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Sovereign Debt: A Primer

Jonathan Eaton

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, raises 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.¹ 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

1. Glick and Kharas (1984), Eaton, Gersovitz, and Stiglitz (1986), Eaton and Taylor (1986), Eaton (1989), and Cohen (1991) provide treatments of a wider range of issues and more comprehensive bibliographies.

Jonathan Eaton is in the Department of Economics at Boston University. He thanks Aditya Bhattacharjea, Zareen Naqvi, and Akiko Tamura for excellent research assistance and Ib Madsen, John Underwood, and the referees for comments and criticisms. The original version of this article was prepared for a course on external debt given by the Debt and International Finance Division of the World Bank.

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 , $B_t^i = \dot{D}_t^i$.

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_t^i , then the total change in the country's debt is

$$(1) \quad \dot{D}_t = \sum_i \left[E_t^i B_t^i + (\dot{E}_t^i/E_t^i) (E_t^i D_t^i) \right].$$

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 ρ (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:

$$(2) \quad U_0 = \sum_{t=0}^{\infty} \rho^t u(C_t).$$

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

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

and debt at the end of period t is

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

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

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

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:

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

This last condition is often called the intertemporal budget constraint.

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

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

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 ,

$$(8) \quad D_t \leq \sum_{\tau=t+1}^{\infty} \frac{Q_{\tau} - C_{\tau}}{(1+r)^{\tau-t}}.$$

Because consumption cannot be negative, this condition implies that

$$(9) \quad D_t \leq W_t$$

where

$$(10) \quad W_t = \sum_{\tau=t+1}^{\infty} \frac{Q_{\tau}}{(1+r)^{\tau-t}}$$

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

$$(11) \quad \lim_{t \rightarrow \infty} \frac{D_t}{(1+r)^t} \leq 0.$$

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

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

where λ is the shadow price associated with the solvency condition.

The first-order conditions for a maximum are

$$(13) \quad [(1+r)\rho]^t u'(C_t) = \lambda, \quad \forall t = 0, \dots, \infty.$$

With nonsatiation (so that the marginal utility of consumption is always strictly positive), λ is strictly positive, meaning that the constraint is binding. Optimal borrowing thus implies that equation 6 holds with equality, or that

$$(14) \quad \sum_{t=0}^{\infty} \frac{C_t}{(1+r)^t} = W_0.$$

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

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.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

$$(15) \quad Q_t = K_t^\beta (e_t N_t)^{1-\beta} H_t^{1-\beta+\gamma}$$

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 β , which lies between 0 and 1, and γ is a nonnegative parameter.

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 H_{it} , in period t , and working a fraction of his time e_{it} contributes $e_{it}H_{it}$ 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^γ 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

$$(16) \quad w_t = (1 - \beta) \left[\frac{K_t}{(e_t H_t N_t)} \right]^\beta H_t^\gamma$$

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 $\dot{K}_t = I_t$, 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

$$(17) \quad \dot{H}_t = H_t \varphi (1 - e_t)$$

where $\varphi > 0$, $\varphi' > 0$, $\varphi'' \leq 0$, 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 3.⁴ An individual's nonhuman wealth, A , evolves according to

$$(18) \quad \dot{A}_t = rA_t + w_t e_t H_t N_t - c_t N_t$$

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

4. I deviate from Lucas in not weighting per-period utility by population. Defining ρ as $\rho - n$ 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

$$(19) \quad V(H_0) = w_0 H_0 \int_0^\infty \exp \left\{ \int_0^t [g_w(\tau) + \varphi(1 - e_\tau) - r] d\tau \right\} e_t dt$$

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_t is independent of the stock of human capital, H_t . If wages grow at a constant rate, then the first-order condition for an interior maximum is

$$(20) \quad r - g_w = \varphi(1 - e) + e\varphi'(1 - e)$$

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 $\dot{Q}/Q = \dot{K}/K = g_Q$,

$$(21) \quad g_Q = \frac{(\gamma + 1 - \beta)\varphi(1 - e)}{1 - \beta} + n$$

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

$$(22) \quad g_w = \frac{\gamma}{1 - \beta} \varphi(1 - e).$$

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

$$(23) \quad r = \frac{\gamma + 1 - \beta}{1 - \beta} \varphi(1 - e) + e\varphi'(1 - e).$$

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

$$(24) \quad 1 - e = \frac{(1 - \beta) \left(\frac{r}{\epsilon - 1} \right)}{\gamma}$$

(as long as $\gamma > 0$).⁵

5. If $\gamma = 0$, there is no interior solution. If $r > \epsilon$ (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 φ , implying decreasing returns to learning at the individual level.

