government are generated by fiscal deficits and by capital gains and losses on assets and liabilities. Stocks of gross assets and liabilities are independent of the net position (a given level of net debt or net assets determines the difference between gross assets and liabilities but not their level) and are important because leverage alters the expected returns and the variability of net worth. One way to measure leverage is the ratio of gross assets to net worth. A convenient way to think about the composition of assets and liabilities is to measure change in net worth that results from changes in

variables such as interest rates or exchange rates. Exposure of the portfolio clearly depends on changes in the value of individual assets and liabilities and the covariance of changes. We call this the economic exposure of the portfolio.

In the next section a variety of theoretical arguments relevant for debt management policy are reviewed. The objective is to carefully set out how management of the government debt "affects" welfare. The "easy" place to start is a neoclassical model in which debt management policy is powerless to affect equilibrium values of economic variables. Modifications of the neoclassical model introduce distortions to a first best equilibrium that might be corrected through debt management policy. Some of these are familiar. Distortions to labor and capital markets imply that net debt management might help smooth fluctuations in output. If taxes are distortionary or costly to collect, an optimal path for net debt will generally involve some smoothing of tax rates over time. Distortions that might favor alternative types of government debt and asset portfolios, and the leverage of those portfolios, are less familiar but may be more relevant for debt management policy. While many potential distortions have been examined in the literature this paper considers only a subset that is likely to be important for emerging markets. The more important models focus on the effects of incomplete financial markets, time consistency of government policy, multiple equilibria and political markets for distributional shares.

In section V we develop the idea that while these models are interesting and informative the distortion most likely to be important to developing countries is not explicitly considered in the context of industrial countries. For emerging economies a dominant distortion has been the loss in output and growth that has followed financial crises.

Section VI explores the distinction between the portfolio that is managed and the much larger portfolio to be optimized. Although only a subset of the government's assets and liabilities are actively managed, sensible debt management policy is concerned with the value of the entire portfolio and the effects of changes in its value on residents' welfare. The widespread practice of establishing a benchmark portfolio for foreign currency denominated assets and another benchmark portfolio for foreign currency denominated liabilities seems very likely to violate this fundamental rule. Benchmark portfolios are usually derived from historical relationships between levels and variability of yields on the set of instruments included in the portfolio. Dooley (198) shows that the straightforward merging of asset and liability portfolios for developing countries provides a much different picture for what countries are accomplishing and should be trying to accomplish by managing the currency composition of their financial assets and liabilities. The problem with separating asset and liability portfolios is that there is a perfectly predictable covariance of minus one between the value of otherwise similar assets and liabilities denominated in the same currency.

But considering financial assets and liabilities together clearly does not go far enough. Domestic currency debt is also an important part of many governments portfolios. Moreover, governments have one dominant asset, future tax receipts. There is no practical way to manage this asset except in rare cases where revenues from oil or another commodity can be hedged. Markets for

future tax receipts simply do not exist .(Tax farming is an interesting exception but hardly more than a curiosity). It follows that a government with one dominant undiversified asset may not find it optimal to diversify its net financial liabilities.

IV Debt management policy

Management of net debt is straightforward if Ricardian equivalence holds. The key assumption in this class of models is that the government debt is treated by taxpayers as if it were their own. Government spending matters for household behavior but the time profile of taxation and borrowing does not. Any pattern of taxes and borrowing that does not lead to insolvency is optimal because a representative, perpetual household anticipates future tax burdens and hedges its exposure by adjusting private savings. It should be noted that taxes are special in the conventional model in that it is assumed that the government will manipulate tax rates (or government spending) in order to honor its net debt. The expected present value of conventional net tax receipts is the principle asset that the government holds. I like to think of this as an assumption that a well-defined set of taxpayers have an equity position in the government in that they hold the residual asset or liability position. If the effective tax rate is bounded by either political or economic constraints, it is clear that in some circumstances the value of net liabilities can exceed the present value of net taxes and the value of some liability will have to be reduced. We will refer to the allocation of losses across net nontax liabilities as a crisis and the reduction in the value of alternative liabilities a default. The standard assumption in the context of industrial countries is that surprise inflation is the relevant default technology available to the government.

