The troublesome debts of a number of developing countries have spawned a large literature on why countries borrow, on the extent to which debt contributes to growth, on why countries repay, and on how debt problems should be handled. This article provides a basic introduction to some issues in sovereign debt. First, it presents the basic accounting concepts associated with debt. Second, it treats debt as a component of the intertemporal maximization of a borrower in a competitive loan market facing an intertemporal budget constraint. Third, it introduces debt into recent models of endogenous growth and examines what these models imply about the relationship between debt and growth. Fourth, it discusses issues arising from sovereign risk. Fifth, it examines incentives to repay. Sixth, it reviews the various options available to a creditor facing a debtor unwilling to meet current debt service obligations. Seventh, it examines debt buybacks.

The recent debt problems of a number of developing countries, and the potential demand for foreign capital by former socialist countries, raise several questions about the role of debt in economic development and growth. This article provides a basic analytic introduction to some of the issues raised by foreign borrowing, especially foreign borrowing by sovereign governments from private creditors.

I focus on three broad questions: Why do countries borrow, and what does borrowing contribute to growth? Why should sovereign debtors repay their debts? How are repayment problems best dealt with?

The article is not meant to be a survey of the literature: several issues are ignored, and many important contributions are unmentioned. Rather, I have tried to identify areas in which recent analytic developments may provide useful tools, or at least food for thought, for the applied economist; points that are likely to present pitfalls; and topics on which existing literature seems to have generated confusion. I have then attempted to provide rudimentary frameworks.


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for applying existing analytic tools to applied problems, to show where traditional analysis can lead one astray, and to clarify what I find to be misleading or confusing points in the literature.

Section I presents some basic accounting distinctions. Section II discusses debt as part of the intertemporal maximization problem of a debtor country and introduces the intertemporal budget constraint and the transversality condition on borrowing. Section III then considers borrowing in a recent class of optimizing growth models in which the rate of growth is endogenous. Here the focus, as in the much earlier "two-gap" literature, is on the relation between debt and growth, but the methodology is quite different. I consider two particular contributions to this literature, one by Uzawa (1965), which is elaborated on by Lucas (1988), and one by Cohen (1991), and I point out what these models imply about the effect of foreign capital-market conditions on growth.

Sections II and III consider debt in a world in which debt contracts with sovereign debtors are automatically and costlessly honored; as long as a nation has the resources to pay its creditors what it owes, it does so. Sections IV and V consider problems that arise from a sovereign government's potential inability to appropriate domestic resources to service debt or from its unwillingness to service debt. Section IV discusses four particular issues: the "public finance" problem (the excess burden associated with taxing domestic resources to repay debt), the "liquidity" problem, the "enforcement" problem, and the "information" problem. Section V considers what incentives a sovereign debtor has to service its debt and what these incentives imply about how much debt it can sustain. A particular issue is whether a nation's desire to maintain a "reputation for creditworthiness" can in itself provide enough incentive to service debt, a point about which there has recently been a great deal of confusion.

Sections VI and VII consider how creditors should deal with nonpayment. In section VI, I review the options facing creditors whose sovereign debtors are not paying what they owe and also discuss debt relief, the role of official lenders, and the notions of a "debt overhang" and the "debt Laffer curve." In section VII, I turn to "market-based" debt reduction schemes, such as swap arrangements and debt buybacks. Section VIII provides conclusions.

I. SOME BASIC CONCEPTS

Some simple distinctions among the various stocks and flows associated with debt should be made. Starting with stocks, one distinction is between disbursed and undisbursed debt, the latter consisting of commitments made by lenders that have not been drawn upon and therefore are not yet accumulating interest. Part of disbursed debt is interest arrears, which are accumulated unpaid interest obligations. Henceforth, by "debt" (or $D_t$) I mean "disbursed debt."

Turning to flows, debt service in period $t$ ($DS_t$) consists of interest payments ($IP_t$) and principal repayments ($PR_t$) associated with disbursed debt. Thus $DS_t = IP_t + PR_t$. The net flow in period $t$ ($B_t$) is new borrowing (loan disbursements...
plus the accumulation of arrears) in that period \((NB_t)\) less repayments of principal, that is, \(B_t = NB_t - PR_t\). This is the amount by which the nominal stock of debt denominated in any one currency changes in period \(t\). Hence (denoting the change over time in a variable \(x\) as \(\dot{x}\)), for debt denominated in currency \(i\), \(B_i = \dot{D}_i\).

Debt may be denominated in several currencies. If currency 1 serves as the numeraire and the exchange rate between currency \(i\) and currency 1 is \(E_{1i}\), then the total change in the country's debt is

\[
\Delta D_t = \sum_i \left[ E_{1t} B_i + \left( E_{1t}/E_{1i} \right) \left( E_{1t} D_i \right) \right].
\]

Changes in nominal exchange rates among creditor countries have had major effects on the value of the outstanding debt of some countries. Nevertheless, the analysis that follows has little to say about the implications of changes in debt obligations that result from currency swings. To concentrate on the issues at hand, I will simply ignore exchange rate changes and treat debt as if it were all denominated in a single currency.

Finally, the net transfer in period \(t\) \((NT_t)\) equals the net flow less interest payments or, equivalently, new borrowing less debt service; that is, \(NT_t = B_t - IP_t = NB_t - DS_t\). This concept is especially critical because it represents the net flow of real resources from creditors to the debtor. A positive value means that creditors are contributing resources to the debtor country, and a negative value means that creditors are taking resources away.

II. INTERTEMPORAL OPTIMIZATION AND THE BUDGET CONSTRAINT

Why do countries borrow, and how much credit will capital markets extend to them? A standard formulation that introduces a motive for borrowing treats a small borrowing country as an entity whose behavior is governed by that of a representative, constituent individual (or dynasty) that tries to maximize the discounted value of its utility from consumption. Bardhan (1965) is an early example.

A common simplification is that utility is additively separable across time and that utility in any period \(t\) is a concave function \(u(C_t)\) of consumption \(C_t\) in period \(t\). Consumption cannot be negative. The representative individual discounts future consumption by some factor \(\rho\) (between 0 and 1). It can borrow and lend in international credit markets at an interest rate \(r\), which, for simplicity, I treat as constant over time. Output per period is \(Q_t\).

Consider a time 0 when the country's foreign debt is 0. As of that point, the country's objective is to maximize the following:

\[
U_0 = \sum_{t=0}^{\infty} \rho^t u(C_t).
\]

Each period \(t\), the country chooses to borrow some net amount \(B_t\) (defined as new borrowing less repayments of principal on old debt), but it must pay inter-
est $rD_{t-1}$ on debt accumulated as of the end of the previous period. What is left over for consumption is then

(3) \[ C_t = Q_t + B_t - rD_{t-1} = Q_t + NT_t \]

and debt at the end of period $t$ is

(4) \[ D_t = D_{t-1} + B_t = (1 + r)D_{t-1} + NT_t. \]

Iterating the second part of equation 4 backward to period 0 gives

(5) \[ D_t = \sum_{i=0}^{t} (1 + r)^{t-i} NT_i. \]

Debt in period $t$ is just the cumulative discounted net resource transfer since period 0 (when debt was 0).

If the country faces absolutely no limit on what it can borrow in any period, it can attain an arbitrarily high level of consumption without defaulting by perpetually financing debt service obligations with new borrowing. What keeps a country from pursuing this strategy?

Lenders as a group would lose money if they let the borrower do this. To avoid a loss, lenders cannot allow the anticipated discounted value of resource transfers that they ultimately provide the country to exceed 0, so that:

(6) \[ \frac{\sum_{t=0}^{\infty} NT_t}{(1 + r)^t} = \sum_{t=0}^{\infty} \frac{C_t - Q_t}{(1 + r)^t} \leq 0. \]

This last condition is often called the intertemporal budget constraint.

Dividing equation 5 by $(1 + r)^t$ gives

(7) \[ \frac{D_t}{(1 + r)^t} = \sum_{i=0}^{t} \frac{NT_i}{(1 + r)^t}. \]

Restrictions on Debt

Equations 6 and 7 imply the following restrictions on debt: the solvency restriction and the transversality condition.

The solvency restriction. Substituting equation 7 into equation 6 gives, for any period $t$,

(8) \[ D_t \leq \sum_{r=t+1}^{\infty} \frac{Q_r - C_r}{(1 + r)^{r-t}}. \]

Because consumption cannot be negative, this condition implies that

(9) \[ D_t \leq W_t, \]

where

(10) \[ W_t = \sum_{r=t+1}^{\infty} \frac{Q_r}{(1 + r)^{r-t}}. \]
is the present discounted value of the borrowing country's remaining income stream. The condition given by equation 9, often called the solvency constraint, states that debt in any period cannot exceed \( W_t \), if lenders are to find their relation with the borrower profitable.

In principle, the right side of equation 9 could be infinite, in which case the constraint disappears. This would mean that the country's current and future resources are infinitely valuable, which could happen if the country's growth rate was on average greater than the interest rate.

Presumably, the demand for borrowing by such a country would drive the world interest rate up to the point at which the constraint became binding. Some of the earlier literature on external debt speaks of a country as "solvent" if its growth rate exceeds the interest rate. For a country to be permanently solvent in this sense implies that its resources are infinitely valuable. In this case, any level of debt is consistent with solvency. It is unlikely that any country meets this criterion. A growth rate above the interest rate is almost surely a temporary phenomenon. As discussed below, however, almost all sovereign borrowers are probably solvent in the sense that the discounted present value of their national resources exceeds the value of their external debt.

The transversality condition. Together, equations 6 and 7 imply that

\[
\text{(11)} \quad \lim_{t \to \infty} \frac{D_t}{(1 + r)^t} = 0.
\]

Equation 11 is often called the transversality condition: to realize a collective positive return on their loans, foreign creditors cannot allow the discounted value of debt in the infinite future to be positive. As is clear from equation 4, a borrowing strategy that never called for a net resource transfer to creditors would require debt to grow at or above the rate of interest, violating equation 11. The condition allows \( D_t \) to remain positive, that is, for the country to remain a net debtor forever. Debt just cannot grow, on average, faster than the interest rate.

