
Public Debt Management and Macroeconomic Stability: An Overview

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Recent research suggests that management of the public sector's debt can have important effects on a country's macroeconomic performance. This article provides an overview of the factors that the recent literature has identified as important in determining the optimal composition of the public debt. Based on this analysis, it attempts to establish general guidelines for public debt management in emerging economies. To retain market access and promote domestic financial market development, governments should generally finance themselves at market rates using a wide variety of securities. Beyond this general principle, the optimal composition of the public debt involves a tradeoff between enhancing the government's anti-inflationary credibility and reducing the vulnerability of its budget to macroeconomic shocks. Consequently, the optimal composition of the debt depends on a country's circumstances. Debt should be heavily weighted toward long-term nominal securities for governments that have anti-inflationary credibility and toward long-term indexed debt for those that do not.

Macroeconomists have long been concerned with the economic effects of changes in the allocation of the public sector's balance sheet between monetary and nonmonetary liabilities. This is the traditional domain of monetary policy. Analysis of the macroeconomic effects of changes in the structure of the government's nonmonetary liabilities—the composition of the public debt—has received much less attention.¹ This situation has recently begun to change, however, as issues such as fiscal credibility and the role of balance sheet effects in triggering macroeconomic fluctuations have gained prominence in policy discussions. As a result, macroeconomists have increasingly been attracted to investigation of the potential macroeconomic effects of public sector debt management.

This article provides an overview of the ways the structure of public debt can affect macroeconomic performance in emerging economies. Thus the article focuses

on the liability rather than the asset side of the public sector's comprehensive balance sheet. Asset composition is taken as given. The article considers the factors that the recent macroeconomics literature has identified as relevant for determining the optimal composition of the public debt and synthesizes them into some general guidelines for public debt management in emerging economies.

The first section evaluates the view that the objective of debt management should be to minimize the cost of debt service. Although reasonable from a normative perspective, and an objective in the debt management practices of many countries, it is too narrow in scope. Debt management should seek instead to achieve an optimal tradeoff among multiple and competing social objectives. The next section examines the conflict between the objective of minimizing debt servicing costs and the structural objective of promoting domestic financial development. It concludes that promoting financial development requires the government to eschew financial repression—a policy motivated by fiscal considerations—and instead to finance itself by selling securities on market terms, even if that raises debt servicing costs. This leads naturally to the issue of the optimal composition of such securities. The next three sections consider the choices between indexed and nominal debt, short-term and long-term debt, and domestic and foreign-currency debt. In all of these cases the government faces a similar fundamental tradeoff: between anti-inflationary credibility and robustness of the government's budget in the face of shocks.

The final section examines how the optimal choice among these tradeoffs is likely to be affected by country circumstances, thereby extracting some simple guidelines for debt management in emerging economies.

Minimizing Debt Servicing Costs as an Objective of Public Debt Management

A naive view of the optimal determination of the public sector's debt structure is that the composition of the government's liabilities should be chosen so as to minimize the costs of debt servicing. Although this objective may be naive, it is clearly not arbitrary, because it can readily be justified on welfare grounds.

To see how, consider a government whose objective is to maximize social welfare. A useful benchmark is the case in which the government has access to costless lump-sum taxation and all public debt is held domestically. In this case, servicing the existing stock of debt simply represents a nondistortionary transfer within the domestic economy from taxpayers to holders of government debt. A welfare-maximizing government would have no incentive to seek to minimize debt servicing costs.

However, if taxes are distortionary or costly to collect, raising the revenue required to service the debt imposes an “excess burden” on the economy (in the form of collection costs and deadweight losses associated with distortionary resource allocation effects) that can be reduced if debt servicing costs are minimized.² A reduction in debt service costs would increase social welfare, and minimizing such costs becomes a reasonable government objective.³ Under the assumption of full debt repayment, the incentive to reduce debt servicing costs in this case is further strengthened when at least some of the debt is held by foreigners. In that event the costs imposed by distortionary taxation are even less fully compensated by payments to domestic agents than when all debt is domestically held.

However, the single-minded pursuit of this criterion may have harmful consequences for the other social objectives that a welfare-maximizing government would tend to value. To see this most simply, note that the most direct way to minimize debt service costs is just to repudiate the entire stock of interest-bearing debt. Debt repudiation is, at least to some extent, (by definition) the only recourse for an insolvent government. But even a solvent government may have an incentive to repudiate. For example, the welfare-maximizing government described above could minimize the excess burden associated with distortionary taxes simply by opting not to pay its debt service obligations. Because creditors are aware of this incentive, sustaining an equilibrium with positive levels of debt means that repudiation must entail a cost that induces the government to continue to service its debt. For a welfare-maximizing government, this cost must take the form of a sacrifice of other welfare-enhancing objectives.

What might such other objectives be? The costs associated with debt repudiation are both direct and indirect. An obvious source of direct costs is the actions of creditors, who will appeal to the legal system to enforce their debt contracts and may be able to penalize the government for reneging on its obligations. Moreover, creditors’ ability to impose such costs may leave the status of the repudiated debt uncertain, creating a “debt overhang” problem that potentially distorts intertemporal relative prices in the domestic economy, to the detriment of macroeconomic performance.

Indirect costs of repudiation may arise through reputation effects. If governments that repudiate are subsequently unable to borrow, the cost of repudiation is the loss of market access. This implies the necessity to rely on tax and money finance. Full tax financing of government expenditures may increase the present value of the excess burden associated with the financing of a given program of exhaustive government spending (government spending on goods and services) if the excess burden associated with each dollar of tax revenue is an increasing function of the tax ratio (Barro 1979). Full tax financing, by causing tax rates to vary intertemporally with government expenditures, may also distort the intertemporal allocation decisions of economic agents by inducing them to redistribute their production and spending decisions over time. Moreover, it would involve raising tax rates during cyclical downturns and lowering them during booms, thus causing fiscal policies to

behave procyclically. Finally, full tax funding forces the current generation to bear the burden of public sector capital expenditures that will benefit future generations, thus violating the benefit principle of public finance.