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

$$(25) \quad g_H = \frac{r - \left\{ r^2 - \epsilon^2 \left[1 + \frac{2\gamma}{(1-\beta)} \right] \right\}^{\frac{1}{2}}}{1 + \frac{2\gamma}{(1-\beta)}}.$$

The corresponding growth in per capita output is

$$(26) \quad g_q = \frac{r - \left\{ r^2 - \epsilon^2 \left[1 + \frac{2\gamma}{(1-\beta)} \right] \right\}^{\frac{1}{2}}}{\frac{(1-\beta+2\gamma)}{(1-\beta+\gamma)}}.$$

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 $\epsilon = 0.05$. (To satisfy the transversality condition at $e = 0$, we need $r > \epsilon$.) 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 economy, the steady-state interest rate is $r = \rho + \sigma g_c$, where g_c is the growth rate of per capita consumption and $\sigma = u''(C)C/u'(C)$, the elasticity of the marginal utility of consumption. For a σ 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.⁷

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.

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 α is an exogenous constant. The capital stock evolves according to

$$(27) \quad K_t = (1 - \delta)K_{t-1} + I_t$$

where δ is the rate at which capital depreciates and I is investment. Following an earlier literature on adjustment costs, going back to Penrose (1971) and Treadaway (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

7. Raising the capital share, β , from 0.33 to 0.5 or raising γ to 0.07 implies growth rates that are about 0.2 percent higher at each interest rate.

capital stock (gross of depreciation) requires a sacrifice of current resources of J_t , where

$$(28) \quad J_t = I_t \left[1 + \left(\frac{\phi}{2} \right) \left(\frac{I_t}{K_t} \right) \right].$$

The parameter ϕ 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

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

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 (α is higher) and is lower when the depreciation rate, δ , and the cost of installation, as reflected by the parameter ϕ , are higher. For some (plausible) parameter values, the model has no steady-state growth rate.

taxation can reduce the resources that a government can marshall 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 starker 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 $T_0 + tg(K)$.

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 $t(K) = (D - T_0)/g(K)$. The after-tax rate of return is

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

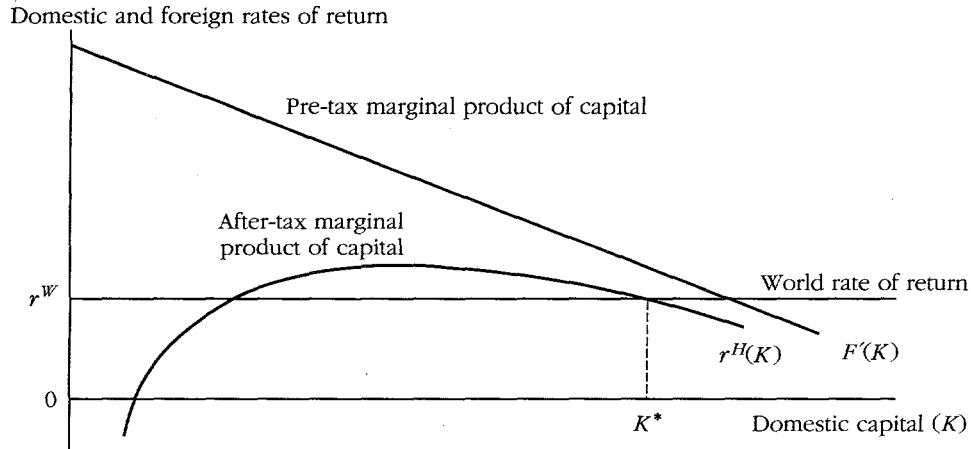
which can be increasing in K when K is near 0 but decreases in K once K becomes large enough. Individual investors are small in relation to the total number (so that they ignore the effect of their own investment on the total stock, K). Investment can occur at a level at which $r^H(K) = r^W$ or, because

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

$K = 0$ 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-

Figure 1. *The Public Finance Problem and the Potential for Capital Flight*

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.⁹

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

9. Diaz-Alejandro (1984) recounts the example of Chile during the 1970s.

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 lend 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 π 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 π . 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

12. Bargaining theory can shed light on how the size of a penalty affects how much a creditor can extract in payment. Bulow and Rogoff (1988b, 1989a), Fernandez and Rosenthal (1990), Fernandez and Glazer (1990), and Eaton and Engers (1992) provide analyses.

(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.¹³

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.¹⁴

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.¹⁵

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

$$(32) \quad \sum_{\tau=t}^{\infty} \rho^{\tau-t} u(C_\tau) \geq \sum_{\tau=t}^{\infty} \rho^{\tau-t} u(Q_\tau), \quad t = 0, \dots, \infty$$

where, as in section II, ρ 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

$$(33) \quad \max_{C_t} \left\{ \sum_{t=0}^{\infty} \rho^t u(C_t) + \mu_t \sum_{\tau=t}^{\infty} \rho^{\tau-t} [u(C_\tau) - u(Q_\tau)] + \lambda \left(\frac{Q_t - C_t}{(1+r)^t} \right) \right\}$$

where λ is again the Lagrange multiplier associated with the solvency constraint (equation 5), μ_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

$$(34) \quad [(1+r)\rho]^t u'(C_t) \left(1 + \sum_{\tau=0}^t \mu_\tau \right) = \lambda, \quad t = 0, \dots, \infty.$$