Net debt management in an imperfect world

Empirical work seems to be quite hostile to the idea that the private sector systematically offsets changes in the government's net debt. As Krugman (1996) points out, policy discussions are dominated by a model in which sticky prices and less than perfect foresight imply an important role for fiscal policy in stabilizing national output. Blanchard, Dornbusch and Buiter (1986) present an intertemporal model in which deficit finance can make an important contribution to stability and growth. For the purposes of this paper the implication is that net debt management policy is likely to be dominated by concerns about economic stability. In the context of small open economies this includes concerns about real exchange rates and current account imbalances in addition to domestic prices and output. Given the importance governments place on internal and external stability, we should expect that from time to time significant stocks of net government debt and net government assets will have to be managed. Managing the portfolio can contribute to the value and variability of the government's net position but the debt manager's job seldom extends to telling the government what its fiscal deficit should be. The modern neoclassical literature on net debt management is largely based on the idea that taxes discourage productive activity (Barro,1979). Since taxes are distortionary this is potentially an important

argument. The government can minimize the loss in output over time by smooth tax rates in the face of unexpected shocks to expenditures or receipts. The optimal pattern for debt is simply the difference between optimal taxation and expenditures.

Regardless of the source of indebtedness, the stock of net debt is an important problem for the debt manager. As the stock of net debt (or net assets) rises or is more highly leveraged, capital gains and losses on that net position become more important relative to the flow of fiscal deficits in generating changes in the government's net worth. The working assumption for this paper is that fiscal policy is, or is at least is thought to be, too important to be delegated to a debt manager. We focus therefore on the management of the portfolio.

Portfolio management policy

A time path for net worth restricts the difference between the expected present value of the government's assets and liabilities at each point in time but does not restrict the scale of the government's portfolio of gross assets and liabilities or the composition of either gross assets or liabilities. For convenience we will refer to the management of gross assets and liabilities (both on and off balance sheet) given net worth as portfolio management policy.

There are two issues to be resolved. The first is the optimal leverage of the portfolio. The second is the composition of the portfolio. Some readers will find it useful to think of the government as a financial intermediary that inherits a net worth position, issues liabilities to acquire assets and manages the economic exposure of assets and liabilities to maximize a risk return trade off. The intermediary also manages off - balance-sheet risks in order to protect its net worth.

The counterpart to Ricardian equivalence for net debt is a Miller-Modigliani theorem for the scale and structure of gross debt. The conditions under which this neutrality result holds have been carefully set out in the literature. If there is no uncertainty, and if representative, perpetual households consider the government's portfolio their own, it seems clear that any gross position the government takes would be fully offset by the private sector.

With uncertainty, the private sector must also offset the expected variability of their net tax liabilities generated by changes in the market value of the government's portfolio. For example, if the government takes a highly leveraged position by issuing domestic currency debt in order to acquire foreign currency assets the private sector would have to be able to offset the government's position in the same or equivalent markets. This is the basic reason why sterilized intervention, or any other changes in the economic exposure of the government's portfolio, has no economic effects in a neoclassical model.

One of the many strong assumptions necessary for this result is that households must be able to

forecast their share of taxes associated with the government's capital gains and losses as well as the gains and losses on their share of government liabilities. Clearly the household cannot manipulate its portfolio to offset its contingent tax liability if it doesn't know what that tax liability will be.

Portfolio management in an imperfect world

If the private sector does not seem to offset net government debt it seems even less likely that gross positions are systematically offset. If, for a variety of reasons discussed below, the private sector cannot offset the exposure and leverage of the government's portfolio, portfolio management policy can contribute to or detract from residents' welfare.