**Borrowing for Consumption Smoothing**

Say that output during each period is exogenous. The country's problem, then, can be seen as choosing \( NT_t \) in each period \( t \) to maximize \( U_0 \), subject to either the intertemporal budget constraint (equation 6) or the transversality condition (equation 11). Setting this problem up as a constrained maximization, it becomes

\[
\text{(12)} \quad \max_{C_t} \left\{ \sum_{i=0}^{\infty} \left[ \rho^i u(C_t) + \lambda \frac{O_t - C_t}{(1 + r)^t} \right] \right\}
\]

where \( \lambda \) is the shadow price associated with the solvency condition.

The first-order conditions for a maximum are

\[
\text{(13)} \quad [(1 + r)\rho]^t u'(C_t) = \lambda, \quad \forall t = 0, \ldots, \infty.
\]
With nonsatiation (so that the marginal utility of consumption is always strictly positive), \( \lambda \) is strictly positive, meaning that the constraint is binding. Optimal borrowing thus implies that equation 6 holds with equality, or that

\[
\sum_{t=0}^{\infty} \frac{C_t}{(1 + r)^t} = W_0.
\]

This framework identifies two motives for borrowing. One is to allow consumption to grow permanently at a different rate than the endowment. Another is to smooth consumption in the short run if endowments fluctuate. Empirically, the framework suggests why countries borrow after disasters that reduce output (if the reduction is perceived as temporary) and why news that future output will be higher than previously expected can lead to a borrowing binge.

Equation 13 has two implications. First, given the discounted present value of initial resources \( W_0 \), international borrowing and lending completely separate the timing of consumption from that of production. The intertemporal budget constraint is the only link between the two; given the present discounted value of resources, the timing of their availability should have no implications for consumption. Second, consumption rises or falls over time depending upon whether \((1 + r)\rho\) is larger or smaller than 1, or whether the world interest rate is higher or lower than the country's discount rate.

The first implication follows quite generally from the assumptions of perfect capital mobility and smallness in international capital markets: An economy should maximize the present discounted value of its output at the world interest rate regardless of its own preferences.\(^2\)

The second implication follows from the assumption of a constant discount factor. Engel and Kletzer (1989) develop a model of borrowing with a variable discount factor. This modification can imply a much richer dynamic structure, one that is more descriptive of the historical experience of industrial countries, which have passed through "stages" of borrowing and lending.

**Borrowing for Investment**

The analysis can be extended to incorporate a productive role for capital. As long as the production technology and other factors of endowment are exogenous, however, little is affected. Say, for example, that output in period \( t \) is a constant returns-to-scale function \( F(K_t, L_t, t) \), where \( K_t \) is the domestic capital stock and \( L_t \) is a set of exogenous factors such as labor and land. Optimal investment requires investing up to the point at which \( F_K = r \), where \( F_K \) is the marginal product of capital. Let \( K^*(L_t, t, r) \) denote the value of \( K \) that is consistent with optimal investment. Defining \( Q_t = F(K^*, L_t, t) \) and redefining

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2. How mobile capital is, even among industrial countries, is questionable. See, for example, Feldstein and Horioka (1980) and Obstfeld (1989). Gersovitz (1985) provides evidence that the consumption-smoothing model very poorly describes borrowing by developing countries during the 1970s. Section V takes up reasons for imperfect capital mobility.
foreign debt $D_t' = D_t + K_t^* - K_0$, where $K_0$ is the period 0 capital stock and $D_t$ is derived as before, the analysis follows as above.

This extension points to another motive for borrowing: to bring the capital stock up to the level at which its marginal product equals the world interest rate.\textsuperscript{3}

### III. Debt and Growth

How does debt relate to the growth of the debtor? Early on, economists used the Harrod-Domar growth model (Harrod 1939; Domar 1946) to answer this question. The approach provided a framework for analyzing national debt dynamics with a very parsimonious description of the economy. Unfortunately, it had a number of implications that are inconsistent with optimizing behavior on the part of either creditors or debtors (see Eaton 1989).

In the first formulation of the optimal borrowing problem in section II, income was exogenous, so that foreign capital could not make any contribution to growth whatsoever. Even with a productive role for capital, however, if other factor supplies are exogenous and returns to scale are constant, then foreign capital, or changes in international capital market conditions, can affect growth only in the short run, when a country borrows to bring its marginal product of capital into line with the world interest rate.

Several papers, including Kaldor and Mirrlees (1962), Uzawa (1965), Shell (1966), Inada (1969), and, more recently, Romer (1986) and Lucas (1988), provide models of growth in which the long-run growth rate is endogenous. This literature suggests a framework in which, as in the Harrod-Domar and two-gap approaches, foreign capital has implications for long-run growth. In two quite different extensions of these models, an increase in the cost of foreign capital implies lower long-run growth.

#### The Uzawa-Lucas Model

The first extension draws on Uzawa (1965) and Lucas (1988). Consider an economy with the technology

$$Q_t = K_t^\beta (e_t N_t)^{1-\beta} H_t^{-\beta+y}$$

where $Q_t$ is output, $K_t$ is the capital stock, $N_t$ is the labor force, and $H_t$ represents the state of "technological knowledge" of a typical worker in the economy, all in period $t$. The variable $e_t$, which lies between 0 and 1, is the share of an average worker's time spent working rather than developing productive knowledge. The capital share is $\beta$, which lies between 0 and 1, and $\gamma$ is a nonnegative parameter.

\textsuperscript{3} Without any adjustment costs associated with investment, the borrowing and investment needed to bring the marginal product of capital into line with the world interest rate would ideally occur all at once. Introducing an adjustment cost to investment, as in the Cohen (1991) model discussed below, implies that borrowing and investment should be smoothed out.
A worker's knowledge contributes to current output in two ways. First, it increases the productivity of the worker in proportion to the worker's knowledge. Hence, worker $i$, with knowledge $K_{it}$ in period $t$, and working a fraction of his time $e_{it}$ contributes $e_{it}K_{it}$ to the labor force in that period. Workers capture the return to this aspect of their knowledge by earning proportionately higher wages. Second, if $H_t$ is the average state of knowledge in the economy, then output is affected in proportion $H_t^\beta$ beyond what is implied by the contribution of $H_t$ to the effective labor force. Returns to capital and effective labor exhaust production, so these general returns are not appropriated. The wage per unit of effective labor is

\begin{equation}
\omega_t = (1 - \beta) \left[ \frac{K_t}{(e_t H_t N_t)} \right]^{\beta} H_t^\beta
\end{equation}

There is only one produced good, which can be used for investment or for consumption. (Issues concerning the relative price of capital are thus not addressed; the price is 1.) Hence, the capital stock grows according to $K_t = I_t$, where $I_t$ denotes investment in period $t$ (assuming no depreciation). The physical labor force grows at a constant rate.

At any moment workers have a given state of knowledge. They can add to it by allocating time toward learning, which takes away from their efforts toward current production. A worker's increase in knowledge in period $t$ is given by

\begin{equation}
\dot{H}_t = H_t \varphi (1 - e_t)
\end{equation}

where $\varphi > 0$, $\varphi' > 0$, $\varphi'' < 0$, and $H_t$ is the individual worker's current knowledge. Hence the productivity of time spent learning, denoted by $g_H$, is proportional to the worker's existing knowledge, so that $g_H = \dot{H}_t / H_t = \varphi (1 - e_t)$.

Aside, then, from the two contributions that knowledge makes to production, knowledge increases the productivity of time spent learning. Consider the decisions of a single individual in this economy who takes the profile of the wage (per effective unit of labor) and the interest rate as exogenous. Each period $t$, the worker chooses a level of consumption $C_t$ that is greater than or equal to 0 and an allocation of time between work and learning $e_t \in [0, 1]$. Preferences are as in equation 2, and national debt evolves as in equation 3. An individual's nonhuman wealth, $A_t$, evolves according to

\begin{equation}
A_t = r A_t + \omega_t e_t H_t N_t - c_t N_t
\end{equation}

where $c$ is per capita consumption in period $t$ and $r$ is the interest rate (again treated as constant).

As in section II, maximizing discounted utility subject to equations 17 and 18 implies that consumption grows according to equation 13. Individuals can borrow and lend as much as they want at $r$; therefore, their optimal learning

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4. I deviate from Lucas in not weighting per-period utility by population. Defining $\rho$ as $\rho - \nu$ in Lucas's analysis implies the same results.
decisions maximize the value of their wage incomes independent of their preferences. As of period 0, wage income is derived as

\[ V(H_0) = w_0 H_0 \int_0^\infty \exp \left\{ \int_0^t \left[ g_w(\tau) + \varphi(1 - e) - r \right] d\tau \right\} e \, d\tau \]

where \( H_0 \) denotes the level of per capita human capital in period 0 and \( g_w \) denotes the rate of growth of the wage rate per unit of effective labor. The optimal choice of \( e \) is independent of the stock of human capital, \( H_0 \). If wages grow at a constant rate, then the first-order condition for an interior maximum is

\[ r - g_w = \varphi(1 - e) + e\varphi'(1 - e) \]

and the (strict) second-order condition for a maximum is \( \varphi'' < 0 \). When this condition is satisfied, the amount of learning that an individual undertakes falls as the growth of wages rises or as the interest rate falls. If the left side of equation 20 exceeds the right at \( e = 1 \), then \( e = 1 \) (no learning) is optimal for the individual.

This result characterizes an individual's optimal amount of time spent learning, given the economywide growth in the real wage and the real interest rate. Turn now to the behavior of the aggregate economy and consider a balanced growth path or steady state in which output and the capital stock grow at the same rate, \( g_Q \). Differentiating the production function and setting \( Q / Q = \dot{K} / K = g_Q \)

\[ \dot{c}_w = \frac{(\gamma + 1 - \beta)\varphi(1 - e)}{1 - \beta} + n \]

where \( e \) now represents the average level of time spent learning in the economy and \( n \) is the constant growth rate of the physical labor force. Differentiating equation 16 and substituting \( g_Q \) gives

\[ g_w = \frac{\gamma}{1 - \beta} \varphi(1 - e) \]

The wage (per unit of effective labor) grows in a steady state only if there are externalities associated with the accumulation of human capital. But without externalities, the wage could still grow in terms of natural labor units.