The presence of the μ_r 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 $(1 + r)\rho < 1$. 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

$$(35) \quad W_L = \frac{(1 + r)[(1 + r)Q^L + Q^H]}{r(2 + r)}.$$

Without any enforcement problem the optimal consumption profile satisfies equation 13. If $\rho < 1 + r$, 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 $Q^L \geq (1 + r)\rho Q^H$, 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 $(1 + r)\rho$ 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

Interest rate, r	Discount factor, ρ	Output level		Net resource transfer from debtor to creditor		Maximum amount of debt at the beginning of a high-output period	Indicator for the enforcement constraint ^a
		High	Low	Under high output	Under low output		
<i>Output cycles between 8 and 12</i>							
0.001	0.90	12	8	1.60	-1.37	111.5	110.1
0.01	0.90	12	8	1.64	-1.42	11.9	10.5
0.05	0.90	12	8	1.83	-1.61	3.1	1.4
0.1	0.90	12	8	2.05	-1.85	2.1	0.1
0.001	0.85	12	8	1.27	-1.13	73.0	71.9
0.01	0.85	12	8	1.32	-1.17	7.9	6.7
0.05	0.85	12	8	1.51	-1.37	2.2	0.8
0.1	0.85	12	8	1.73	-1.60	1.5	-0.2
0.001	0.95	12	8	1.91	-1.60	155.2	153.6
0.01	0.95	12	8	1.95	-1.64	16.5	14.8
0.05	0.95	12	8	2.14	-1.84	4.2	2.3
0.1	0.95	12	8	2.36	-2.07	2.7	0.5
<i>Output cycles between 9 and 11</i>							
0.001	0.90	11	9	0.49	-0.47	11.5	11.1
0.01	0.90	11	9	0.54	-0.51	1.4	0.9
0.05	0.90	11	9	0.73	-0.71	0.5	-0.2
0.1	0.90	11	9	0.95	-0.95	0.5	-0.5
0.001	0.85	11	9	0.20	-0.19	1.9	1.7
0.01	0.85	11	9	0.24	-0.24	0.3	0.1
0.05	0.85	11	9	0.43	-0.43	0.2	-0.3
0.1	0.85	11	9	0.65	-0.67	0.2	-0.5
0.001	0.95	11	9	0.78	-0.72	28.2	27.5
0.01	0.95	11	9	0.82	-0.77	3.2	2.4
0.05	0.95	11	9	1.01	-0.96	1.0	0.0
0.1	0.95	11	9	1.24	-1.20	0.8	-0.5

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^L , 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

$$(36) \quad Q_1 - R_1 - e + \pi(e)(Q^H - R_2^H) + [1 - \pi(e)](Q^L - R_2^L)$$

where R_2^H is whatever the borrower ends up owing in period 2 (which is only paid if output is Q^H) and R_2^L 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, $\pi'(e)(Q^H - R_2^H - Q^L + R_2^L)$, 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: $e(Q^H - R_2^H - Q^L + R_2^L)$. What is crucial for the argument is that effort falls as R_2^H rises, given R_2^L .

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^H , 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^L . 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

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, π .

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_2^H were to equal R_2^L), 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.²⁰ 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.²¹

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

$$(37) \quad V(D) = \int_0^D R dF(R) + [1 - F(D)]D$$

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

$$(38) \quad p = \int_0^D \left(\frac{R}{D}\right) dF(R) + 1 - F(D)$$

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 λ . In this case, buying back a unit of debt at price p reduces resources available for repayment by λp . 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

$$(39) \quad [V(D)]/D - V'(D) - \lambda p F(D) = p - 1 + F(D)(1 - \lambda p).$$

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 (λ 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 λ 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

$$(40) \quad \frac{dp}{dB} = \frac{[p - 1 + (1 - \lambda p)F(D)]}{D}.$$

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 $p = 1$.)²⁴

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 π 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 $p(D) = (1 - \pi)T_0/D + \pi$.

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 π and by $-\lambda pB$ 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 $\pi[g(K^*) - D] + (1 - \pi)[r^W K^* - T_0]$ 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

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 πB , 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. Constraints 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 hazard 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 problems 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 desirability 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 commonly available through library systems.

- Alexander, Lewis S. 1987. "Three Essays on Sovereign Default and International Lending." Ph.D. dissertation. Yale University, Department of Economics, New Haven, Conn. Processed.
- Arnott, R. J., and J. E. Stiglitz. 1988. "The Basic Analytics of Moral Hazard." *Scandinavian Journal of Economics* 90: 383-413.
- Bardhan, Pranab K. 1965. "Optimum Accumulation and International Trade." *Review of Economic Studies* 32: 241-44.
- Bulow, Jeremy, and Kenneth Rogoff. 1988a. "The Buyback Boondoggle." *Brookings Papers on Economic Activity* 2. Washington, D.C.: Brookings Institution.
- . 1988b. "Multilateral Sovereign Debt Reschedulings." *IMF Staff Papers* 35: 644-57.