Incomplete markets

One of the more interesting distortions emphasized in the literature is associated with incomplete credit markets. By issuing various "new" types of debt the government can provide vehicles that allow the private sector to increase welfare. In some cases the new asset allows trade between generations. In others the new asset has a desirable covariance with risks that cannot be hedged using existing markets. The idea is that, once established, a liquid market for a new asset such as a fixed interest nominal bond of varying maturities provides free information about market expectations to the private sector. Since the information is free to all there may be under investment without government intervention. If such debt really is useful to the private sector they will hold it at a lower yield. This suggests that minimizing debt service costs is a good indicator that the government is providing welfare-improving debt instruments. For emerging markets it seems likely that this argument is relevant for optimal portfolio management policy. Emerging markets lack many of the financial markets that are potentially useful to the private sector. For example, the development of a liquid market for long-term, fixed-interest government debt may fill an important gap in the ability of residents to finance long term investment.

Credibility

Another interesting class of models points to debt management as a way for the government to commit to utilize conventional taxes rather than surprise inflation to satisfy the government's budget constraint. The government can commit price stability by issuing assets and liabilities that would not benefit from surprise inflation. This idea seems particularly relevant as the stock of debt grows as it has recently in several European countries.

These models imply that the government can reduce real debt service costs by shortening the maturity of domestic currency debt, indexing returns to inflation or replacing

domestic-currency-denominated debt with foreign currency debt. This is clearly at odds with the idea that the government should develop a long-term domestic bond market in order to complete the market. But we are not done with this issue yet. In the next section we review an important reason to lengthen the maturity of domestic currency debt.

Multiple equilibria.

The lesson from the previous section is that private expectations concerning future inflation determine this period's debt service costs if the government issues debt that is subject to the inflation tax. This raises the possibility that changes in private expectations can quickly generate a crisis in the sense that market interest rates on short-term debt can rise very quickly and call into question the government's willingness and ability to finance debt service obligations.

Moreover these shifts in private expectations can, in some cases, lead to multiple equilibria and self-fulfilling expectations of high rates of inflation. Calvo (1983) summarizes the implications of the argument as follows: "The implications for policy could be staggering: for our results suggest that postponing taxes (i.e., falling into debt) may generate the seeds of indeterminacy; it may, in other words, generate a situation in which the effects of policy are at the mercy of peoples expectations - gone would be the hopes of leading the economy along an optimal path." If there are real costs associated with financial crises, the government should avoid short-term domestic debt and spread refinancings evenly over time. In this context lengthening maturity minimizes the chance that the debt will have to be rolled over just when expectations are at a bad point. There is an obvious conflict here. The inability to commit to low inflation means that the private sector will not give up its option to alter the inflation risk premium by buying long term bonds unless they are induced to do so by a very steep yield curve. But the possibility of a shift in private expectations means that government should avoid relatively cheap short-term debt if it wants to avoid a crisis.

V Default risk

While inflation is clearly a default option for developing countries we have considerable evidence that outright default on some types of financial obligations is also an option. Even countries that have never defaulted are exposed to expectations that such an option is available. This additional option makes portfolio management for emerging markets more difficult and more important. Any debt management policy must be evaluated for its contribution to probability that a default will occur and for the costs of the default if it does occur. The universal assumption that inflation is the relevant default technology for industrial countries is consistent with the idea that alternative types of default are too costly to deserve serious consideration. While this is a more important issue for large net debtors, even countries with modest net indebtedness should avoid capital losses that might reduce net worth to levels that make

insolvency a possibility. Open economies are subject to shocks from commodity prices, real exchange rates, international interest rates and losses in their domestic banking systems. When combined with highly leveraged structures of financial assets and liabilities these shocks can generate capital gains and losses for the government that call into question their ability and willingness to roll over their financial obligations on market terms. In the remainder of the paper we develop the implications of this possibility for debt management policy.

An analogy with the earlier discussion of fiscal policy might be useful. It was argued above that the welfare effects of net debt management were too important to be entrusted to debt managers. In this section we develop the view that debt managers' natural preference for maximizing returns on assets and minimizing costs of debt service should be subjugated to a more important objective. If financial crises are very costly debt and asset management should focus on one objective: avoiding capital losses that call into question the government's willingness and ability to roll over existing debt on market terms.