Substituting equation 22 into equation 20 yields the result that at an interior solution the average time spent working must satisfy

\[ r = \frac{\gamma + 1 - \beta}{1 - \beta} \varphi(1 - e) + e\varphi'(1 - e) \]

Lucas considers the linear case in which \( \varphi(1 - e) = e(1 - e) \). The value of \( 1 - e \) satisfying equation 23 is then

\[ 1 - e = \frac{(1 - \beta) \left( \frac{r}{e - 1} \right)}{\gamma} \]

(as long as \( \gamma > 0 \)).

5. If \( \gamma = 0 \), there is no interior solution. If \( r > e \) (which is necessary to satisfy the transversality condition), the solution must be the corner in which \( e = 1 \), and the model degenerates into the standard neoclassical optimal growth model, with no endogenous technical progress.
A startling implication is that time spent learning rises with the interest rate and falls with the productivity of time spent learning. But this result rides on the linearity of both the earnings and learning functions in \( e \): to be indifferent between working and learning at the margin, the individual must also be indifferent between the two activities at any level. The first-order condition for a maximum is satisfied everywhere, whereas the second-order condition is only weakly satisfied. If individuals are indifferent initially, an increase in the interest rate will cause them to stop learning altogether unless wage growth increases by an offsetting amount. But higher wage growth requires more learning in the aggregate.

In fact, as this discussion suggests, for a given interest rate an interior solution is unstable: if, for example, at this solution workers happened to invest slightly less in education than they were supposed to, then wage growth would fall. Given the interest rate, everyone would want to invest nothing in education, causing wage growth to fall even further. The only stable solution that satisfies the transversality condition and the first- and second-order conditions for a maximum has no learning and no growth.\(^6\)

The model can be amended to yield a stable interior solution by introducing a strictly concave function \( \varphi \), implying decreasing returns to learning at the individual level.

Consider, for example, \( \varphi = \varepsilon (1 - \varepsilon)^{\frac{1}{2}} \). The expression for the growth rate of human capital is then

\[
\dot{g}_H = \frac{r - \left\{ r^2 - \varepsilon^2 \left[ 1 + \frac{2\gamma}{1 - \beta} \right] \right\}^{\frac{1}{2}}}{1 + \frac{2\gamma}{1 - \beta}}.
\]

The corresponding growth in per capita output is

\[
\dot{g}_q = \frac{r - \left\{ r^2 - \varepsilon^2 \left[ 1 + \frac{2\gamma}{1 - \beta} \right] \right\}^{\frac{1}{2}}}{(1 - \beta + 2\gamma)}.
\]

Differentiating this expression with respect to \( r \) shows that growth falls with the interest rate.

Consider an example in which \( \gamma = 0.05, \beta = 0.33, \) and \( \varepsilon = 0.05 \). (To satisfy the transversality condition at \( e = 0 \), we need \( r > e \).) At an interest rate of 0.06, per capita output grows at 3.1 percent, corresponding to an allocation of time spent learning of nearly 33 percent. At \( r = 0.1 \), output growth falls to 1.46 percent, with 7.4 percent of time spent learning. At \( r = 0.15 \), the growth rate is

6. Because Lucas treats a closed conomy, the steady-state interest rate is \( r = \rho + \sigma g_w \), where \( g_w \) is the growth rate of per capita consumption and \( \sigma = \mu''(C)/\mu'(C) \), the elasticity of the marginal utility of consumption. For a \( \sigma \) that is sufficiently large, the interior solution is stable.
only 0.9 percent, with only 3.0 percent of time spent learning. With these parameter values, the model implies that changes in real interest rates of the magnitude observed in the past two decades can have substantial effects on growth.\footnote{Raising the capital share, $\beta$, from 0.33 to 0.5 or raising $\gamma$ to 0.07 implies growth rates that are about 0.2 percent higher at each interest rate.}

A limitation of this analysis is its focus on the steady state. More realistic applications will require more analysis of dynamics out of steady state. For example, it would be interesting to examine the flows of international capital as a function of the initial stocks of physical and human capital. Presumably, poor countries that lack physical capital in relation to human capital would initially borrow, but those that are poor because of a paucity of human capital would initially lend.

With capital perfectly mobile internationally, differences in national growth rates are the consequence of differences in the technologies that transfer learning effort into knowledge or that transfer knowledge, labor, and capital into output: Other things being equal, a country grows faster if time spent learning produces more knowledge or if general knowledge makes a greater contribution to output. Differences in rates of time preference have no implications for differences in growth rates, although an increase in impatience, by raising the world interest rate, would slow growth everywhere.

Introducing an element of capital immobility would break the independence of time preference and growth. Countries that are more patient, other things being equal, would have lower interest rates and higher growth, and countries with better learning technologies or where knowledge is more productive, other things equal, would have higher interest rates and higher growth. We do seem to observe international differences in interest rates. An interesting empirical question is the international correlation between growth rates and interest rates. The sign of this correlation would shed light on whether differences in time preference or differences in technologies are primarily responsible for the international variation in growth rates.

\textit{The Cohen Model}

Cohen (1991) developed an alternative, somewhat simpler, discrete-time endogenous growth model that is more in keeping with the assumptions of the two-gap literature. In particular, as in the Harrod-Domar model, output is proportional to the capital stock. Hence, in period $t$, $Q_t = \alpha K_t$, where $\alpha$ is an exogenous constant. The capital stock evolves according to

$$K_t = (1 - \delta)K_{t-1} = I_t,$$

where $\delta$ is the rate at which capital depreciates and $I$ is investment. Following an earlier literature on adjustment costs, going back to Penrose (1971) and Treadway (1969), Cohen assumes that investment uses resources beyond those needed to contribute to the capital stock. In particular, adding an amount $I_t$ to the
capital stock (gross of depreciation) requires a sacrifice of current resources of \( J_r \), where

(28) \[ J_r = I_r \left[ 1 + \left( \frac{\phi}{2} \right) \left( \frac{I_r}{K_r} \right) \right]. \]

The parameter \( \phi \) is meant to capture capital installation costs.

As in the Uzawa-Lucas model, the competitive equilibrium of an open economy facing a given world interest rate will entail the maximization of the present discounted value of output at world prices. This maximization yields a quadratic expression for the ratio of investment to the capital stock that is independent of the level of the capital stock. Only one solution satisfies the transversality condition. The consequent growth rate of output \( g_Q \) is

(29) \[ g_Q = r - \sqrt{\frac{(\delta + r)^2 - 4(\alpha - r - \delta)}{\phi}}. \]

As in the Uzawa-Lucas model with a strictly concave learning function, the growth rate of the Cohen economy falls as the interest rate rises. This is simply because a higher world interest rate makes it less worthwhile to allocate resources toward future rather than current consumption. When \( \alpha = 0.6, \delta = 0.05, \) and \( \phi = 100, \) an increase in \( r \) from 0.05 to 0.15 causes growth to fall from 0.05 to -0.03.8

Both the Cohen and Uzawa-Lucas models, as well as several other treatments of endogenous growth, provide a way to relate foreign indebtedness to long-run growth. Reasonable specifications of these models imply that an increase in the world interest rate can lower growth significantly.

IV. SOVEREIGN RISK

The analysis so far rests on an assumption that sovereign debtors will meet debt service obligations to foreign creditors as long as the debtors remain solvent, meaning that what they owe does not exceed the present discounted value of national resources. There are reasons why sovereign debt may pose problems before the solvency constraint bites. Moreover, problems relating to the sovereignty of the debtor can produce inefficiencies. One inefficiency arises from the need to finance repayment with tax revenue. Another arises from the effect of debt on the debtor's incentives. I discuss the first below and the second in section VI.

The Public Finance Problem

An issue in sovereign debt is the solvency of the sovereign government itself as opposed to that of the nation as a whole. Even if the government perfectly represents the interests of the population, the administrative cost and excess burden of

8. In addition growth is higher when capital is more productive (\( \alpha \) is higher) and is lower when the depreciation rate, \( \delta \), and the cost of installation, as reflected by the parameter \( \phi \), are higher. For some (plausible) parameter values, the model has no steady-state growth rate.
taxation can reduce the resources that a government can marshal to meet a debt service obligation below what is available nationally. Countries known as "problem debtors" seem to have particular difficulty raising tax revenue. The phenomenon of capital flight suggests the extent to which a significant portion of nationally owned resources may lie beyond the grasp of a sovereign debtor.

In fact, depending on how debt service obligations are financed, even a relatively small amount of debt can have a devastating effect on investment and government revenue.

To make the argument in its starkest terms, consider an economy in which domestic output forms part of the tax base. Domestic output is an increasing, concave function, \( g(K) \), of the domestic capital, \( K \), and \( g'(K) \) is the marginal product of capital. Revenue from other sources is available in amount \( T_0 \). Denoting \( t \) as the tax rate on domestic output (assumed, for simplicity, to be constant), total tax revenue, \( T \), is then \( T = T_0 + t g(K) \).

The government owes an amount \( D \) that is greater than \( T_0 \), and \( D \) must be covered by tax revenue. Knowing that this government owes \( D \), potential investors can invest their funds in other countries and earn a given return, \( r^W \). The government cannot tax income earned abroad. Investing in the debtor country yields an after-tax return of \( r^H = (1 - t)g'(K) \). Investors must decide where to invest before the tax rate is decided. (It does not matter here whether potential domestic investors are nationals or foreigners; all that matters is that this government can tax domestic output but not income earned abroad.) To meet its debt service obligations, the government sets a tax rate of \( t(K) = \frac{D - T_0}{g(K)} \). The after-tax rate of return is

\[
(30) \quad r^H(K) = [1 - t(K)]g'(K)
\]

which can be increasing in \( K \) when \( K \) is near 0 but decreases in \( K \) once \( K \) becomes large enough. Individual investors are small in relation to the total number (so that they ignore the effect of their own investment on the total stock, \( K \)). Investment can occur at a level at which \( r^H(K) = r^W \) or, because

\[
(31) \quad [1 - t(0)]g'(0) < r^W,
\]

\( K = 0 \) is also an equilibrium outcome. Income from any investment by a single, small investor acting alone will be taxed at a very high rate because the tax base will be very small.