- _____. 1989a. "A Constant Recontracting Model of Sovereign Debt." *Journal of Political Economy* 97: 166-77.
- _____. 1989b. "LDC Debt: Is to Forgive to Forget?" *American Economic Review* 79: 43-50.
- Cohen, Daniel. 1991. *Private Lending to Sovereign States*. Cambridge, Mass.: MIT Press.
- Demirguc-Kunt, Asli, and Ishac Diwan. 1990. "The Menu Approach to Developing Country External Debt: An Analysis of Commercial Banks' Choice Behavior." WPS 530. World Bank, International Economics Department, Washington, D.C. Processed.
- Diaz-Alejandro, Carlos F. 1984. "Goodbye Financial Repression, Hello Financial Crash." *Journal of Development Economics* 19: 1-24.
- Domar, Evsey. 1946. "Capital Expansion, Rate of Growth, and Employment." *Econometrica* 14: 137-47.
- Eaton, Jonathan. 1987. "Public Debt Guarantees and Private Capital Flight." *The World Bank Economic Review* 1: 337-95.
- _____. 1989. "Foreign Public Capital Flows." In H. B. Chenery and T. N. Srinivasan, eds., *Handbook of Development Economics*. Amsterdam: North Holland.
- _____. 1990. "Debt Relief and the International Enforcement of Loan Contracts." *Journal of Economic Perspectives* 4: 43-56.
- Eaton, Jonathan, and Maxim Engers. 1992. "Sanctions." *Journal of Political Economy* 100: 899-928.
- Eaton, Jonathan, and Mark Gersovitz. 1981. "Debt with Potential Repudiation: Theory and Estimation." *Review of Economic Studies* 48: 289-309.
- Eaton, Jonathan, Mark Gersovitz, and J.E. Stiglitz. 1986. "The Pure Theory of Country Risk." *European Economic Review* 30: 481-513.
- Eaton, Jonathan, and Lance Taylor. 1986. "Developing Country Finance and Debt." *Journal of Development Economics* 22: 209-65.
- Eichengreen, Barry, and Richard Portes. 1990. "Foreign Lending and Default: The Experience since the 1920s." World Bank, Debt and International Finance Division, Washington, D.C. Processed.
- Engel, Charles, and Kenneth Kletzer. 1989. "Saving and Investment in an Open Economy with Non-Traded Goods." *International Economic Review* 30: 735-52.
- Feldstein, Martin S., and Charles Horioka. 1980. "Domestic Saving and International Capital Flows." *Economic Journal* 90: 314-29.
- Fernandez, Raquel, and Robert W. Rosenthal. 1990. "Strategic Models of Sovereign-Debt Renegotiations." *Review of Economic Studies* 57: 331-50.
- Fernandez, Raquel, and Jacob Glazer. 1990. "The Scope for Collusive Behavior among Debtor Countries." *Journal of Development Economics* 32: 297-313.
- Gersovitz, Mark. 1983. "Trade, Capital Mobility, and Sovereign Immunity." Research Program in Development Studies Paper 108. Princeton University. Processed.
- _____. 1985. "Banks' International Lending Decisions: What We Know and Implications for Future Research." In G. W. Smith and J. T. Cuddington, eds., *International Debt and Developing Countries*. A World Bank Symposium. Washington, D.C.
- Glick, Reuben, and Horni J. Kharas. 1984. "The Costs and Benefits of Foreign Borrowing: A Survey of Multiperiod Models." World Bank, Washington, D.C. Processed.
- Grossman, Herschel I., and J. B. van Huyck. 1988. "Sovereign Debt as a Contingent Claim: Excusable Default, Repudiation, and Reputation." *American Economic Review* 78: 1088-97.