Developing countries have defaulted on both internal and external debt. Further, developing countries have defaulted differentially on "domestic" and "foreign" debt and have defaulted differentially on different types of debt within these two classes. This makes the analysis of optimal debt management much more difficult for developing countries. Private investors have to consider the possibility of surprise inflation and devaluation but also must consider the possibility of outright default. This makes the market yield on internal and external debt highly interdependent. For this reason the distinction between internal and external debt for developing countries has lost much of its meaning. As residents of developing countries have gained access to international credit markets they have chosen to hold their government's foreign-currency-denominated debt. In recent years it has become common for nonresidents to hold developing country governments' domestic currency debt.

To start to understand debt management in such a world Dooley and Stone (1993) develops a model of "implicit seniority" in order to understand why governments are able to borrow at different interest rates even when payment on all classes of debt comes from the same expected stream of government revenue. In that paper it is argued that it is difficult for the government to credibly commit in advance to treat one class of creditors better than another. If some default will be necessary in some states of the world, it is reasonable to assume that the government at that time will opt for the least costly form of default. There are a long list of options. Since the government will certainly consider the whole list when trouble comes, lenders will consider their relative standing in different states of the world when setting the terms on alternative instruments. A positive theory of the government's choice of default would simply be that it is unable to commit ex ante to any rule and ex post minimizes the losses and penalties associated with each option. We can say a few things about this process. First, the revenue gained from a given rate of default depends on the tax base or the initial size of the position. It is often argued, for example, that foreign currency sovereign bonds are safer than other forms of debt. We suspect this is simply because international bond issues have been small as compared to domestic debt and alternative international debt. If there are fixed costs to default, rational governments would

avoid defaults that yield little income.

The interdependence of the value of sovereign debt suggests an important and somewhat counter intuitive problem for portfolio management in emerging markets. The marginal contribution of a given asset or liability to the risk faced by the government will normally appear in the market valuation of other assets and liabilities. Suppose, for example, that the accumulation of foreign-currency-denominated debt, and retirement of domestic currency debt, exposes the government to a capital loss that the market considers quite likely. But suppose also that in the event the loss occurs foreign currency debt will be first in line for payment. The incidence of the expected loss might fall, for example, on entitlements for older residents. The fall in the market value of these entitlements will be difficult to observe. Moreover, I have little faith in the view that residents will immediately increase their own retirement savings although the tendency for this response is clear enough. So the government faces a very difficult task. A simple lesson is that if the present value of expenditures is not affected by changes in the terms of trade then the present value of debt should also not depend on terms of trade. In short, domestic currency debt is the preferred financial obligation. If the government wants to hold some foreign exchange assets for liquidity it should hedge these with a foreign currency debt. But why would the "market" accept the counter party risk associated with a government that might become insolvent? If a small subgroup of creditors believes that they will do well in states of the world where the government becomes insolvent it might be in their interest to offer very risky (to the government) positions at very low risk premia.

Policy toward instruments and creditors

A very general way to express this result is that the government must be concerned both with the contribution of a credit to the probability that some creditor group will find it in their narrow interest to refuse to roll over debt, thereby forcing a renegotiation, and the contribution of that creditor group to the bargaining that will occur following a default. The optimal strategy for a sovereign manager is to choose a debt portfolio (rather than an optimal contract) that on the one hand makes strategic default unattractive but on the other hand attempts to minimize the damage associated with bargaining that will follow an unavoidable default.

A portfolio that makes strategic default unattractive would allow for frequent calls for rescheduling probably through short maturities and rescheduling that would be costly to the government. If the probability of a bad state is zero the government will simply choose the portfolio that generates dead weight losses to itself following a strategic default that equals the payment necessary to generate a competitive rate of return for the creditor. This is a form of commitment that makes lending possible. In the sovereign debt case high dead weight loss credit structures are associated with slow settlement. But as the probability of a bad state of nature rises the optimal debt structure involves quick settlement so that the creditors get some payment before the investment depreciates. If the only observable difference between the two types of