Figure 1 illustrates a possible relation between \( r^H(K) \), \( K \), and \( r^W \). At \( K^* \), \( [1 - t(K^*)]g'(K^*) = r^W \). Investment is sufficient to allow a competitive after-tax return even after enough is collected to repay the debt. (Also, at \( K^* \), \( r^H(K) \) is declining in \( K \), so that \( K^* \) is locally stable.) However, when the initial amount of capital is zero, a small investment is taxed at such a high rate that it is not worth making.

Two implications of this discussion, which is developed further in Eaton (1987), are worth mentioning. First, public debt might be associated with pri-
vate capital flight because domestic investors invest elsewhere to avoid the taxes needed to repay the debt. $K^*$ could exceed $D$, so that positive investment would imply a net resource inflow, and no investment a net outflow. Second, governments with large debts might do better to rely on taxing internationally immobile factors, such as land.

So far, I have made the extreme assumption that a capital tax is the only source of marginal tax revenue. Obviously this is unrealistic. However, as long as capital income is a significant share of the marginal tax base, the basic point of the analysis stands. In fact, many of the problem debtors have used inflation as a major source of finance. For many investors, inflation imposes a tax on domestic investment. An old question is, what keeps a government from imposing a capital levy when it might be the optimal policy in the short run but not in the long run? Constitutional constraints are one answer, reputational concerns another.

Why, given the public finance problems associated with sovereign borrowing, has so much borrowing been done by governments rather than by private entities? There are probably many reasons. But given the nature of contract enforcement and bankruptcy procedures in many debtor countries, lending to private borrowers would not have avoided problems of sovereign risk. Lenders would have had to rely on the borrower's government to enforce loan contracts, protect property rights, and administer bankruptcy procedures fairly. In fact, much of what was borrowed privately was ultimately assumed by borrower governments, even when loans were not guaranteed by the borrower's government.  

Why did governments assume these debts? One possibility is that lenders may have threatened to worsen the government's own credit terms. Another is that

lenders may in large part assess the creditworthiness of individual national borrowers collectively, so that default by any one private borrower would worsen the credit terms of other private and public borrowers. In this case a default by any single private borrower would have a significant negative effect on other borrowers in the country.

The Liquidity Problem

Another problem sometimes mentioned in discussions of sovereign debt is liquidity: a debtor may be solvent but lack the resources needed to meet a current debt service obligation. But if the borrower is really solvent, a natural question is why lenders will not lend what is needed to make the current payment. Section VI returns to this issue in considering a lender’s options in dealing with a debtor not paying what it owes.

The Enforcement Problem

Most domestic borrowing occurs in a context in which creditors have significant legal rights over the assets of debtors. For secured debt, specific assets that the creditor can seize in the event of a default provide collateral. For unsecured debt, a default can lead to the general liquidation of the debtor’s assets, with the proceeds being distributed to creditors. In either case, the transfer of assets from debtor to creditor in the event of nonpayment places a lower bound on what the creditor can recover if default does occur and provides an incentive for the debtor not to default in the first place.

If creditors can seize all of the debtor’s assets and realize a return on them that is as high as the debtor can realize, then lenders can issue up to the discounted present value of the debtor’s income without an expected loss. The solvency constraint is thus the relevant limit on what can be lent. In the context of sovereign debt, however, a creditor’s legal remedies do not usually include the means to obtain a significant portion of the debtor’s assets. The creditor might be able to use its own legal system to obtain the debtor’s foreign assets, but, to the extent that the debtor is a net debtor, these will not suffice to compensate lenders. The question then is: what is a sovereign debtor’s incentive to repay any (net) debt, given that it does not stand to lose assets of comparable value if it defaults?10 This question is the topic of section V. First, however, one implication of the enforcement problem deserves mention and is discussed below.

Credit Rationing and the Monitoring of Indebtedness

In the presence of enforcement problems (as well as in a wide range of situations in which problems of moral hazard arise), markets function more effi-

10. This is not to argue that, domestically, legal remedies usually protect the creditor to the extent that it can lead up to the value of a debtor’s assets and not expect to lose something. Even domestically, default often leaves debtors with significant control over their assets, whereas transferring an asset from the debtor to the creditor may significantly impair its value. But the lack of legal remedies makes these problems especially severe in an international context.
ciently when participants can observe not only prices but also other variables, such as quantities. The following two-period model illustrates the role of information in the context of sovereign debt.

Consider a borrower who in the first period borrows some amount $L$, incurring a debt service obligation $D = L(1 + r)$ in the second period, where $r$ is the interest rate on the loan. Payment of anything less than what is owed in the second period causes the debtor to suffer a penalty equivalent to the loss of an amount $P$ of income. Hence, the debtor will pay all that it owes if $D \leq P$, and it will default if $D > P$. (For simplicity, I resolve indifference on the debtor's part in favor of the creditor.) Creditors, who realize this and can monitor total indebtedness, will ensure that $L(1 + r)$ does not exceed $P$. As long as debt satisfies this constraint, loans are perfectly safe, and competitive lenders should provide them at the world interest rate, $r_w$.

However, the debtor may want to borrow more than $P/(1 + r_w)$ at this rate. If it does, it will surely default in the next period if the interest rate is competitive with the world rate. Lenders will therefore constrain loans not to exceed this amount. The consequence is credit rationing: competitive lenders provide less than the debtor wants to borrow at the interest rate charged. The interest rate does not rise in response to this excess demand, because total indebtedness in the next period would then exceed $P$, thus ensuring default. No risk premium can compensate lenders for certain default: Competition among lenders will ensure, however, that any amount borrowed at or below $P/(1 + r_w)$ is available at the rate $r_w$. But credit rationing requires that lenders know the debtor's total debt. In this example, as long as $P$ is finite, if creditors are ignorant of total debt then the debtor will borrow more than it will be willing to repay and will then default. Knowing this, no one will lend.

This result points to the role of accurate information about the stock of total indebtedness in sovereign debt. In this situation, the debtor benefits from public observability of its total indebtedness. If its level of debt cannot be observed, it is not able to borrow.11

Lack of information need not close the loan market entirely. Using the methodology of Kletzer (1984), say that the cost of default, $P$, is infinite with some probability $\pi$ and an amount $P_L$, that is less than infinity, $1 - \pi$. A loan requiring repayment of $P_L$ or less is then perfectly safe, because it will be repaid in any event, whereas a loan requiring repayment of more than this amount will be repaid only with probability $\pi$. If indebtedness is unobservable, risk-neutral lenders will charge an interest rate $r^U = (1 - \pi + r_w)/\pi$ to compensate for the risk of default. But, as Kletzer shows, the debtor may prefer to have loans rationed at $P_L/(1 + r)$ if debt is observable, to benefit from improved credit terms.

11. Arnott and Stiglitz (1988) show, very generally, how the presence of moral hazard implies that the observability of quantity as well as price variables improve welfare.
V. THE INCENTIVE TO REPAY

A common assumption is that default on a current debt service obligation will prevent a borrower from obtaining new credit, at least in the current period. But losing access to current credit provides an incentive to meet a current debt service obligation only if potential new lending exceeds current debt service obligations, so that the debtor receives a net resource transfer from creditors if it repays but receives nothing if it does not. As discussed in section II, however, creditors can earn a competitive return on sovereign lending only if the debtor at some point makes net resource transfers to its creditors. Sovereign debtors did in fact transfer large amounts to their creditors during the 1980s.

Sanctions

Much of the literature on sovereign debt simply asserts that the debtor suffers an exogenously specified penalty if it defaults. One rationalization is that the legal system in the community of lender countries allows creditors to intercept payments that the debtor might make to exporters or payments that it might receive from importers. Knowing that creditors might seize payment, potential suppliers in this community would be less willing to export to the debtor. Similarly, the debtor would find exporting pointless if it could not receive payment. Although it might be possible to evade creditors’ attempts to intercept payments (through barter arrangements, trade through third parties, and so on), evasion would be costly.

A common assumption is that the cost of default increases with the debtor’s output. This is a natural assumption to make when creditors can seize the debtor’s income-generating assets. But in the context of sovereign debt, this assumption is less compelling. For example, if default leads to worsened terms of trade, then, for the cost of default to rise with output, the gains from trade must also increase with output. But there is no presumption that they do. Output growth might be “import biased,” for example, so that higher income implies less reliance on foreign trade (Gersovitz 1983).

If one nevertheless assumes that the penalty increases with output, an implication is that debt reduces the debtor’s incentive to invest. Investment, by raising future output, increases the cost of default. Lenders can then extract more repayment, effectively taxing growth.12 The notions of a debt overhang and a debt Laffer curve, discussed in section VI, require an assumption that the debtor pays more when its output is higher.

Do creditors actually tax increments to debtor output? Eaton (1990) presents the results of a regression of annual net resource transfers to private creditors during 1983–88 for a panel of 17 countries classified by the World Bank as “highly indebted.” Explanatory variables were current gross domestic product

(GDP), the stock of debt to private creditors at the end of the previous period, the current net resource transfer to public creditors, and country and time dummies. The coefficient on GDP was significantly positive but implied a marginal tax rate of only 1.1 percent. (The coefficient on debt was more significant, implying that an increase in nominal debt of $1.00 increased repayment by $0.14.)