- Grossman, Sanford, and Oliver Hart. 1980. "Takeover Bids, the Free Rider Problem, and the Theory of the Corporation." *Bell Journal of Economics* 11: 42–64.
- Harrod, Sir Roy F. 1939. "An Essay in Dynamic Theory." *Economic Journal*: 49: 14–33.
- Hellwig, Martin F. 1977. "A Model of Borrowing and Lending with Bankruptcy." *Econometrica* 45: 1879–1906.
- Helpman, Elhanan. 1990. "The Simple Analytics of Debt-Equity Swaps." *American Economic Review* 79: 440–51.
- Inada, Ken-Ichi. 1969. "Endogenous Technical Progress and Steady-State Growth." *Review of Economic Studies* 36: 99–108.
- Kaldor, Sir Nicholas, and J. A. Mirrlees. 1962. "A New Model of Economic Growth," *Review of Economic Studies* 29: 174–92.
- Kenen, Peter B. 1990. "Organizing Debt Relief: The Need for a New Institution." *Journal of Economic Perspectives* 4: 7–18.
- Kletzer, Kenneth M. 1984. "Asymmetries of Information and LDC Borrowing with Sovereign Risk." *Economic Journal* 94: 287–307.
- Kletzer, Kenneth M., and Brian D. Wright. 1990. "Sovereign-Debt Renegotiation in a Consumption-Smoothing Model." University of California at Berkeley, Department of Agricultural and Resource Economics. Processed.
- Krugman, Paul R. 1988. "Financing vs. Forgiving a Debt Overhang." *Journal of Development Economics* 29: 253–68.
- . 1989. "Market-based Debt Reduction Schemes." In Jacob A. Frenkel, Michael P. Dooley, and Peter Wickham, eds., *Analytic Issues in Debt*. Washington, D.C.: International Monetary Fund.
- Lucas, Robert E. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22: 3–42.
- Obstfeld, Maurice. 1989. "How Integrated Are World Capital Markets?" In Guillermo Calvo, Ronald Findlay, Pentti Kouri, and Jorge B. de Macedo, eds., *Debt, Stabilization, and Development: Essays in Memory of Carlos Diaz-Alejandro*. Oxford: Basil Blackwell.
- Ozler, Sule. 1990. "Have Commercial Banks Ignored History?" University of California, Los Angeles, Department of Economics. Processed.
- . 1992. "The Evolution of Credit Terms: An Empirical Study of Commercial Bank Lending to Developing Countries." *Journal of Development Economics* 38: 79–97.
- Penrose, Edith. 1971. *The Growth of Firms, Middle East Oil, and Other Essays*. London: Frank Cass & Co.
- Romer, Paul M. 1986. "Increasing Returns and Long-Run Growth." *Journal of Political Economy* 94: 1002–37.
- Sachs, Jeffrey D. 1990. "A Strategy for Efficient Debt Reduction." *Journal of Economic Perspectives* 4: 19–30.
- Shell, Karl. 1966. "Toward a Theory of Inventive Activity and Capital Accumulation." *American Economic Review* 56: 62–68.
- Stiglitz, Joseph E., and Andrew Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71: 393–411.
- Treadway, A. B. 1969. "On Rational Entrepreneurial Behavior and the Demand for Investment." *Review of Economic Studies* 36: 228–39.
- Uzawa, Hirofumi. 1965. "Optimum Technical Change in an Aggregative Model of Economic Growth." *International Economic Review* 6: 18–31.
- World Bank. 1990. *World Debt Tables 1990–91*. Washington, D.C.

Modeling the Macroeconomic Effects of AIDS, with an Application to Tanzania

John T. Cuddington

A Solow-style model is developed to study the effects of the AIDS epidemic on the growth path of the economy and GDP per capita. The model uses conjectures about the demographic effects of AIDS in Tanzania to estimate the macroeconomic effects on the economy. The findings suggest that, without decisive policy action, AIDS may reduce Tanzanian GDP in the year 2010 by 15 to 25 percent in relation to a counterfactual no-AIDS scenario. Per capita income levels are expected to fall by 0 to 10 percent by 2010.

The acquired immunodeficiency syndrome (AIDS) epidemic in Africa has received considerable attention by epidemiologists and demographers, as well as health economists concerned with the sectoral impact of the disease. Given the alarming—and still growing—prevalence of the disease within various regions in Côte d'Ivoire, Kenya, Malawi, Tanzania, Uganda, Zaire, and Zimbabwe, several questions are now being raised: Will AIDS have important macroeconomic effects on the stricken societies? If so, what will these effects be, and to what extent can various policies alter them?

This article develops a simple but tractable framework for analyzing the effects of AIDS on the growth paths of potential gross domestic product (GDP) and per capita GDP. The classic Solow (1956) growth model is extended to incorporate the key macroeconomic consequences of AIDS. Using this model, AIDS and no-AIDS scenarios are compared analytically and through simulations based on Tanzanian demographic and macroeconomic data.

Section I discusses various channels through which AIDS might affect the macroeconomy and describes its expected demographic impact in Tanzania. A model incorporating these key channels is developed in section II. The model is used to discuss the likely effect on the ratio of capital to labor and on output per capita as the economy moves from a no-AIDS situation toward a new steady

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state, in which AIDS is assumed to be endemic. Although comparing steady states is useful for developing intuition about the possible consequences of AIDS, the directions of several key effects are shown to be ambiguous. Furthermore, the time horizon needed to reach a new steady state may be very long indeed, given the epidemiological and demographic dynamics of a disease like AIDS. To address these concerns, section III uses a simple simulation model to forecast the time paths of macro aggregates in Tanzania as the prevalence of AIDS rises. These time paths are compared with simulated results for a no-AIDS situation to determine the severity of the impact of the disease on the growth path of the Tanzanian economy. Bulatao's (1990) demographic scenarios for the no-AIDS case and a rather pessimistic AIDS scenario are used as inputs in the simulated version of the model. (A brief appendix relates the growth model approach developed here to the human capital approach, which is commonly used in the health economics literature.) Section IV concludes with a tentative discussion of the policy implications of the analysis.