Full tax funding thus involves unacceptable sacrifices of other valuable social objectives of efficiency, stability, and equity. The alternative of financing deficits by printing money runs the risk of subjecting the economy to high and unstable inflation. The increased transaction costs, and the instability of intratemporal and intertemporal relative prices that this entails, have adverse consequences for efficiency and equity that have always rendered pure money financing unacceptable.

In short, one reason that debt is not repudiated is that although it is costly to service debt, it may be even more costly not to do so. Welfare-maximizing governments do not routinely repudiate debt, despite the excess burdens associated with servicing it, because doing so entails an unacceptable sacrifice of the important economic objective of retaining market access. But nonrepudiation implies that governments will typically find themselves with a stock of financial liabilities that includes some interest-bearing debt. They then face the debt management problem of determining the composition of those liabilities so as to achieve desirable outcomes on a set of multiple—and possibly conflicting—social objectives.

Debt Management and Financial Development

With debt repudiation likely to be prohibitively costly under normal circumstances, governments typically seek to solve their debt management problem subject to the constraint that debt be serviced on schedule. This does not prevent the government from adopting the objective of minimizing public sector borrowing costs as the overriding consideration guiding its debt management policies, *subject to that constraint*. This would suggest choosing the composition of the debt to reduce its carrying cost to the greatest extent possible, leaving all other considerations aside. The incentive for a welfare-maximizing government to do so is the same as the incentive to repudiate debt: to minimize tax collection costs and the resource misallocations associated with distortionary taxation.

One obvious way to minimize debt servicing costs is to issue debt at below-market interest rates. The question, of course, is why anyone would choose to hold such debt, and the answer is that (by definition!) no one would. Thus the government would have to compel private agents to hold it. Strictly speaking, this is more akin to a form of taxation than to partial repudiation, because creditors know *ex ante* that they will be receiving below-market returns.

Various policies associated with financial repression have precisely this effect, including ceilings on deposit and lending rates, controls on capital outflows, public ownership and management of commercial banks, and reserve and liquidity requirements imposed

on private commercial banks.⁴ The effect of such policies is to create artificial demand for government securities, enabling the public sector to borrow at rates below those that would prevail if creditors had more choice in the assets they could hold.

However, although such policies may carry the benefit of reducing the government's financing costs, they also carry the important social costs of distorting resource allocation and impeding financial development. Distortions in the allocation of resources arise because the portfolio restrictions that policies of this type place on financial institutions compromise their ability to perform the financial intermediation function efficiently, preventing financial institutions from allocating the funds that the government absorbs to activities that offer higher returns. Moreover, the implicit tax that these restrictions place on the financial sector reduces the incentives for investment in formal financial intermediation, potentially favoring less efficient types of intermediation.

Financial development is impaired not only through this form of taxation but also because government financing through these means, as opposed to selling government securities in an open primary market, deprives the market of a benchmark for pricing risk in the domestic economy (in the form of a market-determined interest rate on relatively safe government securities) as well as of other means to aggregate and disseminate information through the pricing of securities (through the term structure, return differentials on nonindexed and indexed bonds, and so on).

These observations suggest that reducing debt servicing costs through financial repression is socially costly, and given the important role that recent research suggests that financial development can play in promoting economic growth, these costs may be quite large (Levine 1997).⁵ The message is that governments that place high value on promoting economic growth are likely to find it optimal to issue liabilities that promote financial development even though that increases their borrowing costs. From the standpoint of promoting the development of an efficient domestic financial system, it is preferable for the government to sell its securities in undistorted primary markets and to issue securities with diverse characteristics, to facilitate market processing of financially relevant information, than to place government obligations with financial institutions that are provided with artificial incentives to hold those obligations.

However, this prescription hardly begins to solve the problem of optimal debt management, because it leaves the government with many choices to make. For example, the government can issue securities that are denominated in nominal terms or that are indexed to the domestic price level, that are of short or long maturity, and that are paid in domestic or foreign currency. These choices are examined in turn.

Credibility and Hedging: Indexed or Nominal Debt

Assuming that government interest-bearing liabilities consist of securities that are issued in open markets and that are expected to be serviced on contractual terms,

should the government issue nominal debt (denominated in the domestic currency) or issue at least some share of its debt indexed to the domestic price level? The following section considers the role of optimal debt maturity; for now, all debt is assumed to be long-term debt.

Recent research has emphasized that the existence of a large stock of long-term nominal debt may have important macroeconomic consequences, even if the government's solvency can be taken for granted. These consequences help us understand the conditions that affect the optimal share of the government debt that should be indexed to the price level. The key issue concerns a tradeoff between credibility and robustness: between the government's anti-inflationary credibility and the avoidance of risks to the government's solvency or to the economy's welfare that can be caused by fluctuations in the government's financing needs.

Time Inconsistency

A potential consequence of a large stock of long-term nominal debt is that it may aggravate the time-inconsistency problems associated with monetary policy when the central bank lacks a precommitment mechanism. Time inconsistency arises when the sequence of policy choices that a government would make over some time horizon when it exercises discretion in each period are different from those that it would make over the same horizon if it could fully precommit its future behavior at the beginning.

Consider the simple framework pioneered by Barro and Gordon (1983). In this framework, if unanticipated inflation tends to increase the level of output and distortions in the economy make the "natural" level of output suboptimally high, a welfare-maximizing government that cannot precommit its future behavior (and thus that retains policy discretion in every period) may be tempted to generate "surprise" inflation in each period to move real output closer to its optimal level. That temptation is assumed to be restrained by social costs of inflation that increase nonlinearly.

The Barro-Gordon analysis shows that under these circumstances the equilibrium rate of inflation turns out to be suboptimally high and the level of social welfare suboptimally low compared with the case where the government could precommit its actions. The reason is that the government's attempt to generate surprise inflation must fail in a rational-expectations equilibrium in which the public understands the government's motivation.

Even so, the equilibrium rate of inflation must nonetheless be positive in this case, determined such that the marginal social benefits of inflation (which are constant) are equalized to the marginal social costs (which increase nonlinearly from an initial value of zero). Welfare must be lower in the discretionary equilibrium than in the nondiscretionary equilibrium in which the government can precommit itself to producing zero inflation, because the level of real output must be the same in both

equilibria, whereas the rate of inflation is higher in the discretionary case. The key point here, however, is that in the discretionary case the equilibrium rate of inflation is higher—and thus the loss of social welfare is greater—the greater the social benefit from inflationary surprises and the smaller the social cost of inflation.