**Maintaining a Reputation for Repayment**

A debtor might also choose to repay to maintain access to foreign credit markets on favorable terms. Historically, widespread default on sovereign loans has led to loss of access to credit markets by sovereign lenders. After a series of defaults in the 1930s, for example, Latin American countries were unable to raise much private portfolio investment until the 1970s. As Bulow and Rogoff (1989b) have emphasized, losing access to gross loans from foreign credit markets does not, by itself, provide an incentive to repay. Say that a sovereign debtor in default can earn the same rate of return investing abroad as the cost of borrowing even after it defaults. If the only consequence of default is the inability to borrow again, at some point a debtor will be called upon to transfer so much to its creditors that it would do better to default and invest what it owes, remaining a net creditor from then on.

But how can a sovereign debtor that is in default itself enforce a loan contract with a foreign borrower? The discussion up through section III assumed two-sided automatic enforcement: a country automatically repays its debts as long as it has the resources to do so and can count on other countries to do the same. At the opposite extreme there might be no automatic enforcement: Credit arrangements in either direction might be honored only if credit arrangements had always been honored in the past (as, for example, in Eaton and Gersovitz 1981, Grossman and van Huyck 1988, or Kletzer and Wright 1990). Default implies not only that foreign lenders will not lend to the borrower again but that foreign investments by the borrower will themselves not be repaid. Hence, default leads to total financial autarky, not just to an embargo on gross loans.

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13. There is, however, disagreement about the extent to which an individual developing country’s repayment performance affected its own credit terms rather than those of developing countries as a whole (Eichengreen and Portes 1990; Ozler 1990, 1992).

14. Default could prevent the country from entering into insurance contracts that call upon the insurer to make a transfer to that country under some contingencies (because wronged creditors would then seize the transfer). Nevertheless, Bulow and Rogoff (1988a) show that with one-sided enforcement the country could provide itself equivalent insurance with “cash-in-advance” contracts, that is, contracts in which the insurer never makes a present value transfer to the country.

15. One reason that a borrower in default may be unable to lend again is that the legal system in the creditor community would transfer any investment by the borrower to the wronged creditor until all the debt in default had been repaid. But Kletzer and Wright (1990) show that no such legal arrangement is necessary. Even with multiple creditors, a total financial embargo that applies to loans as well as to investments (rather than just a credit embargo that applies only to loans) can be an equilibrium outcome even when there is no legal mechanism that automatically transfers the borrower’s foreign assets to the initial creditors.
As shown below, the threat of complete financial autarky can sustain lending and repayment. But it can do so only if it is certain that thereafter resources will never flow in just one direction.

Bulow and Rogoff's result is that reputation alone cannot sustain lending if there is just one-sided automatic enforcement in the credit market (that is, if default leads only to a loan embargo but not to an embargo on lending). The result has been misinterpreted, however, to mean that a threatened loss of access to international credit markets, both to borrow and to lend (complete financial autarky) cannot enforce repayment; see, for example, Cohen (1991: 94).

The model of a representative borrower, developed in section II, can be extended to illustrate how much the threat of total financial autarky (no further borrowing or lending) can enforce loan contracts. Say that preferences are as in equation 2, that debt evolves according to equation 3, and that the solvency constraint (equation 5) limits total indebtedness. In addition, enforcement constraints require that the borrower always finds maintaining access to the international financial market (to borrow or lend) at least as advantageous as not meeting a debt service obligation, which would condemn it to financial autarky thereafter and force it to consume its endowment.

At each period t the consumption path C_t associated with participation in the world financial market would have to satisfy

\[
\sum_{t=0}^{\infty} \rho^t u(C_t) \geq \sum_{t=0}^{\infty} \rho^t u(Q_t),
\]

where, as in section II, \( \rho \) is the discount factor, \( u \) is utility in period \( t \), and \( Q \) is output. The left side of equation 32 is the discounted present value of maintaining access to financial markets. The right side is the present discounted value of consuming the endowment—the debtor's fate if it ever defaults.

Sensible creditors will restrict the debtor to debt and repayment profiles that satisfy not only the solvency constraint (equation 5) but the enforcement constraints (equation 32) as well. The debtor's problem is now to maximize equation 2 subject to equations 3, 5, and 32. The relevant optimization problem is given by the Lagrangian at

\[
\max_{C_t} \left\{ \sum_{t=0}^{\infty} \rho^t u(C_t) + \mu_t \sum_{t=0}^{\infty} \rho^t [u(C_t) - u(Q_t)] + \lambda \left( \frac{Q_t - C_t}{1 + r_t^t} \right) \right\}
\]

where \( \lambda \) is again the Lagrange multiplier associated with the solvency constraint (equation 5), \( \mu_t \) are the (undiscounted) Lagrange multipliers associated with the enforcement constraints (equation 32), and \( r \) is the world interest rate.

The first-order conditions for a maximum become

\[
[(1 + r_t) \rho] u'(C_t) \left( 1 + \sum_{t=0}^{\infty} \mu_t \right) = \lambda,
\]

\( t = 0, ..., \infty \).
The presence of the \( \mu_\tau \) on the left-hand side reflects the fact that higher consumption in period \( t \) relaxes the enforcement constraints of the current and prior periods.

Consider a particular example in which output fluctuates between a high-value \( Q_H \) and a low-value \( Q_L \). Per-period utility is \( u(C_t) = \log(C_t) \). The country thus has an interest in maintaining access to the world capital market to smooth consumption. In addition, say that the country discounts future utility by more than the international interest rate, meaning that \( (1 + \rho) \rho < 1 \). In this case the country would also like to use world capital markets to shift consumption ahead of endowment.

From the perspective of any period in which output is low, the present value of current and future resources discounted at the world interest rate is

\[
W_L = \frac{(1 + \rho)((1 + \rho)Q_L + Q_H)}{(1 + \rho)^2}.
\]

Without any enforcement problem the optimal consumption profile satisfies equation 13. If \( \rho < 1 + \rho \), then without any enforcement constraint consumption diminishes over time, approaching 0 as \( t \) becomes large. Because the country is more impatient than world capital markets, it exchanges present for future consumption. At some critical time \( t^* \), then, \( C_t^* < Q_L \) for all \( t \) that is greater or less than \( t^* \). From that point on, the optimal borrowing program would call upon the country to make net resource transfers to creditors every period. The country would do better at that point to default and consume its endowment thereafter, so that the enforcement constraint is violated. Thus the enforcement constraint affects the consumption path.

How much borrowing can still occur? If \( Q_L \geq (1 + \rho)\rho Q_H \), the consumption-smoothing motive to maintain creditworthiness cannot sustain any borrowing at all: the decline in output from \( Q_H \) to \( Q_L \) does not provide an incentive to repay any debt in good times in order to borrow in bad times. But otherwise a debtor will be willing to make a positive net resource transfer to creditors when output is high in order to borrow again when output is low.

As in the unconstrained program, the debtor who initially has no debt borrows in order to consume the endowment before it arrives. At some point, however, debt reaches a level at which the borrower is indifferent between maintaining access to the international capital markets and defaulting. Debt cannot increase beyond that level. Thereafter, when output is low, the debtor receives a net resource transfer from its creditors but makes a net resource transfer back when output is high. In high-output periods the debtor is indifferent between repaying and defaulting, but in low-output periods (when it receives a net resource transfer from creditors), it is strictly better off than under financial autarky.

Once the enforcement constraint binds, it binds in every high-output period thereafter, and the level of debt is the same in each subsequent high-output period. How large the maximum debt level can be depends on the present value
of the net resource transfer over the cycle that the debtor is prepared to make to avoid financial autarky.¹⁶

Table 1 provides magnitudes of indebtedness and net transfers for the case in which output cycles between 8 and 12, a 20 percent standard deviation, and for the case in which it cycles between 9 and 11, a 10 percent standard deviation, for various values of the discount factor, ρ, and the world interest rate, r. The net resource transfers from debtor to creditor are always positive when output is high and always negative when output is low. The table indicates the maximum amount of debt at the beginning of a high-output period.

The final column in the table compares the maximum debt with the value of debt incurred in the previous (low-output) period times 1 + r. If the difference is positive, the debtor can in fact borrow enough before the enforcement constraint becomes binding to remain a net debtor thereafter. Otherwise, the enforcement constraint binds immediately, and the debtor cannot initially borrow enough to remain a net debtor over the cycle. Instead, it can borrow only 1 / (1 + r) times the maximum debt when output is low. The net transfer it then makes to creditors when output is high not only fully repays debt but includes, in addition, a net investment to finance consumption when output is again low.

The table reveals several relations. Not surprisingly, how much debt can be sustained depends positively on the variability of output and the discount factor and negatively on the interest rate. Moreover, the effect of output variability is dramatic: An order of magnitude more debt in relation to average income can be sustained when output fluctuations are 20 percent rather than 10 percent. Also notable is the sensitivity of the maximum debt level to the interest rate.

Finally, increases in ρ offset by reductions in r that maintain (1 + r)ρ constant increase the maximum sustainable debt level. An interpretation is that high-frequency fluctuations (say, over the seasons) allow for more debt than low-frequency fluctuations (say, over the business cycle).

This stylized example ignores uncertainty, growth, and investment. Introducing these factors will not affect the basic point that maintaining access to credit markets can by itself be a reason to service debt. With uncertainty, however, circumstances deemed unlikely (at least by the lender) at the time of the loan may emerge such that the debtor may not want to honor a debt service obligation.¹⁷

¹⁶. Using a model similar to the one here, Cohen (1991: 94) claims that avoiding financial autarky cannot, by itself, provide an incentive to service debt. What he actually shows is that avoiding financial autarky cannot be the reason for making a net transfer two periods in a row. If it is the reason in the second period, then in that period the debtor must be indifferent between repayment and autarky. But in that case the net transfer in the previous period would bring utility strictly below the autarky level.