I. CHANNELS OF THE MACROECONOMIC INFLUENCE OF AIDS

The rising prevalence of AIDS can be expected to affect the macroeconomy through several separate channels. At the most primitive level, the effects of AIDS can be grouped into two categories: those associated with rising morbidity and those associated with rising mortality rates for particular age cohorts, especially sexually active adults and children infected at birth.

Rising Morbidity

The rise in morbidity will have two immediate effects: a negative labor productivity effect and a positive health care expenditure effect. These effects, in turn, may alter savings behavior as well as investment in education. The negative labor productivity effect will arise because sick or worried workers are less productive than happy, healthy workers. Even the productivity of those who do not have AIDS may be negatively altered as infection rates and illness among friends, families, and coworkers rise.

The positive health care expenditure effect refers to increased expenditures by households and the (public or private) health care system to assist AIDS patients and their families in coping with deteriorating health.¹ Pallangyo and Laing (1990) estimate that in Tanzania, for example, the average cost incurred per adult AIDS patient over the duration of the patient's illness is approximately T Sh50,139, assuming that the present centralized health care delivery system (not home-based care) remains in place and that 60 percent of the required drugs for treatment are actually available. For children, the corresponding figure is

1. Care must be taken to consider the difference in health expenditures in the no-AIDS and AIDS scenarios, because health care costs that are not related to AIDS may be reduced if individuals die earlier and more quickly as a result of AIDS. Also, changes in the age structure may affect health care costs per capita.

T Sh34,395. These figures imply annual costs per adult patient of T Sh33,426 and per child patient of T Sh34,395, under the assumption that the typical adult with AIDS lives one and a half years and the typical child with AIDS one year.² Comparing these figures with Tanzania's per capita income, which was roughly T Sh12,590 in 1988, it is clear that these AIDS-related health care costs could become a tremendous burden as the epidemic worsens.³

As health care costs rise because of AIDS, there will be a negative domestic saving effect, except in the unlikely case where the entire increase in medical spending is paid for by reducing other current expenditures. The AIDS epidemic will affect saving through several mechanisms: The direct effect of higher medical expenditures will presumably reduce saving as well as nonhealth current expenditures to some extent. In addition, AIDS may affect saving through its effect on the growth rate, life expectancy, age structure, and healthiness of the population. Whether the negative saving effect falls primarily on private or public saving will depend to a large extent on the nature of the health care delivery system. The fall in domestic saving will imply a reduction in capital formation, which in turn will lead to a potentially large adverse effect on per capita income over the long term. In addition to the direct dissaving effect, AIDS may increase precautionary demand for saving by households that experience greater income variability in the presence of AIDS.

In all likelihood, higher medical expenditures—and ultimately higher funeral costs—will reduce other current expenditures, not just saving. Funeral costs can be very large in traditional societies, where workers must stop working and travel great distances to pay their last respects. Families with the AIDS illness may attempt to increase saving in anticipation of having to pay large funeral expenses in the not-too-distant future. And anecdotal evidence suggests that reduced spending on education (reduced supply) may be an important consequence of ballooning health care expenditures. The demand for education may also be reduced as children are forced to leave school earlier to support ill parents. The potential for adverse growth effects from AIDS will be heightened to the extent that investment in human capital is reduced.

The adverse effect of AIDS on the stock of human capital will have several related aspects, which will depend in part on whether the human capital is acquired through experience (learning by doing) or is the result of investments in education or on-the-job training programs. The analytical and simulation models below focus on experience-based human capital; no explicit decision to invest in education is involved. To the extent that AIDS causes experienced

2. The World Bank (1992) estimates that 90 percent of children with AIDS die within one year and 100 percent die within two years. As for adults with AIDS, it is estimated that 80 percent die within one year and 90 percent within two years.

3. It is difficult to obtain detailed information on AIDS-related health costs, days of illness, and other related statistics. Despite these difficulties, Scitovsky and Over (1988) have compiled evidence from various sources showing medical costs per person per year between one and ten times the value of per capita GDP for a selected group of industrial and developing countries in the mid-1980s.

workers in the current work force to die prematurely, it will erode the existing human capital stock and hence national output. Additional losses (in relation to the no-AIDS scenario) will cumulate over time as AIDS shifts the composition of the labor force permanently toward younger, less-experienced workers.