The presence of long-term nominal debt affects this outcome by reducing the net social costs associated with inflation. Because the contractual interest rate on such debt is fixed, an increase in the rate of inflation that was unanticipated at the time the debt was incurred acts like a capital levy, reducing the real value of such debt. Thus, the existence of long-term nominal debt effectively increases the base of the inflation tax. This creates social gains arising from the fact that the reduced real value of the debt permits the government to reduce the level of taxation, decreasing tax collection costs as well as the resource misallocations associated with distortionary taxation. These gains partly offset the social costs of inflation. But because the net social costs of inflation are thus reduced, the government's incentive to act in a discretionary manner and to engineer an inflationary surprise is magnified. That in turn reduces the government's anti-inflationary credibility and increases the economy's equilibrium rate of inflation. Thus, the effect of a large stock of long-term nominal debt is to increase the magnitude of the social loss associated with the discretionary equilibrium (see Calvo 1991).

It is worth reiterating that this problem arises only when the government is not prevented from acting in a discretionary fashion by reputational considerations or by institutional mechanisms that prevent it from attempting to generate surprise inflation, such as participation in a currency board or currency union (see Alesina and Barro 2000). In addition, when such restraints are not present, the mechanism suggests that the loss of anti-inflationary credibility arising from the presence of nominal debt should be larger not just the larger the stock of nominal debt but also the greater the tax collection and distortion costs that the government has to incur to raise an additional unit of revenue, because the larger such costs, the greater the gain in social welfare from an inflationary erosion of the real value of nominal debt. In turn, the convexity of the tax collection cost function implies that these costs will be larger the larger the level of government spending to be financed. All of these considerations suggest that the magnitude of this credibility effect depends on a specific set of country circumstances.

How can this problem be alleviated? Taking as given the absence of institutional constraints on government discretion, the properties of its revenue system, the size of the expenditures to be financed, and the total stock of outstanding debt, debt management policies provide one solution. Calvo (1988), for example, suggests that the loss of credibility can be ameliorated by increasing the share of long-term debt that is indexed to the domestic price level, because the government's credibility problem is aggravated by the existence of long-term nominal debt. Indeed, the role of debt in aggravating time-inconsistency problems can be eliminated entirely by full indexation

of the debt. Notice that a government that is more likely to resist inflation than the public gives it credit for would find the issuance of indexed debt particularly attractive, because in addition to the credibility gains, issuing indexed debt would also reduce its debt servicing costs by lowering the real interest rates it would have to pay. (This assumes, of course, that the government has better information about its future intentions than the private sector does.) Thus, the objectives of increasing the government's anti-inflationary credibility and reducing its debt servicing costs both suggest that governments lacking anti-inflationary credibility should replace nominal debt with indexed debt.

These arguments suggest that the optimal share of long-term nominal debt in the portfolio of a government that retains discretion and lacks anti-inflationary credibility should be zero. Since reliance on indexed debt would eliminate the possibility of a "bad" (high inflation) equilibrium for such governments, the question that arises is whether governments in these conditions should ever choose to issue nominal debt at all.

Stabilization of Tax Rates across States of Nature

Bohn (1988) offers one reason why governments might still wish to issue nominal debt. Consider a world of uncertainty in which the government's budget is subject to random shocks. Suppose that markets are incomplete, in the sense that the government cannot structure its debt as state-contingent contracts with payoffs conditioned on the effects of shocks on the government's budget (such contracts would promise larger payoffs to creditors when shocks are favorable and smaller ones when they are unfavorable). Shocks to the government's budget would then require offsetting discretionary changes in tax revenues—either in the present or in the future.

If, as assumed earlier, raising tax revenue by altering tax rates is subject to convex costs (the marginal cost of raising tax revenue increases with the tax rate), then the variability of tax rates across states of nature associated with these shocks would tend to increase the *expected* burden of distortionary taxes and thus reduce economic welfare, just as varying tax rates across time would. (Indeed, if the government's budget is sufficiently vulnerable to shocks, and the variability of potential shocks is sufficiently large, the social costs of raising the required revenue in the face of an adverse shock may be large enough to trigger an optimal default.) Thus organizing the government's finances so as to equalize expected tax rates across states of nature is a desirable goal.

What does this have to do with the structure of the government's debt? Suppose that in an attempt to minimize time-inconsistency problems, all debt is indexed to the price level, as suggested. Although this might reduce the government's incentive to try to engineer inflationary surprises, in a world of uncertainty it does not guarantee

that unexpected inflation will not occur (for example, as a result of shocks to the demand for money). Suppose that unanticipated inflationary shocks give rise to positive correlations between the price level and the government's *real* financing needs. This might happen because the shocks reduce income levels and thus tax revenues, because taxes are defined in nominal terms or paid with a lag so that as the price level rises their real value declines (known as the Olivera-Tanzi effect). Or it might happen because the shocks represent unexpected changes in government spending, as in the case of wars or natural disasters.⁶ If the shocks do give rise to positive correlations between the price level and the government's real financing needs, the additional revenue that would have to be raised through distortionary taxation would be greater the greater the extent to which the government's debt is indexed to the domestic price level. Indeed, under such shocks, fully indexed debt would have the effect of maximizing the variability in the government's financing needs and thus of increasing the average distortionary effects of taxation, relative to a situation in which some portion of the debt is nominal.

Bohn's (1988) observation is therefore that with uncertainty and incomplete markets, nominal debt can provide the government with a valuable hedge and be welfare improving by reducing the excess burden of higher tax revenues required to finance a given plan of exhaustive public spending. If changes in the price level are positively correlated with changes in the government's financing needs, an increase in the price level would reduce the real costs of servicing the debt just when the government's financing needs are increasing, whereas a reduction in the price level would increase the real burden of servicing nominal debt just when the government can most afford it. Thus, having some nominal debt helps stabilize tax rates across states of nature, which is welfare improving. Of course, this benefit would need to be offset against the adverse credibility effects described previously, but because such effects would tend to disappear when the stock of nominal debt is zero, in general this argument would justify at least some positive level of nominal debt, even for governments with imperfect anti-inflationary credibility.