¹⁷. Grossman and van Huyck (1988) and Kletzer and Wright (1990) develop related models in which the endowment fluctuates stochastically. They also find that the threat of financial autarky suffices to induce repayment. Moreover, Kletzer and Wright examine why the threat to impose autarky is credible and show that autarky need only be temporary. In these analyses repayment is contingent on the realized
Table 1. Magnitudes of Indebtedness and Net Transfers Sustainable through Reputation

<table>
<thead>
<tr>
<th>Interest rate, r</th>
<th>Discount factor, ρ</th>
<th>Output cycles between 8 and 12</th>
<th>Output cycles between 9 and 11</th>
<th>Net resource transfer from debtor to creditor</th>
<th>Maximum amount of debt at the beginning of a high-output period</th>
<th>Indicator for the enforcement constrainta</th>
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<tr>
<td></td>
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<td>Under high output</td>
<td>Under low output</td>
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</table>

Note: Average output is normalized at 10 units.
a. The maximum amount of debt at the beginning of a high-output period minus the value of debt incurred in the previous (low-output) period times 1 + r. If the difference is positive, the debtor can continue to borrow and remain a net debtor. If the difference is negative, the enforcement constraint becomes binding immediately (see the text).

Source: Author's calculations.
Domestic investment opportunities can provide an additional reason to want to maintain access to credit markets. The expected return on investment opportunities may also fluctuate. If a country must finance its own investment, taking advantage of investment opportunities may then force consumption to fluctuate. Access to international capital markets allows it to vary its investment level in response to changes in domestic investment opportunities without completely offsetting movements in consumption.

Annual data on net resource transfers between highly indebted countries and their private creditors (World Bank 1990) indicate that during the 1970s and 1980s the direction of the flow of funds between highly indebted countries and international capital markets changed on average around five times. Possibly there was much more variation within the year.

VI. DEALING WITH NONPAYMENT

Consider the general situation of a creditor confronted with a debtor that owes more than it is able or willing to transfer. There are four basic options: declaring the borrower in default and seeking a legal remedy; lending the difference (which could take the form of rescheduling, tolerating arrears, or providing "new money"); forgiving the difference; or finding another creditor to lend the difference.

The following formulation, which draws on several formulations in the literature, sheds some light on the attractiveness of the various options. It is a variant of Arnott and Stiglitz's (1988) general model of moral hazard and illustrates how moral hazard, as well as the tax problem discussed in section IV, can create debt problems. The particular problem here is that debt gives the debtor an incentive to make outcomes in which it pays more less likely.

The model does not deal with why the borrower borrowed or why anyone lent it anything in the first place. It takes the presence of an outstanding stock of problem debt as given. It begins with a debtor owing \( D_1 \) now and initially contracted to owe \( D_2 \) next period. But the debtor comes up with a payment of only \( R_1 < D_1 \) this period. There are two possible outcomes in period 2: either the debtor has a high output, \( Q^H \), in which case the debtor is assumed to pay whatever is owed, or output is low, \( Q^L \), and the debtor repays some given amount, \( R_2 \), that is less than \( D_2 \). (Why the debtor is willing to pay more when output is high than when it is low follows from the assumption, discussed in section IV, that the cost of default rises with output. For the reasons given there, it is not obvious that this is necessarily the case.) The probability, \( \pi(e) \), that

endowment of the borrower. Nominal debt service obligations can be interpreted as the payment that is contingent on the highest level of income. Lower realizations result in only partial payment, what Grossman and van Huyck call "excusable" default. But repayment below the level called for by the equilibrium is "inexcusable" and leads to loss of market access.
income is high depends positively on the debtor's effort, \( e \), in period 1. The effort might represent, for example, investment or fiscal reform.

In period 1, then, the debtor chooses \( e \) to maximize

\[
Q_1 - R_1 - e + \pi(e)(Q^H - R^H_2) + [1 - \pi(e)](Q^L - R^L_2)
\]

where \( R^H_2 \) is whatever the borrower ends up owing in period 2 (which is only paid if output is \( Q^H \)) and \( R^L_2 \) is the (exogenously specified) amount that the borrower repays if output is \( Q^L \). Effort is costly to the debtor. At an interior equilibrium the debtor equates the cost of a unit of effort, \( 1 \), with the expected return, \( \pi'(e)(Q^H - R^H_2 - Q^L + R^L) \), where \( \pi'(e) \) is the increase in the probability of high income from an extra unit of \( e \). The amount of effort that the debtor will want to undertake depends positively on the difference between output net of repayment in the two states. Hence, we can write the equilibrium amount of effort as an increasing function: \( e(Q^H - R^H_2 - Q^L + R^L) \). What is crucial for the argument is that effort falls as \( R^H_2 \) rises, given \( R^L_2 \).

**Creditors' Options**

Consider now the creditor's four options: formal bankruptcy and legal remedies, new money, forgiveness, and seeking a bailout.

**Formal bankruptcy and legal remedies.** One option is a formal declaration of default and subsequent legal remedy. It is not entirely clear, in the context of sovereign debt, what this would mean. But it could allow the creditor to take some of the debtor's current assets within the territory subject to the jurisdiction of the creditor's legal system. Moreover, some form of sanctions (potentially harmful to the creditor as well as the debtor, as a trade embargo would be) might be invoked. Say that this course of action yields the creditor a net gain, \( G \), and the debtor a direct loss, \( L \). But assume for the sake of argument that once the disposition of the debt is adjudicated, all remaining claims against the sovereign are wiped clean.

The debtor would find it worthwhile to expend an amount of effort \( e(Q^H - Q^L) \) because the period 2 debt is canceled. This is the socially efficient amount of effort, because the debtor captures all the gains from its effort. Any distortion imposed by the debt itself is eliminated. But to the extent that \( L \) exceeds \( G \), bankruptcy itself is inefficient. Inefficiency could arise, for example, if the adjudication process is costly, if during the period of adjudication trade is curtailed or investment opportunities foregone, or if the debtor's assets are less valuable in the hands of creditors.

In fact, for sovereign debt, \( G \) might be very low in relation to \( L \). Assets available to the lenders are probably small compared with debt, and sanctions associated with default might be very costly to lenders. In fact, \( G \) might well be negative. Consequently, a lender might find formal default procedures relatively less fruitful in dealing with a recalcitrant sovereign debtor than with a domestic debtor.
Why would lenders ever impose sanctions? One reason is that they might want to maintain a reputation for toughness. Bulow and Rogoff (1988b) develop another argument, separating the interests of private creditor banks from the rest of the creditor community. Default gives banks the legal right to seize any assets of any debtor in default in the creditor community. These claims reduce or eliminate gainful trade between the creditor community as a whole and the debtor country. Both lose, but the banks do not suffer and may even gain if some trade remains. The banks' legal rights may even allow them to extract transfers from citizens of the creditor country, who are willing to pay the banks (or give the debtors money to pay the banks) to forestall default and maintain trade with the debtor. The remaining question is why creditor governments would protect creditor claims when doing so harms the public interest. Alexander (1987) discusses legal issues surrounding the enforcement of private claims on foreign sovereigns. His discussion of the Allied Bank case suggests that the U.S. judicial system has not resolved the status of private claims on foreign sovereigns when the executive branch opposes enforcement of repayment.

*New money.* The next option is to lend the difference. The creditor gets $R_1$ now and increases its period 2 obligation, $R_2^*$, by $(D_1 - R_1)(1 + r^L)$, where $r^L$ is the interest rate on what is rolled over. But this amount is paid only if the level of output is high ($Q = Q^H$). If the level of output is low ($Q = Q^L$), the debtor pays only $R_2^*$. This option places the debt burden at its maximum, so that the debtor has the least incentive to put in effort; but if $Q = Q^H$, the creditor recovers the most.

The relative futility of seeking legal remedies compared with rolling over debt can make the disposition of sovereign debts very unclear to the outside observer. Creditors, perceiving the borrower to be suffering a temporary liquidity problem, may lend with the expectation of eventual full repayment, or they may lend simply to minimize their losses on previous loans.18

*Forgiveness.* The third option is to forgive the current shortfall. Again the creditor receives $R_1$ now, but receives $D_2$, the original obligation, only if income is high. Hence, the period 2 debt obligation and the debtor's effort are somewhere in between what they are in the case of a rollover and a cancellation.19

In comparing the second and third options, the creditor trades off the size of the period 2 obligation with the likelihood that the obligation will be met. The

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18. Hellwig (1977) models the behavior of a creditor who lends to try to salvage previous loans. New loans are not profitable on their own, but are made to increase the probability of repayment on previous loans.

19. Formally, through the choice of $r^L$, financing a postponement of repayment includes debt forgiveness ($r^L = -100$ percent) and cancellation ($r^L = -D_2/(D_1 - R_1) \times 100$ percent) as special cases. We are thinking, however, of rollovers as occurring at the actuarially fair rate. A rollover at anything less involves an element of forgiveness.
higher the debt obligation, the less effort the debtor is likely to put into ensuring that circumstances will be such that it will pay.

*Seniority and potential bailouts.* The fourth response of a creditor to a recalcitrant debtor is to find another party to lend the difference between what the debtor owes and what it is willing to pay.

In a domestic context, seniority provisions discourage lending by new creditors to a distressed borrower. These provisions protect initial lenders in at least two ways. First, if there is any circumstance in which the debtor makes only partial repayment on all that it owes, the initial creditors receive all that is paid up to the amount owed them. Without seniority, new lending would reduce the value of old loans by forcing old lenders to share partial repayments with new lenders. Old lenders would thus be adversely affected by new borrowing even if the borrower has no control over the likelihood of partial default. Second, because these provisions lower the return on new lending, they discourage it. The public finance and moral hazard problems discussed above imply a negative externality associated with new loans: new lending increases the potential for inefficiencies that will be borne partly by old lenders. New lenders presumably do not take this cost into account when they lend. By discouraging new lending, seniority gives initial creditors more control over the debtor’s total debt, reducing the scope for this externality. Ultimately, seniority provisions can benefit potential debtors as well as creditors by improving the terms upon which credit is initially available.

Seniority provisions can serve these purposes also in sovereign lending. But with sovereign debt a finding of default does not usually lead to distribution of the debtor’s assets among the creditors. (Or, as discussed, if it does, the assets available are likely to be worth much less than the debt.) Seniority consequently has less importance. Moreover, when lenders are providing new money to finance shortfalls in debt service obligations, the initial seniority of the lenders has less meaning: debts to those lenders who provide more new money (in relation to their initial debt) are subordinated to debts to lenders who provide less. Hence, those lenders who feel less obligation to provide new money to finance a payment shortfall end up “more senior,” regardless of the timing of the initial loans.