defaults is the liquidity of the government, then the crucial point is the ability of the government to buy back its debt following a strategic default. Clearly the government would want no buy back rules for commitment. But in an unavoidable default this would make settlement more difficult. Countries with little or no risk of an unavoidable default will favor debt structures that insure maximum punishment following a strategic default. The problem in both the corporate and sovereign cases is to determine how different numbers or types of creditors affect the optimal debt structure. The corporate case proceeds as follows. All the managers, potential managers, creditors, and potential creditors look forward to the bids that each will make following a seizure of the firm's assets. The composition of debt matters under any set of assumptions where the value of the asset to individual participants in this game depends on the behavior of the other participants. Bolton and Scharfstein (1996) assume that new managers earn lower returns on the asset and incur costs of evaluating the assets. In order to distinguish between one and many creditors they also assume that each creditor has the right to seize a well-defined asset and that these assets are worth more when used together than separately. The ability of a creditor to block coalitions that can best utilize the seized asset provides the result that the number of original creditors matters for the expected value of the investment to the initial manager. .

The structure of the game that determines the equilibrium for different debt structures is quite specific to the assumptions that seem appropriate for corporate finance. These assumptions do not travel well to the case of sovereign debt. But the intuition we want to pursue for the case of sovereign debt does emerge in this very formal model. In general, the government and the corporate manager must consider both the contribution of a given debt structure to the probability that a default specified in the optimal contract and the costs of that default should it occur.

The key assumption that makes the model interesting is that which insures that conflict resolution generates dead weight losses for all the participants. In the corporate finance model outlined above this is a static problem in which the salvage value of the company's assets depends on the structure of debt. For sovereign debt it seems natural to model the dead weight losses that result from the passage of time during which the creditors and debtors argue about the division of future income. During this interval we will assume that the ability of anyone to utilize the asset is impaired. Thus we have a coordination problem that is related to the structure of the debt. This can be modeled as a war of attrition (Drazen and Grilli, 1993) where creditors' uncertainty about the attributes of other creditors generates delay in settlement.

In applying these ideas to the sovereign debt case we are both more and less ambitious. We are less ambitious in that we will not try to solve for an optimal contract but assume that the government chooses among a limited set of conventional contracts in order to assemble the optimal debt portfolio. We are more ambitious in that we attempt to describe the incentives for repayment in a new manner.

The existing sovereign debt literature has interpreted the fact that seizure of assets is impossible as suggesting that the punishment for nonpayment is unrelated to the assets acquired through the

issue of debt. This makes the corporate debt literature of little direct use. The lack of collateral or the means to seize it means that some alternative threat is necessary to provide an incentive for repayment. The typical threats that have been modeled involve trade sanctions or prohibition of future borrowing. The trouble with these enforcement mechanisms is that the former has never been observed and the latter seems very weak relative to the amount of debt observed. Moreover if countries had the ability to impose such sanctions they should do so regardless of the debt. The assumption is that nonpayment triggers the right to impose these sanctions that are always in principle desirable. This has proven to be a useful assumption but here I propose alternative ad hoc assumptions that seem to me more useful as a way to understand sovereign debt management. The main feature of this specification is that the threat available to creditors is the ability to block the use of assets acquired by the debtor government. The threat obviously evaporates as the assets depreciate. This provides an end to the recontracting game that seems more consistent with experience. Sovereign debt reschedulings are eventually resolved.

A sovereign debt model

The world lasts for three periods. In the first period a foreign creditor lends the government K to buy some assets where K is a dollar amount. The risk free interest rate is assumed equal to zero.

The government uses K to import an asset that in the second period yields x with probability T and zero with probability $1-T$. The government can also import unproductive assets that yield zero. This behavior is not observable by the creditor. The asset lasts for one more period but depreciates uniformly during the period and yields a certain return y . The government agrees to pay Z in the second period. If the government pays less than Z the creditor has the right to impair the government's use of the asset until a new agreement is reached for a share of the residual value of the asset, y . During the third period the asset cannot be used by the government if a negotiation for sharing y is in progress. The value of the asset declines during the third period from y to zero. This specification of the punishment technology is appealing because it means that the creditor(s) is only able to interfere with the government's ability to utilize the assets acquired with the foreign funds and for only as long as the assets last. The alternative interpretation that the creditor(s) can punish the debtor forever and without regard to the seriousness of the offence is less appealing. One might think of a subsistence economy lifted temporarily to a higher level of output by an infusion of foreign capital, but once the capital depreciates the creditor has no way to push output below the initial level.