In the case of human capital resulting from investment in education and training, by contrast, the effects of AIDS will be slightly different. Again, there will be the loss (unanticipated at the time of investment) of existing human capital as previously educated workers die prematurely. In addition, as AIDS becomes more prevalent, the perceived costs and benefits from undertaking new investments in human capital will change.⁴ Total expenditure will shift toward health care and away from schooling. To the extent that AIDS reduces expected lifetime, the incentives for individual workers or their employers to invest in education and training will also be reduced. Shifts in the relative wages of skilled and unskilled workers caused by differences in the prevalence of AIDS among various skill groups might also affect decisions to invest in human capital.

Rising Mortality Rates

The gradual rise in mortality rates caused by AIDS will have two important demographic aspects, which in turn will have macroeconomic consequences.

First, there will be a *negative population growth rate effect*, which will result in a smaller population at each future date. The presumption from demographic simulations is that the effect of higher death rates will more than offset any change in birth rates, so that the population growth rate will indeed fall. There are at least two reasons why birth rates may be affected by the AIDS epidemic: (a) fertility rates may change if, as the prevalence of AIDS rises, women alter their childbearing behavior because of various economic and noneconomic considerations (which could cut in either direction), and (b) AIDS may change the number of women in the various childbearing-age cohorts, thereby affecting the overall birth rate, even if behavior patterns within each age cohort are unchanged. Bulatao's (1990) model incorporates the latter effect, but (understandably) not the former, as it would require that the model completely endogenize fertility decisions. According to Bulatao's demographic simulations, the size of Tanzania's working-age population by 2010 will be roughly 20 percent smaller because of the AIDS epidemic than it would be without it.

Second, a rising number of deaths from AIDS will shift the age structure of the population toward the younger-age cohorts.⁵ Bulatao (1990) estimates that the AIDS epidemic in Tanzania will have opposing effects on the youth and elderly

4. One might view the first effect as a "stock" effect, which results from the unexpected negative shift in health after the investments are made. The second effect is an ongoing "flow" effect, which depends on how AIDS affects both the supply and demand for investments in education and training.

5. For interesting, recent discussions of the macroeconomic effects of the aging of the population in major industrial countries, see Masson and Tryon (1990) and the references listed there. To the extent that AIDS causes the age distribution to shift away from the elderly, one might expect macroeconomic consequences that are roughly the opposite of what Masson and Tryon predict for an aging population.

dependency ratios:⁶ between 1985 and 2000 the youth dependency ratio (the number of people ages 0 to 14 as a fraction of the number of people ages 15 to 64) will rise a couple of percentage points more than it would if there were no AIDS; the elderly dependency ratio (the number of people age 65 and older as a fraction of the number of people ages 15 to 64) will be slightly higher with AIDS than without until 2000, after which it will fall during the next 20 years by roughly 2 percent more than it would if there were no AIDS. (The higher elderly dependency ratio up to 2000 is presumably because the first AIDS cases appeared only in the late 1970s and AIDS-related mortality rates are increasing more dramatically in the younger-adult cohorts, at least initially.) In sum, the AIDS epidemic will reduce the overall size of the population and will shift its composition toward the young. The labor force, in turn, will be composed of younger, less-experienced workers. According to Bulatao's estimates, the mean age of the working-age population (15 to 64 years of age) will fall from 32 years in 1985 to 28 years in 2020 with AIDS, compared with 31 to 31.5 years in 2020 without AIDS.

The foregoing shifts in age structure can be expected to have important effects on both aggregate supply and aggregate demand. On the supply side, the size of the working-age population (and perhaps the participation rate of the labor force) will be reduced. The smaller working-age population will directly reduce potential output (even if participation rates and the rate of capital investment are unaffected). The loss in output will be exacerbated by a fall in labor force productivity as the average age and experience of the labor force declines.

On the demand side, the shift in the size and composition of the population will affect the level and the composition of public expenditures, as well as the economy's overall (private and public) saving rates. For example, the smaller absolute number of younger people will place lower demands on the educational system. In per capita terms, by contrast, educational expenditures may rise because of the increased proportion of the young in the total population. The resulting effect on the government budget will be exacerbated because more and more of the young will be orphans as the AIDS epidemic worsens, implying higher government costs (if not total social costs) of raising children.

If the elderly dependency ratio falls, per capita expenditures on health and pensions and social security (where present) will fall, other things being equal. A higher youth dependency ratio, however, is often associated with higher medical expenditures in developing countries. Of course, the emergence of AIDS hardly leaves other things equal where health care costs are concerned. Presumably the higher health care costs arising from AIDS will overwhelm any net change in health costs associated with a younger population, although this should be investigated more thoroughly.

6. The shift in the population age structure toward the young is apparent when five-year age cohorts are examined. See Cuddington (1991b) for details.

Finally, overall consumption rates will be higher (and therefore household saving rates will be lower) because of the younger age structure, which should affect saving rates through standard life cycle savings channels. In addition, the severing of generational linkages among dynamic households (as parents die, leaving children either as orphans or in the care of grandparents of other relatives) will also adversely affect saving rates.