The Optimality of Nominal Debt

These arguments indicate the tradeoffs that the government faces in choosing the optimal composition of debt between indexed and nonindexed liabilities. It can enhance its anti-inflationary credibility by opting for a larger share of indexed debt, but only at the expense of greater budget vulnerability to certain types of shocks, thus making the economy more susceptible to the distortions associated with variability in tax rates across states of nature and possibly increasing the likelihood of default. In short, the tradeoff is between anti-inflationary credibility and the robustness

of the government's budget in the face of shocks. What considerations should govern this choice?

First, as already argued, a critically important factor is the extent to which the government can independently precommit its future actions. The greater the amount of precommitment possible, the greater the hedging benefit of nominal debt relative to its credibility cost. Thus, a greater ability to precommit (say, because of participation in a currency board or monetary union) suggests a lower optimal degree of indexation and therefore a larger optimal share of nominal debt. In the limit, if the government can fully precommit, there is no credibility benefit to indexation. In this case if positive inflation shocks have adverse effects on the budget, hedging considerations favor the issuance of nominal debt.

Second, the choice depends on the magnitude of the social costs of inflation. The higher the social costs of inflation, the more important it is to avoid the discretionary outcome and thus the larger the optimal share of indexed debt.

Third, given an incomplete ability to precommit, the costs associated with a larger share of nominal debt (a lower degree of indexation) depend on the additional incentives that a larger share creates at the margin for the government to turn to inflation. Thus the optimal degree of indexation should increase with the level of debt, because a given increment to inflation has a larger positive budgetary impact the larger the stock of nominal debt.

Fourth, as mentioned, the tradeoff depends on the relative empirical importance of shocks that give rise to a positive correlation between the government's financing needs and the price level, compared with those that do not.⁷

Fifth, it depends on the variability of the shocks just described. The correlation between the government's financing needs and the price level depends both on the frequency with which such shocks arise relative to other types of shocks and on their magnitude when they do arise. The greater the variance of shocks, the greater the excess burden associated with raising a given expected level of taxation, and the more valuable the hedge provided by nominal debt.

Finally, the severity of the excess burden associated with higher tax rates has an ambiguous theoretical effect on the choice between nominal and indexed debt. The greater the excess burden associated with higher tax rates, the greater the incentive for the government to rely on the inflation tax and the smaller the government's anti-inflationary credibility, implying larger credibility gains from the use of indexed debt. However, a more distortionary tax system also magnifies the costs associated with variations in tax rates across states of nature, which tends to increase the hedging benefit associated with nominal debt.

The upshot is that the tradeoff between credibility and robustness that the government faces in choosing between nominal and indexed debt depends on characteristics of the domestic economy. Theory can pin down what these are, but it does not suggest that either type of debt is superior to the other under all circumstances.

Short-Term versus Long-Term Nominal Debt

The previous section considered the tradeoff between nominal and indexed debt, holding the maturity of the debt constant. Leaving aside for now the possibility of indexing the debt, and thus taking all debt as nominal, this section turns to the choice between short-term and long-term nominal debt.

As will become clear, the choice between short-term and long-term debt involves a tradeoff between the government's anti-inflationary credibility and the robustness of its budget, just as is true in choosing between nominal and indexed debt. Short-term nominal debt may not be as effective as long-term indexed debt in projecting credibility, and it leaves the government vulnerable to different types of risk than does indexed debt. In particular, although short-term nominal debt may protect the government's finances from the inflation shocks to which indexed debt makes it vulnerable, it exposes the government to real interest rate and rollover risks.⁸ In addition, the existence of a large stock of short-term debt may constrain monetary policy when the government's solvency is perceived to be precarious. Through that channel it may also render an economy that operates with an officially determined exchange rate vulnerable to self-fulfilling currency crises.

Anti-Inflationary Credibility versus Robustness

Why do governments borrow in the short term? In a world of asymmetric information and moral hazard, creditors lend at short maturities to monitor and control borrowers. Creditors see the recurrent capacity to repay loan principal as a sign of continued solvency, and they use the threat of withdrawing funds or renegotiating at much higher interest rates as disincentives for borrowers to behave in ways that undermine the creditors' interests. Thus when information and moral hazard problems are acute, short-term loans will be relatively cheap compared with long-term loans. Under these circumstances, the objective of minimizing borrowing costs will tempt governments to opt for short-term financing.

The second reason governments may choose to borrow in the short term is to enhance their anti-inflationary credibility. Unlike the case with long-term debt, with short-term debt the interest rate is continuously renegotiated, so creditors can adjust the contractual interest rate to compensate for the effects of anticipated inflation in reducing the real values of their claims. This means that, unlike with money and long-term nominal debt, the government may not be able to regard its short-term liabilities as part of the inflation tax base, and this would tend to reduce the incentive to renege on inflationary commitments that gives rise to the time-inconsistency problem. Thus, governments may issue short-term debt to "tie their hands" and remove the temptation to inflate that arises from a large inflation tax base. In this way, governments can enhance the credibility of their anti-inflationary commitments.

Short-Term Debt and Time Inconsistency. Just how effective is short-term debt in enhancing credibility? At least two reasons have been proposed for doubting its effectiveness. The first is that government may be able to tax short-term debt with inflation, even if the public can anticipate it. The second is that the existence of short-term debt can make the economy vulnerable to multiple equilibria, with the “bad” equilibrium characterized by low credibility and high inflation.

Concerning the first argument, the key point is that the government can use an increase in anticipated inflation to “tax” short-term debt if the increase is associated with a reduction in the equilibrium value of the real interest rate—if the nominal interest rate on such debt does not fully adjust to an increase in expected inflation. In a financially open economy, under officially determined exchange rates, Calvo (1989) notes that the central bank may be able to use monetary policy to engineer an increase in the inflation rate that exceeds its preannounced rate of exchange rate depreciation, causing the real exchange rate to appreciate and the real interest rate to fall. The government would thus be able to erode the real value of short-term debt by increasing the rate of inflation.