If the government can pay, which occurs with probability T , it will consider a strategic default. The temptation to keep z , the contractual payment in period two, is compared to the value of y that the government expects to capture following a negotiation with the creditor(s). The incentive constraint for the government to pay z if x occurs is

$$(1) \quad z < y - gyts$$

where gy_t is the expected share of y that goes to the government following a negotiation lasting $0 < t_s < 1$.

The value of strategic default depends on the expected duration of the negotiation in period 3. If the government cannot pay, which happens with probability $(1-T)$, there is a similar negotiation. The difference is that following a strategic default the government has secret resources that can be used to overcome the coordination problem and speed a settlement.

The creditor must expect to make a fair rate of return

$$(2) \quad T(z) + (1-T)cy_{tb} - K = 0$$

where cy_{tb} is the share of y that goes to the creditor following an unavoidable default. Note that gy , cy , t_s and t_b are a complicated function of the structure of debt and that t_s will generally not be equal to t_b .

The problem for the government is to design a debt structure that maximizes its net revenue from investment. The general form of the government's net revenue function is

$$(3) \quad T(x - z) + (1 - T)gy_{tb} = R$$

Substituting (1) and (2) into (3)

$$(4) \quad R = Tx + y - K - (1-T)y_{tb}$$

The first three terms of (4) are the first best expected return on the asset if there is no default.

The fourth term is the dead weight loss associated with rescheduling. A full description of how a portfolio of debt might be designed to maximize the expected value of (4) is very difficult. Analytic and simulation solutions for this problem are topics for future research. In principle the key parameters could be estimated from data on how long it takes to renegotiate different debt structures and how costly the renegotiation is. A result that stands out however is that the optimal portfolio is clearly related by the probability that the investment will fail for reasons beyond the control of the debtor government. At the start of the third period it might be natural to assume an immediate meeting of the minds. Clearly if there is one creditor and one debtor, they might assess each other's bargaining power and rather than watch the asset melt will divide the spoils. However, if the two sides are uncertain about the other's preferences or have very different expectations about a fair division, some waiting and dead weight losses are likely. The equilibrium condition is that each creditor, and if not liquidity constrained, the debtor compares the marginal cost of waiting with the marginal benefit of winning. The benefit is the probability that the other side will concede in the next instant times the difference between the winner's and

looser's share of what remains of the asset. If there are a few creditors they will have to assess the others' expected returns for delaying a settlement. If there are very many creditors it might be difficult to arrange any agreement for a very long time.

It is important to remember that the actual coalitions that emerge following a default may be difficult to predict and the behavior of coalitions may be difficult to predict. A natural assumption is that classes of liabilities, for example all foreign-currency-denominated liabilities, would be natural attractors for a coalition. But foreign-currency-denominated bond holders might find it in their interest to be free riders on an agreement between other large creditors. It follows that the number of types of liabilities issued might not be a good predictor of the number of coalitions that would form following a default.

An important aspect of the problem facing the government is that alternative credits cannot be evaluated according to the explicit contractual terms since these are only relevant in nondefault states of the world. Moreover, credits or creditors cannot be evaluated according to its marginal contribution to the probability that a default will occur. Once default is a possibility, a credit influences the probability that a default will occur and the expected cost to the debtor and the dead weight loss suffered by the debtor associated with adding that credit to the bargaining game. A reasonable conjecture is that creditors that expect to do well in the bargaining game are those best positioned to delay settlement. Other things equal such creditors will offer relatively good terms as the probability of default rises. Because the tough bargainer does not internalize the dead weight loss that it will impose on others, ex ante market prices are distorted and are a misleading guide for the government. In fact, as default becomes more likely, a debtor might be tempted to choose debt that minimizes the probability of a default in that it offers reduced contractual payments. This would be a mistake if this type of debt was associated with very high costs to the debtor if the default occurs.

It might be optimal to create as few instruments and classes of creditors as possible. If there are no "niches" in which particularly hostile creditors can gather, they might self select out of the credit supply. The industrial countries have adopted just such a rule. In general, industrial country governments issue one class of liabilities with a range of maturities but with no implicit or explicit seniority among credits or creditors.