In the second subsection below, the argument is raised that coordination failures among private lenders justify public involvement in the debt crisis. The argument here suggests a different reason why public lending institutions have become involved: public desire to avoid inefficiencies arising from a formal default (inefficiencies such as trade disruption, unexploited investment opportunities, and political instability) has created political pressure for a public takeover of some private debt. To the extent that public lenders have more reason to avoid these inefficiencies, they have more incentive to finance payment shortfalls to private creditors. To the extent that they do finance more, public debt ends up subordinate to private debt. Already, on an ad hoc basis, official lending agen-
cies have lent problem debtors some of the difference between what they owe and what they want to pay their private creditors. Various proposals for debt relief institutionalize this response.

Public involvement may indeed have helped avoid the costs of a formal default (although, without the possibility of public lending, private lenders might have provided more new money themselves or have forgiven more debt). But even if public lending has had this positive short-run effect, the anticipation of public involvement could have had a negative effect in the longer run. Private lenders, knowing the public's desire to avoid the cost of default, might have anticipated that public institutions would help finance a payment shortfall if a loan was not repaid on schedule. This anticipation may have led them to lend more than was prudent from the perspective of the lender community as a whole.

The "Debt Laffer Curve" and Debt Relief

In the model developed above, an increase in a debtor's debt can actually lower its expected net resource transfers to its creditors. If the expected value of these transfers determines the market price of the debt, then a lower nominal amount of debt can actually have a higher market value.

The potential for a negative relation between the nominal and market value of the debt gives rise to what has been called a "debt Laffer curve." Because zero obligations imply zero transfers and have zero value, the relation between the face value and market value of the debt must be nondecreasing over a range beginning at zero. But at some point, the argument goes, a high debt burden creates such a disincentive to raise output that more nominal debt means that less, on average, will be repaid. Beyond this point, regardless of what the debtor pays in period 1, creditors would find it in their collective interest to reduce period 2 debt service obligations in order to raise the debtor's effort, \( e \), and, therefore, the probability that income will be high in period 2, \( \pi \).

In this example there are two possible outcomes in period 2 that bear the following relation to each other. In one, the debtor pays less than it owes, and what it does pay is independent of what it owes. In the other, the debtor pays what it owes, so what it does pay increases with what it owes.

More generally, a debt Laffer curve requires two conditions on repayment: the debtor pays strictly more when output is high, and the amount repaid when output is high responds more positively to the nominal value of the debt than what is repaid when output is low. These two conditions were satisfied in this model. They would not be satisfied if, for example, the debtor was expected to pay the same amount regardless of income (if \( R^1 \) were to equal \( R^2 \); or if expected payment in both states was independent of the amount the debtor is contracted to pay in period 2 \( D_2 \). The typical assumption is, as in the example, that the nominal amount of debt affects repayment only when debt is fully repaid. In this case belief in a debt Laffer curve requires a belief that there is some possibility that the debt will be fully repaid. Otherwise, the face value of the debt is irrelevant.
Stiglitz and Weiss (1981) give another reason why creditors might want to reduce the nominal value of debt: The debtor faces a choice between a risky investment and a safe investment that has a higher expected return. The debtor repays fully if it makes the safe investment or makes the risky investment and it succeeds. But if it makes the risky investment and it fails, then the debtor does not pay in full. The risky project can then yield the debtor a higher expected return, because creditors absorb some of the loss. If creditors cannot monitor or control the debtor's investment decision, they may do better forgiving debt to the point at which the debtor earns a higher return in the safe investment. To apply this argument to sovereign debt also requires that what creditors recover increases with the debtor's output. As already discussed, there is less reason to suppose such a relation for sovereign debt, because creditors have little ability to seize a debtor's assets.

Coordination, Free Riders, and a Public Institution

If lowering the face value of a country's debt raises its actual value, why do lenders not forgive debt to the point at which its market value is maximized? One explanation is that reducing the face value requires coordination among lenders, each of whom benefits from debt relief by others. The explanation is incomplete, however. It would still pay for a single purchaser to buy up all (or at least a major portion) of the outstanding debt and then reduce the debt. The initial holders might appropriate much of the gain, but an offer contingent on 100 percent participation would still leave a reward to anyone trying to consolidate the debt and achieve the gain.

Proponents of a public buyout of the debt, for instance Kenen (1990) and Sachs (1990), have also made use of the debt Laffer curve. They argue that, because market failures have rendered private markets incapable of writing down the debt, a public institution should correct the failure by buying up the debt and realizing the Laffer curve gain itself.

Obviously, the soundness of such an institution hinges on the position of the relevant debtors on the debt Laffer curve. If debtors are on the "wrong" (downward-sloping) side of the curve, the institution could make money, or at least avoid a loss, by realizing the gains from debt relief (although the institution, like any private creditor, would face the problem that the market price might already reflect the entire gain in the Laffer curve). But if debtors are on the

20. The free-rider problem associated with the debt Laffer curve relates to that of shareholders of corporations subject to takeover bids. See, for example, Grossman and Hart (1980), who discuss how corporate charters can be designed to overcome free-rider problems. Presumably, similar features could be introduced into syndicated loan agreements.

21. Demirguc-Kunt and Diwan (1990) have suggested that deposit insurance causes the market's failure to consolidate debt and achieve potential efficiency gains. They distinguish between sound and unsound banks. For the reason given by Stiglitz and Weiss (1981), unsound banks may actually prefer to hold an asset with a more variable return, even if its expected return is lower. One might ask, then, why unsound banks do not buy up all the debt. One answer might be that regulators do not let them.
upward-sloping portion of the curve, no such potential efficiency gains exist, and, if the public institution buys the debt at anything above market value, it will lose, unless, of course, it has some advantage over private creditors in collecting payment. In fact, public institutions do not seem to have collected net resource transfers from their debtors to the extent that private creditors have.²²

VII. BUYBACKS AND SWAPS: MARKET-BASED DEBT REDUCTION SCHEMES

Various schemes have been proposed, and some implemented, in which debtor countries use foreign exchange reserves to buy back their debt on the secondary market. The original loan covenants typically prohibited debtor buybacks.²³ Hence, overt buybacks require waivers from creditors. Debtor governments may nevertheless be able to buy back covertly, through third parties, for example. In fact, creditors have now permitted debtor buybacks in a number of circumstances.

Buybacks have taken several forms: simple buybacks using the debtor’s own resources, simple buybacks using donated resources, and "swap" arrangements. Under swap arrangements, the government exchanges debt for domestic currency at some stated price, and the use of this currency is tied to particular purposes such as direct foreign investment (in debt-equity swaps) or environmental protection (in debt-for-nature swaps).

Under some conditions, swaps can be decomposed into a simple buyback, with a subsidy to the direct foreign investment financed by the program (in debt-equity swaps) or to environmental protection financed by the program (in debt-for-nature swaps). The amount of the subsidy depends on the price at which debt is repurchased and on the exchange rate offered to the investor. In the extreme, if the exchange rate is close to what foreign investors would pay anyway and the purchase price is close to the price in the secondary market, then there is no subsidy.

Discussion has focused on the buyback component of the scheme. A particular controversy surrounds the extent to which buybacks benefit debtors. Bulow and Rogoff (1988a) argue that, for sovereign debt, buybacks out of the debtor’s own resources benefit creditors at the expense of debtors and that creditors appropriate the lion’s share of funds donated to a debtor to buy back debt. Hence they call buyback schemes intended to help debtors “buyback boondoggles” because, according to their analysis, these schemes are really transfers to lenders rather than “boons” for the debtor. A competing claim is that buybacks

²² This could mean that public institutions are worse at collecting debt. But it could also mean that they have been making socially useful (and possibly even profitable, from the perspective of the lender community as a whole) net transfers when private lenders have not (because of free-rider problems, regulatory constraints, and so on).

²³ One reason for this restriction is that, otherwise, the debtor might have an incentive to make an announcement or take an action that reduces the value of the debt and then buy back the debt at a depressed price.
can benefit both a debtor and its creditors. I present simple examples in which each result emerges and discuss the assumptions driving the different outcomes. Two things matter. One is how much the buyback reduces what the debtor pays subsequently. The more that the buyback reduces future repayment, the more likely it is to help the debtor at the expense of the creditor. Another is how much inefficiency the debt creates. The more the inefficiency created by the debt, the more likely the buyback is to benefit both the debtor and its creditors.

**Average and Marginal Debt: When Are Buybacks Boons or Boondoggles?**

Bulow and Rogoff (1988a) consider a two-period case in which the debtor owes \( D \) in period 2. The maximum that it can be persuaded to pay to service debt in period 2 is an amount \( R \) that has probability distribution \( F(R) \). A critical assumption is that \( F(R) \) is independent of \( D \). The debtor actually pays the minimum of \( R \) and \( D \): If \( R \) exceeds \( D \), it pays its debt in full; otherwise it pays \( R \) and defaults on the rest. (All magnitudes are discounted to period 1 present values.)

Creditors know all this, so they expect to get

\[
V(D) = \int_0^D R dF(R) + (1 - F(D))D
\]

where the first term reflects what creditors get when \( R \) is less than \( D \). The second term is the probability that \( R \) exceeds \( D \) times repayment in that case, \( D \). \( V(D) \) is the expected amount of repayment in period 2. If the market is risk-neutral, then \( V(D) \) should equal the market value of the debt in period 1.

The marginal value of debt is the effect of an increase in one unit of its face value on its market value. Differentiating with respect to \( D \) gives \( V'(D) = 1 - F(D) \), the probability of full repayment.

The average value of a unit of debt, \( p \), equals \( V(D)/D \) or

\[
p = \int_0^D \left( \frac{R}{D} \right) dF(R) + 1 - F(D)
\]

which is the expected payment per unit of debt. It exceeds \( 1 - F(D) \) as long as some payment occurs, even if full repayment is not made, but \( p \) cannot exceed 1.