Turning to the second argument, Calvo (1988) posits that the existence of nominal debt with an interest rate that is responsive to expected inflation (as would be true of short-term debt) makes the government vulnerable to “confidence crises” that can result in high-inflation equilibria. The mechanism is as follows. The government’s incentive to inflate in the absence of precommitment depends on the extent to which it can reduce other forms of distortionary taxation by doing so. That is influenced by the size not only of the inflation tax base (which determines the revenue from inflation) but also of the budget gap, which will determine the benefits from inflationary taxation (recall that if the distortionary costs of tax revenues are a convex function of the size of revenues, these costs will increase with the size of the budgetary gap to be filled). Thus the temptation to inflate is an increasing function of the debt service payments to which the government is obligated. That means that it depends both on the interest rate and on the size of the nominal debt.

But if creditors believe that some of the real value of short-term debt may be eliminated through inflation, they will demand a yield premium that compensates them for expected inflation and the attendant risk. This will itself increase the government’s debt service obligations and thus its incentive to inflate. The positive dependence of the incentive to inflate on the value of the nominal interest rate and of the nominal interest rate on the perceived incentives for the government to inflate create the possibility of multiple, self-fulfilling equilibria. That is, the high nominal interest rates caused by a lack of confidence may induce the government to inflate the debt away. Thus two equilibria could arise: a good equilibrium with low inflation and low nominal interest rates and a bad equilibrium with high inflation and high nominal interest rates. The implication is that short-term debt maturities may make a high-inflation equilibrium more rather than less likely.

Risk Exposures with Short-Term Debt. The credibility problems just examined arise from the government's actual or perceived ability to generate endogenously an increase in the rate of inflation without a commensurate increase in the interest rate that it has to pay on its short-term debt—or, put differently, from its actual or perceived ability to reduce the real interest rate on such debt. But real interest rates on short-term debt may also fluctuate for exogenous reasons (such as from changes in country risk premia associated with international contagion), and such real interest rate movements, like price-level shocks in the case of indexed debt, may induce sub-optimal variability in tax rates. Thus short-term debt may (or may not, as shown) enhance the government's anti-inflationary credibility. But to the extent that it does so, this benefit comes at the cost of exposing the budget to a new type of risk: the risk associated with market fluctuations in real interest rates.

However, matters may be worse than that. Alesina and others (1992) note that a large stock of short-term debt can create vulnerability to self-fulfilling confidence crises in which otherwise solvent governments default on their debt obligations. To see how this can happen, recall that what creates the possibility of a bad equilibrium in the Calvo framework is the government's reluctance to make the fiscal adjustment required to meet a crisis-driven increase in debt service requirements because of the social costs associated with raising the requisite tax revenue. The Alesina and colleagues model relies on a similar mechanism: the convexity of tax collection costs. That convexity means that the cost of raising an incremental amount of public revenues rises as with the amount of revenues the public sector has to raise.

Consider how this affects government decisions on the servicing of short-term debt. As long as creditors are willing to roll over any short-term debt coming due on the same terms, the government does not have to raise additional revenue to service the debt. But if creditors increase the real interest rate on debt they agree to roll over, or if they refuse to roll over the debt, the government can continue to service the debt only by increasing tax revenues, either in the future (if creditors increase the interest rates that they demand to roll over the debt), or in the present (if creditors refuse to roll over any debt). The key question is whether the government will continue to service the debt on schedule when it has to raise more of its own resources to do so.

The answer depends on the impact that higher real interest rates or a refusal to roll over would have on the incremental revenues that the government has to raise. Because interest rates are free to adjust and principal payments are higher, the shorter and more bunched debt maturities are, the more sensitive the need for incremental revenues will be to any increases in rollover costs or to a refusal of new lending. Thus the shorter and more bunched debt maturities are, the more likely the government is to refuse to raise the revenues required to service the debt in the event of an increase in interest rates required to roll over the debt or a refusal of new lending.

Of course, if the government is perceived as unlikely to honor its debt obligations, creditors will be reluctant to take on its short-term liabilities. That means that a

reluctance by creditors to roll over debt for fear of default can be self-fulfilling: when creditors become unwilling to roll over short-term debt the government is more likely to default, because it would then be called on to make payments out of resources that would be too costly for it to raise. Thus a short maturity structure of the public debt may increase the likelihood of a confidence crisis on the debt: the shorter and more concentrated the debt maturities, the greater the government's vulnerability to confidence crises. In this case, such crises take the form of debt runs. The well-known case of Mexico's tesobono obligations in the first quarter of 1995 provides a dramatic example of such a debt run (see Sachs and others 1996).

Giavazzi and Pagano (1990) summarize these results by noting that the likelihood of a Calvo-style bad equilibrium depends on three things: the size of the public debt, its maturity structure, and the time pattern of maturing debt. The logic, as already explained, is that if a substantial amount of debt has to be serviced at a point in time, and if a confidence crisis breaks out at that moment (say, fear of a repudiation or a devaluation), the treasury would have to refinance a large portion of its debt on unfavorable terms. The welfare cost of doing so would be high, and thus the likelihood that the government will repudiate is greater. This makes the confidence crisis more likely to happen. Giavazzi and Pagano argue that under these circumstances, good debt management calls for the issuance of long-term indexed debt to push the economy to a good equilibrium because such debt cannot be monetized away and does not create large short-run amortization obligations.⁹

Short-Term Debt and Monetary Policy

When the government maintains a large stock of short-term debt, the sensitivity of the government's budget to changes in interest rates can affect macroeconomic stability in indirect ways as well as by increasing vulnerability to debt runs. When the stock of interest-sensitive short-term debt is large and the government's solvency is precarious, the adoption of tight monetary policy carries the risk of triggering fiscal insolvency by increasing the government's debt servicing costs. The central bank will thus be constrained from adopting policies that it might otherwise have found necessary to stabilize the economy in response to shocks.

This is bad enough under floating exchange rates, because one of the virtues of floating is to allow scope for an independent monetary policy in response to shocks that are asymmetric with those of a country's trading partners. This constraint essentially renders such scope asymmetric, permitting monetary policy to act when expansionary policies are called for, but not (or at least only to a limited extent) when contraction is indicated.