Why domestic currency debt?

The above discussion suggests that the debt manager might want to limit the ability of interest groups to form by issuing only one type of debt. But the analysis does not help determine what type of debt would be best. In our view the dominant consideration is governments' limited ability to generate changes in the foreign currency value of tax revenue. It follows that governments cannot afford to issue foreign debt, or more precisely foreign currency-denominated-debt, even if that debt helps commit the government to price stability. Foreign currency debt exposes the government to changes in its net worth resulting from changes in the real exchange rate. As far as we know these real exchange rate changes are unrelated in a statistical sense to other changes in

the government's wealth.

Even small amounts of external debt can be very costly, not because a developing country will choose to default on its external debt, but because external debt service can increase when the foreign-currency value of government revenues falls. This often induces the government to default on its internal debt through inflation. Residents' expectations of this reaction generates the extraordinary increases in domestic real interest rates and capital flight that precede financial crises in developing countries.

Is default risk a problem for countries with reserve assets? Industrial country governments have generally been very conservative in leveraging their portfolios because they are quite sensitive to the political problems associated with capital gains and losses generated by highly leveraged positions. For example, the relative unwillingness of the government of the United States to intervene in foreign exchange markets is partly explained by the unwillingness of the Treasury and Federal Reserve to accumulate reserve assets that fluctuate in value relative to the domestic currency debt that necessarily finances such accumulations. Developing country governments have been much more inclined to leverage their positions. Sterilized intervention has created large asset and liability positions that are sensitive to exchange rate changes. Moreover, governments of developing countries are probably more exposed to capital gains and losses than they realize. At a minimum governments that manage exchange rates must consider the implicit liability to guarantee the domestic currency value of the assets and liabilities of the domestic banking system. If a government decides to liberalize its domestic credit markets, prudent debt management policy would immediately recognize an implicit liability that will arise if important institutions prove not viable in this new environment. If the insured institutions are sensitive to increases in international interest rates it is important that the government's other liabilities not be sensitive to these factors.

VI Conclusions

The analytical framework presented above suggests that there may be good reasons for most governments to follow the ultra-conservative debt management strategy observed in industrial countries. Further research and empirical work is needed to translate the model into policy recommendations. In this conclusion I present one interpretation that seems to me worth careful consideration.

In practical terms the government should limit its debt to a homogeneous long-term, domestic-currency-denominated liability. Moreover, the government should avoid leverage that is generated, for example, by sterilized exchange market intervention. Implicit or contingent liabilities are particularly important to identify and control. In cases where leverage is useful, for example, most net debtors will want to hold foreign exchange transactions balances; the covariance between assets and liabilities should be exploited in order to minimize the variance of net worth. The primary reason for advocating a single class of debt is to avoid an adverse

selection problem for sovereign credits. When there is more than one class of creditor and when there is some chance of a default, the expected value of a credit to the creditor depends on her bargaining power during recontracting. It follows that as the probability of default rises, tough creditors will offer better terms. The problem for debt management in developing countries is that these relatively good terms are easily confused with good terms that are justified by better commitment mechanisms. Since market prices for alternative debt instruments are not a reliable guide to the risk to the debtor; market prices for a single class of debt are more informative. A straightforward way to exploit this information is to issue only one class of debt. The debt should be denominated in domestic currency because unpredictable changes in real exchange rates generate large changes in the foreign-currency value of government receipts. The obvious problem with a single class of domestic currency debt is that it exposes all creditors to domestic inflation. This is true but surprise inflation is the likely way that small amounts of foreign-currency debt will be serviced in any case. Most countries will not find it optimal to denominate all their debt in foreign currency. Partial commitment to price stability is no commitment at all. Foreign-currency debt shifts the inflation tax to remaining domestic currency debt or to some other class of less easily observed liabilities.

It follows that the main job of portfolio management policy is to minimize the chance that the marginal contribution of debt is mispriced from the point of view of the debtor. Long-term domestic currency debt seems to me to be the best vehicle from this perspective.

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