When the debtor buys up its own debt, the presumption is that it should pay at least the average price \( p \), because this is the value of the claim that the seller is sacrificing. In fact, buybacks have occurred at prices near or above the market price. To give buybacks the best chance to help the debtor, say that buybacks take place at the market price.

A one-unit buyback lowers what the debtor pays subsequently by the marginal value \( V'(D) \) plus the extent to which resources used for the current buyback \( (p) \) reduce what is available for payment in the next period. Say that every dollar spent on buybacks reduces \( R \) by \( \lambda \). In this case, buying back a unit of debt at price \( p \) reduces resources available for repayment by \( \lambda p \). Because available re-
sources constrain repayment with probability $F(D)$, a unit buyback at price $p$ reduces expected payment the next period by $\lambda p F(D)$.

How a buyback of one unit of debt affects what the debtor ultimately transfers to the creditor thus has three components. First, there is the transfer entailed in the buyback itself, equal to the price paid, which is $p = [V(D)]/D$. Second, there is the reduction in the face value of the debt by one unit. Because the face value affects only what is repaid if the debt is repaid in full, a one-unit drop in the face value of the debt reduces expected repayment by the probability of full payment, that is, $V'(D) = 1 - F(D)$. Finally, there is the reduction in what the debtor pays if there is incomplete payment, $\lambda F(D)p$. Summing these, the total effect is

$$[V(D)]/D - V'(D) - \lambda p F(D) = p - 1 + F(D)[1 - \lambda p].$$

Because $1 \geq p \geq [1 - F(D)]$, the effect on the total amount the debtor transfers to the creditor is positive if $\lambda = 0$, as Bulow and Rogoff (1988a) argue is the case for sovereign debt, and negative if $\lambda = 1$, which they claim to be the case for corporate debt.

Hence, a crucial issue is how much the buyback reduces what is available for later repayment. If future resources are significantly reduced ($\lambda$ near 1), then the buyback is a boon for the debtor. A unit of debt reduction costs $p$. But it reduces its net resource transfer by nearly $p$ if it fails to repay fully and by $1 > p$ if it does repay fully.

But if the use of resources to buy debt does not affect what creditors can later hope to collect (as might be the case when funds were donated for that purpose) then spending $p$ now reduces payment, by 1, if full repayment is made, which occurs with probability $1 - F(D)$, but not at all otherwise. Because $p$ exceeds the probability of full repayment, the debtor loses. The scheme is a "boondoggle" for the creditor.

An empirical issue is the effect that buybacks have had on the value of remaining debt. The value of $\lambda$ determines how the price of remaining debt responds to the buyback. Consider a buyback of $B$ units of debt. Resources available for subsequent repayment fall by $\lambda p B$, so that default now occurs when $R - \lambda p B < D - B$, because full repayment is now an amount $D - B$. Differentiating the resulting expression for $p = [V(D - B)]/(D - B)$ with respect to $B$, the amount of debt bought back, and evaluating at $B = 0$, gives

$$\frac{dp}{dB} = \frac{[p - 1 + (1 - \lambda p)F(D)]}{D}.$$

Hence, under the Bulow-Rogoff presumption that the buyback does not affect resources available for repayment ($\lambda = 0$), the price of remaining debt rises after a buyback (because $p \geq 1 - F(D)$). (Only in the limiting case in which there is no possibility of all debt being paid off [$F(D) = 1$] is the value of remaining debt unaffected.) Alternatively, if resources used for a buyback decrease what is
available for repayment unit-for-unit ($\lambda = 1$), the price of remaining debt falls after a buyback. (There is no effect only in the limiting case in which repayment is assured, so that $p = 1$.)

**Buybacks as a Cure for Debt Hangovers**

So far, the analysis has treated total resources as given. Debt imposes no excess burden. Hence, the only question raised by buybacks is how they affect what the debtor transfers to creditors.

In fact, one argument given in favor of buybacks is their potential to eliminate inefficiencies imposed by the debt overhang (see, for example, Krugman 1988 and 1989 and Helpman 1990). The public finance constraint introduced in section IV suggests one way that they could.

In the example developed there, two equilibrium outcomes were possible. One involved investment at a positive level, $K^*$, and full repayment. The other involved no investment (capital flight) and payment of $T_0 < D$. Say that the expectation is that $K^*$ will be invested with probability $\pi$ and that the flight equilibrium occurs with probability $1 - \pi$. The value of the debt is then $V(D) = (1 - \pi)T_0 + \pi D$, and the price is $p(D) = (1 - \pi)T_0 / (D - B)$.

Consider now a buyback of an amount $B$. If the probability of capital flight stays at $1 - \pi$ as long as the possibility of flight remains, then buying back any amount $B < D - T_0$ will occur at a price $\pi + (1 - \pi)T_0 / (D - B)$. Debt service will be reduced by $B$ with probability $\pi$ and by $-\lambda p B$ with probability $1 - \pi$. As before, the net effect on resources transferred to creditors is positive if $\lambda = 0$ but negative if $\lambda = 1$.

Consider now a buyback of $B \geq D - T_0$ when $\lambda = 0$. A buyback of this magnitude ensures that nondistortionary taxes can cover the debt remaining in the next period. The possibility of a tax on investment is eliminated. Hence, the probability of repayment rises to 1. If creditors realize the extent of the buyback, the price of debt will rise to 1. The debtor must spend $B$ now and $D - B$ the next period on debt. The buyback makes full repayment certain. But the debtor’s expected income during the two periods changes from $\pi g(K^*) + D) + (1 - \pi) g(K^*) - T_0$ to $g(K^*) - D$, where $g$ is output and $r_w$ is the world interest rate. The debtor’s income is expected to increase as long as $g(K^*) - r_w K^* \geq D - T_0$, or as long as the difference between outputs in the no-flight and flight states exceeds the difference in debt repayment between those two states.

The buyback benefits both parties by eliminating potential distortions caused by delay. Because capital is inelastically supplied in the short run but elastically supplied in the long run, future taxes to finance repayment provide more scope for distortion than current taxes do. Hence, a buyback, by moving more of the

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24. If resources used for the buyback are withdrawn from a project that would have yielded more than the world interest rate, then there is a possibility that $\lambda > 1$. 

repayment up front, may require less distortionary taxation than the original repayment schedule does.

This argument contradicts the claim that lengthening maturities will alleviate debt problems. On the contrary, to impose the minimum excess burden, repayment is to be gotten over with quickly. Delay just increases the potential distortions imposed by raising the revenue needed to repay.

Three caveats to the argument are needed. First, the two-period aspect of the example precludes making general inferences about the optimal timing of repayment. Even if debt repayment is postponed beyond the time when current investment would fully depreciate, at some future time anticipated repayment could discourage investment, justifying a buyback then. But anticipation of the tax burden of financing that buyback could discourage earlier investment. By induction, any postponement that maintains the present value of the debt could have a discouraging effect on current investment. Second, the example had a tax on income of inelastically supplied factors as the only alternative to a capital levy. If other factors are in elastic supply, taxing these imposes distortions as well. Standard public finance considerations imply that minimizing excess burden would call for smoothing taxes on the incomes of these factors over time. Third, I have assumed that the debtor government can raise revenue from current taxes to finance the buyback. If instead it borrows domestically, then the operation just replaces foreign debt with domestic debt. This switch might be desirable for a number of reasons, but the debt overhang and consequent potential for capital flight remain.

**Buybacks and the Laffer Curve**

In this example the buyback can benefit both parties even though the situation is not characterized by a "debt Laffer curve," contrary to some claims in the literature. Forgiving any amount of debt \( B \) less than \( D - T_0 \) causes expected repayment to fall by \( \pi B \), whereas forgiving an amount in excess of \( D - T_0 \) causes expected repayment to fall from \( \pi D - (1 - \pi)T_0 \) to below \( T_0 \). In neither case does debt forgiveness increase the value of the debt.

In conclusion, a debt buyback can benefit a debtor. This outcome requires, however, either that funds used to buy back debt reduce what is available subsequently for repayment (in which case the buyback is necessarily at the expense of creditors) or that it reduce or eliminate a distortion associated with a debt overhang (in which case the buyback can benefit creditors as well).

**VIII. Conclusion**

Our understanding of international borrowing remains piecemeal. Several complex issues have yet to be worked out. But a few conclusions can be drawn. Models of national participation in international capital markets point to several roles for foreign debt. In the short run, foreign debt can allow countries to experience uneven endowments or to exploit uneven investment opportunities...
without concomitant unevenness in consumption. In the longer run, foreign
debt can allow countries to undertake long-term investment projects without the
sacrifice of current for future consumption that would otherwise be necessary.
Moreover, models of endogenous growth show how access to international
capital markets can lead to faster growth.

But the literature also shows how foreign debt can cause problems. Con-
straints on the ability to enforce repayment arrangements have limited the extent
to which foreign debt is owed by private entities. Much of the debt has been
borrowed or eventually assumed by governments, adding to their fiscal burdens
and creating an incentive for capital flight. An outstanding challenge is to design
an international institutional framework that can facilitate private lending to
private borrowers with less risk of eventual government bailout. In addition,
large debts can distort the incentives even of private debtors. The design of
international investment instruments that minimize the potential for moral haz-
ard is another outstanding challenge.

A shift back toward more equity investment may mitigate some enforcement
and moral hazard problems, but the issue of sovereign risk remains. Even in a
domestic context, equity investments are subject to fraud, breach of contract,
unfavorable shifts in tax laws, and outright expropriation. The sovereignty of a
judicial system that enforces the rights of foreign investors compounds these
risks immensely. Designing investment instruments that overcome these prob-
lems will require understanding the sources of these risks as well.

Moreover, much of what theory we have has yet to be given serious empirical
examination. We have little idea, for example, what factors determine how
much a country actually repays. But arguments about such issues as the desir-
ability of a public takeover of the debt are based on very specific assumptions
about what the determining factors are. Careful examination of the experience
of the 1970s and 1980s can provide much evidence about what foreign debt
contributes to development and what dangers it poses.

References

The word "processed" describes informally reproduced works that may not be com-
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