But under officially determined exchange rates, this constraint can be a recipe for severe macroeconomic instability by making the economy vulnerable to self-fulfilling currency crises. The logic of second-generation models of currency crises suggests

that in assessing the sustainability of an exchange rate peg, speculators evaluate the benefits and costs to the central bank of sustaining a high interest rate defense of the peg. When speculators perceive that the costs to the central bank of sustaining a high interest rate defense exceed the benefits of sustaining the peg, they will judge the prospects for a successful attack to be good, and that will make an attack more likely. Because the vulnerability of the public sector's solvency to high interest rates is precisely the type of factor that would be perceived by the central bank as making the costs of sustaining a high interest rate defense unbearably high, the combination of a large stock of short-term debt with a precarious fiscal position greatly increases a country's vulnerability to a successful speculative attack.

This issue is of more than academic interest. Observers judge it to have played a key role in some of the more important currency crises of the 1990s. In the 1999 Brazilian crisis, for example, fiscal vulnerabilities associated with short-term government debt seem to have played an important role in inducing the government to float the real, despite the key role that the exchange rate peg had played in the Real Plan's exchange rate-based inflation stabilization since 1994 (Razin and Sadka 2004).

Domestic-Currency versus Foreign-Currency Debt

Choices between nominal and indexed debt and between short-term and long-term nominal debt imply tradeoffs between anti-inflationary credibility and the robustness of the government's budget. In the case of short-term debt, macroeconomic stability is also affected by the potential constraints imposed on an independent stabilization instrument, monetary policy.

This section turns to the choice between domestic-currency (nominal) debt and foreign-currency debt. As in the previous cases the choice involves a tradeoff between anti-inflationary credibility and budget robustness. As in the other cases, the type of vulnerability created in the government's budget is specific to the type of debt instrument adopted to increase anti-inflationary credibility. As in the case of short-term debt, the existence of a large stock of foreign-currency debt may impose constraints on the actions of the central bank when the government's solvency is at risk. But in this case the constraint is on exchange rate policy rather than on monetary policy. Finally, there is an interesting interaction between the analysis of the implications of short-term debt and those of foreign-currency debt. This section takes up each of these issues in turn. Because the basic analysis is now familiar, the discussion will be brief.

Credibility versus Robustness

As is true of indexed and short-term debt, the government can use the issuance of debt denominated in foreign currency as a tool for gaining credibility, on the

assumption that such debt cannot be inflated away. But as with short-term debt, this assumption is questionable. With short-term debt, the government could in effect tax away some of the real value of the debt through inflation if its actions succeeded in reducing the real interest rate. Similarly, inflationary erosion of the real value of foreign-currency debt is possible if nominal shocks succeed in appreciating the real exchange rate. Under officially determined exchange rates, one-time shocks to the domestic price level can indeed succeed in doing so, at least temporarily until the real exchange rate returns to its equilibrium value. But this opportunity to reduce the real value of foreign-currency debt through domestic inflation may not undermine the government's anti-inflationary credibility if the public believes that the government will be unwilling to countenance the associated real exchange rate appreciation. Under these circumstances denominating debt in foreign exchange may enhance the government's anti-inflationary credibility.

However, any such gain in credibility comes at a cost: the assumption by the government of exchange rate risk. A real exchange rate depreciation triggered by independent events will increase the government's debt servicing costs and thus potentially subject the economy to undesirable fluctuations in distortionary taxes or, in the extreme, to the consequences of a government default, as in Argentina in 2002 (Mussa 2002; Serven and Perry 2004). The story, then, is the same as before. What changes in this case is the type of risk exposure undertaken by the government in its attempt to gain credibility.

It is worth noting that as in the case of indexed and short-term debt, foreign-currency debt is likely to be cheaper than domestic-currency debt, precisely because the government, and not its creditors, takes on the foreign-currency exposure and attendant risk. This is particularly important when the government lacks nominal credibility, causing creditors to assess the risk of future exchange rate changes as being high. This situation tends to increase the government's relative cost of borrowing in domestic currency. The supply price of domestic-currency funding is particularly high from creditors with substantial foreign currency exposure, such as external creditors. In the limit, such creditors may demand such a high price for domestic currency lending that no such lending would be forthcoming from them. (Eichengreen and Hausmann 1999 dub this situation "original sin" and consider it a structural characteristic of external borrowing by developing countries.) The net effect is to increase the relative cost of domestic-currency borrowing, because such funds would be forthcoming only from domestic creditors. Other things being equal, this would tend to shift the optimal composition of the government's liabilities toward foreign-currency debt. Thus, the objective of minimizing borrowing costs is likely to once again align itself with that of enhancing anti-inflationary credibility to induce reliance on foreign-currency debt.¹⁰

But how large is the particular type of risk exposure induced by foreign-currency debt likely to be for the government? It is easy to see that the answer would tend to

depend on the currency composition of the government's finances, on the probabilities associated with exchange rate changes, and on the expected magnitude of such changes if they occur. Clearly, if the government holds a large stock of foreign-currency assets (such as foreign exchange reserves) or if a large component of its revenues is indexed to the exchange rate (say, if the government derives substantial revenues from the country's export earnings), the government can sustain a correspondingly large stock of foreign-currency debt without exposing itself to exchange rate risk. Similarly, the risk exposure associated with foreign currency debt may not be inordinately high if the risk of exchange rate movements is slight (because the government maintains a credible hard peg, for example, or because the possible conditions that would render a self-fulfilling speculative attack more likely to succeed—such as a high degree of capital mobility—do not hold).

Foreign-Currency Debt and Exchange Rate Policy

As mentioned, the presence of a large stock of foreign-currency debt is also likely to affect macroeconomic stability indirectly, through its effects on the central bank. Under floating exchange rates, this creates an asymmetry in the conduct of monetary policy, because the central bank has an incentive to resist currency depreciation but not appreciation. The constraints imposed on exchange rate flexibility in developing economies by the existence of a large stock of foreign currency-denominated debt have been emphasized in the “fear of floating” literature (Calvo and Reinhart 2002).

Blanchard (2004) describes a more complicated mechanism through which a large stock of foreign-currency debt can impede the use of monetary policy for inflation targeting. This mechanism relies on the interaction between short-term (or variable-interest) debt and foreign-currency debt. When government debt is short-term or variable-interest, a change in domestic interest rates will affect the government budget, as discussed. An increase in domestic interest rates in response to an anticipated increase in inflation by an inflation-targeting central bank may thus increase default probabilities for government debt. In turn, this requires an exchange rate depreciation to maintain balance of payments equilibrium. However, when the government's stock of foreign-currency debt is high, this depreciation further increases the default probability, which magnifies the required exchange rate depreciation. This depreciation has the effect of increasing expected inflation, rendering tight money an ineffective means to control inflation. The suggestion is that controlling inflation under these conditions calls for a fiscal response.

Under “soft” exchange rate pegs, on the other hand, what is constrained when the stock of foreign-currency debt is high and the government's solvency is precarious is the central bank's exchange rate policy, rather than its monetary policy. Under these conditions, the central bank will have a strong incentive to avoid a devaluation or a regime switch that would result in a substantial depreciation of the currency.

Again, the issues discussed in this section have been of tremendous practical importance among emerging economies. Not only did fiscal vulnerability to exchange rate movements as a result of large stocks of foreign currency debt contribute to the government insolvencies associated with the Latin American debt crisis of the 1980s, but some observers have also blamed a large stock of contingent government liabilities that were essentially indexed to the exchange rate for triggering the Asian financial crisis of 1997 (Burnside and others 1998). Less dramatically, Blanchard (2004) provides evidence that the mechanism described in the previous paragraph was operative in constraining the Brazilian Central Bank from raising real interest rates in the face of an increase in expected inflation in late 2002.

Short-Term Foreign-Currency Debt

It is worth noting an important potential interaction between short-term debt and foreign-currency debt: the debt run outcome as a potential risk incurred by a government carrying large amounts of short-term debt may actually be much more likely when this debt is denominated in foreign currency. To see why, notice that the government may always avoid defaulting on short-term debt denominated in domestic currency in the event of a run simply by printing money, as long as it is willing to live with the resulting inflation. In other words, when short-term debt is denominated in domestic currency, the government at least has a choice between default and inflation. No such choice is available when short-term debt is denominated in foreign currency. Because the government cannot print foreign currency, if its liquid reserves are insufficient to pay off the creditors who “run,” it faces only the choice of resorting to distortionary taxation or defaulting.

Guidelines for Public Sector Debt Management

What do we learn from all of this about management of public debt in emerging economies? This section draws out some general principles suggested by the preceding analysis.

The appropriate conduct of fiscal policy implies that there will be times when for tax-smoothing, countercyclical, or intergenerational equity reasons, it will be optimal for the government to borrow. Preserving this option means that the debt can be repudiated only when such an action does not permanently impair the government’s capacity to borrow—in other words, only under exceptional circumstances that are clearly outside the government’s control or in the context of a clearly identified and credible regime change. This means that debt service payments will inevitably exert a claim on the resources of most emerging economy governments.

Because raising the resources to service debt is costly, and the marginal cost of doing so is likely to increase the larger is the volume of resources that have to be raised, managing the composition of the debt to minimize debt service costs is justifiable from the perspective of a welfare-maximizing government. However, single-minded pursuit of this objective could be socially harmful if it imperils other, equally worthy social objectives. Reliance on financial repression to reduce debt servicing costs is a clear example. The static and dynamic efficiency gains that are sacrificed when financial repression stunts the development of the domestic financial system suggest that this is a socially extremely harmful way for the government to seek to reduce the costs of meeting its financing needs. The implication is that the government should finance itself by issuing securities that are sold on market terms. The objective of promoting financial development suggests that the government should issue a diverse set of securities in order to facilitate information aggregation and dissemination in financial markets.

These broad principles, however, leave the optimal composition of this diverse set of securities unspecified. In principle, such securities could be of varying maturities and could be denominated in domestic currency or indexed to the domestic price level or to the exchange rate (denominated in foreign currency). An important consideration in making these choices concerns their impacts on the government's anti-inflationary credibility. A government that lacks the ability to precommit its future actions (or those of its successors) will face a time-inconsistency problem that could be aggravated by the issuance of long-term nominal debt, because debt issued in that form essentially increases the base of the inflation tax.

Under these conditions, the government may therefore find it advantageous to issue debt in a form that is less susceptible to taxation through inflation— indexed debt, nominal debt with short maturities, or debt denominated in foreign currency. Because these types of debt provide creditors with more information and control (in the case of short-term debt) or protect them from the risks of inflation or devaluation (indexed debt and foreign-currency debt), it is likely to be cheaper than long-term nominal debt. Thus, the objective of enhancing credibility is likely to dovetail with that of reducing the government's borrowing costs. (Indeed, as shown earlier, when nominal credibility problems are extreme, the implications for the cost of domestic-currency borrowing may even preclude such borrowing entirely, in practice leaving some developing economies no choice but to borrow in foreign currency or not at all.)

However, the enhancement of credibility and reduction in borrowing costs associated with eschewing long-term domestic-currency borrowing come at a price: that of increasing the government's vulnerability to price level increases, real interest rate shocks, or exchange rate shocks. Moreover, when the government's solvency is at issue, excessive reliance on short-term debt or foreign-currency debt may severely constrain the actions of the central bank. Thus, the question becomes how to optimize these tradeoffs.

The answer, of course, requires a careful calculation of the benefits and costs associated with each option under a country's particular circumstances. For example, the credibility gains to the government from avoiding the issuance of long-term nominal debt may be significant only when the government otherwise lacks the ability to commit itself credibly not to inflate such debt away. Such anti-inflationary credibility will be lacking when the government actually retains the discretion to use the inflation tax (under a soft exchange rate peg or a float), when it lacks credibility on other grounds (as when it has not previously invested in a reputation for resisting incentives to act in a discretionary fashion), and when its revenue needs are high and conventional taxation is highly distortionary. In combination with a large stock of nominal long-term debt these factors would make a high-inflation discretionary outcome likely. Thus, a government with these characteristics that wants to achieve a low-inflation outcome in the future would have a strong incentive not to issue long-term nominal debt.¹¹

In other words the existence of long-term nominal debt is only one factor in the government's decision to devalue or inflate. Creditors can rationally expect the government to forgo the option to inflate away the real value of their assets if the government is institutionally unable to do so (through participation in a currency board or currency union, for example), if it is perceived as placing a high value on the credibility of its policy announcements, or if inflating creates few net benefits from the government's perspective, because the conventional taxes that are avoided by using the inflation tax are not highly distortionary.

Thus, a government can expect to achieve few credibility benefits from avoiding long-term nominal debt if it has previously created institutions that limit its inflationary discretion (for example, by creating an independent central bank that is explicitly committed to an inflation target), if it has established a reputation for nondiscretionary behavior, and if it has chosen levels of expenditure and has mobilized sources of taxation that tend to minimize distortions. Because the additional credibility gains achievable by forgoing long-term nominal debt would tend to be small under these circumstances, avoiding vulnerability becomes relatively more important. Thus, optimal debt management would suggest heavy reliance on long-term nominal debt.

If these conditions do not hold, then optimal debt composition shifts toward indexed, short-term, or foreign-currency debt. How should governments choose among these as credibility-enhancing devices?

The arguments presented herein suggest that short-term debt may have important deficiencies because it may be vulnerable to the inflation tax, may give rise to multiple equilibria, and makes the government vulnerable to real interest rate and rollover risk. Thus, it is hard to make a strong case for short-term debt as a credibility-enhancing device when other means to enhance credibility are available. But short-term debt is preferred by creditors who face informational asymmetry and moral hazard problems, so the best case for incorporating short-term debt into the government's liability portfolio is to enable the domestic financial market to accumulate and

disseminate information about the risk-free interest rate. In this role, however, the stock of short-term debt should be small enough not to jeopardize the government's solvency should interest rates spike and not to expose the government to excessive rollover risk. Solvency will obviously depend on the strength of the government's finances, whereas rollover risk will depend on its ability to avoid bunching in short-term debt maturities, its capacity to repay the principal on short-term debt out of liquid assets or current revenues, and its access to quickly disbursing nonmarket sources of short-term finance in adequate amounts.

These arguments suggest that the brunt of the credibility-enhancing burden (if one exists) should fall on long-term indexed and foreign-currency debt. Assuming them to be equally effective in enhancing credibility, the question becomes which one minimizes vulnerability to unexpected shocks. The currency composition of the government's financial assets, contingent liabilities, and budget plays an important role. If the government has minimal foreign-currency assets, large contingent liabilities in foreign currency, and its revenues are not particularly sensitive to exchange rate changes, then incurring a substantial amount of foreign-currency debt would create a currency mismatch in the government's comprehensive balance sheet that would leave it heavily exposed to exchange rate risk.¹² Coupled with the likelihood that nominal exchange rates will fluctuate more than the average price level, particularly in emerging economies maintaining a floating exchange rate, the possibility of such mismatches is likely to make the government's net worth substantially more sensitive to changes in the exchange rate than to changes in the price level.

Thus, the use of foreign currency-denominated debt instead of indexed debt as a credibility-enhancing device is likely to have relatively larger impacts on the government's vulnerability to shocks. If so, then for governments that lack anti-inflationary credibility, long-term indexed debt would appear to dominate foreign-currency debt as a credibility-enhancing device.

In short, the optimal composition of the government's debt depends on a country's circumstances. Although governments should generally finance themselves at market rates using a variety of securities, the optimal composition of those securities should be heavily weighted toward long-term nominal debt for governments that have anti-inflationary credibility and toward long-term indexed debt for those that do not.

Notes

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1. Prominent exceptions are a number of papers written several decades ago by Tobin (1971) and Brunner and Meltzer (1976).

2. Debt servicing can obviously be financed by reducing spending or raising tax revenues. Following the literature, this article takes the level of spending as given and focuses on taxation. As long as public

spending is productive and subject to diminishing marginal returns, the welfare arguments in the text would be unchanged if the government responded to changes in its debt servicing needs by adjusting spending rather than revenues.

3. This is essentially the basis for the “tax smoothing” argument that underlies the neoclassical perspective on optimal debt management (see Barro 1979).

4. The classic descriptions of financial repression are by McKinnon (1973) and Shaw (1973). For some empirical estimates of the implicit taxes that governments have collected through these means see, for example, Giovannini and De Melo (1993).

5. For recent reaffirmations of the empirical strength of the finance–growth link despite the econometric challenges in establishing it, see the surveys by Wachtel (2003) and Levine (2004).

6. It is easy to see that the importance of such shocks depends in part on the structure of the government’s budget as well as on that of the economy, because the structure of expenditures and revenues and the other macroeconomic effects of the shock will jointly determine the sensitivity of the government’s primary balance to shocks that give rise to changes in the domestic price level.

7. Not all shocks have this effect. For example, as Bohn (1988) points out, monetary shocks would tend to cause unanticipated changes in interest rates and the price level to be negatively correlated. Nominal debt in that case would tend to increase the variability of tax rates across states of nature, because opposite movements in interest rates and price levels would tend to reinforce their effects on the real value of debt service payments.

8. The role of long-maturity variable-interest debt (long-maturity debt with flexible interest rates indexed to market rates) is not considered here. Such debt exposes the government to interest rate risk but not rollover risk. In the case of variable-interest debt, exposure to interest rate risk depends on duration (how frequently the interest rate on the debt is adjusted to market rates) rather than maturity.

9. As shown, however, such a debt management strategy would leave the government vulnerable to inflationary shocks that are associated with increases in the government’s financing needs.

10. In the limit, if the government’s nominal credibility problems or the degree of development of domestic financial markets is such that the government is unable to issue domestic-currency debt to either domestic or foreign creditors, “original sin” would remove the currency composition dimension of the debt management problem: if the government seeks to borrow at all, it must do so in foreign currency.

11. The international evidence suggests that governments are indeed reluctant to issue long-term nominal debt when they lack credibility, presumably reflecting the combined effects of a desire to enhance credibility and to reduce debt-servicing costs. For an application in the context of inflation stabilization, see Missale and others (1997).

12. For a discussion of the use of public debt management to hedge the risk associated with contingent public sector liabilities, see Becker (1999).

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