II. A SIMPLE ANALYTICAL MODEL

This section describes an initial attempt to model the macroeconomic consequences of the AIDS epidemic. The model is a version of the simple Solow growth model, which has been extended to incorporate many of the considerations highlighted in section I. The Solow growth model is not without shortcomings. To focus squarely on the growth process, the model abstracts from unemployment and short-run macroeconomic stabilization issues. In effect, it makes the optimistic assumption that policymakers are able to implement stabilization and structural adjustment policies that keep the economy near its capacity level. The model obviously has important limitations, especially when studying African economies, most of which have suffered from chronic unemployment or underemployment. To completely capture the macroeconomic effects of AIDS would require addressing the additional (and difficult) question of whether the AIDS epidemic will increase or decrease the extent of unemployment.

Nevertheless, the highly aggregated model continues to be a workhorse model in the economic development literature (see, for example, Lucas 1988). It stresses the linkages between population growth and capital accumulation, on the one hand, and the resulting ratio of capital to labor and per capita income levels on the other. Thus, the model is a logical starting point for a study on the macroeconomic effects of AIDS. One must first determine how AIDS affects capacity output, that is, potential GDP, before considering persistent deviations from full capacity and the effect of AIDS on employment levels.

Cuddington (1991a) considers a slightly more disaggregated model, where production can occur either in the formal or informal sectors of the economy. The formal sector is relatively capital-intensive, has sticky wages, and has access to formal credit markets. The informal sector employs those who are unable to find (more highly paid) work in the formal sector. This perspective seems particularly relevant given the dualistic nature of many of the AIDS-stricken African economies. This article, however, highlights the major conceptual issue involved without the additional complexity that the two-sector framework inevitably entails.

The Solow model is well known; hence, the extension of it used here is sketched only briefly to show how the effects of AIDS are introduced.⁷

7. See Cuddington (1991b) for mathematical details on the material in this section.

Aggregate Output

Aggregate output, Y_t , is assumed to be produced using Cobb-Douglas technology with constant returns to scale:

$$(1) \quad Y_t = \alpha \gamma^t E_t^\beta K_t^{1-\beta}$$

where E_t represents labor input measured in efficiency units and K_t is the capital stock. The labor share of national output is denoted by β , and the rate of technological change over time by γ . A constant scale factor denoted by α is adjusted to fit the model to the actual data in 1985, the first year of the simulation.

The extent of the AIDS epidemic is measured by the proportion of the population that has AIDS, denoted by a_t . The negative effect of the prevalence of AIDS on output arises from the adverse effect of AIDS on the health, experience level, and size of the labor force. These considerations are incorporated in the calculation of labor efficiency units E_t :

$$(2) \quad E_t = \sum_{i=15}^{64} (1 - za_{it}) \rho_i L_{it}$$

where L_{it} is the number of workers of age i at time t , and z indicates the fraction of the work year lost per AIDS-stricken worker as a result of absence or reduced productivity on the job. The loss may be not only in the AIDS victim's labor but also in the labor of others. Thus, z does not necessarily lie between 0 and 1. For example, if a person who gets AIDS stops working immediately and that person's spouse also must stop work to provide full-time care, then $z = 2$.

The parameter ρ_i captures the experience, and hence productivity level, of laborers of age i without AIDS. Average experience is adversely affected as the worsening AIDS epidemic shifts the age structure in favor of younger, less-experienced workers. That is, aggregate human capital accumulated through experience is lost because workers, on average, die at a younger age.

A direct measure of work experience is unavailable. Thus, it is assumed that a worker's experience can be roughly proxied by taking the worker's age and subtracting 15 years. Studies of the relation between earnings (and presumably productivity) and experience suggest a positive but nonlinear relation between the two variables. Consequently, the simulation model assumes that labor efficiency (without AIDS) for a worker of age i is:

$$(3) \quad \rho_i = 0.8 + 0.02(i-15) - 0.0002(i-15)^2.$$

The parameters were chosen to produce productivity differentials that are in the range of values suggested by de Beyer's (1990) estimated earnings functions for workers in the manufacturing sector. No cohort-specific information exists on the prevalence of AIDS or the associated productivity loss (a_{it} or z) for Tanzania. Hence, population averages are used for each cohort.

In addition to its negative impact on labor productivity, AIDS reduces the size of the labor force (in relation to the no-AIDS scenario) as mortality rates rise.

This effect is captured by specifying that AIDS has a negative effect on the population growth rate at time t , denoted n_t :

$$(4) \quad n_t = n_t(a_t) \quad \text{where} \quad \partial n / \partial a < 0.$$

In the simulation model, mortality rates are specified for each age cohort. This information is used to generate population growth and the number of persons with and without AIDS as the epidemic worsens.

Saving Behavior

The model developed here focuses on the direct effect of increased health care expenditures on saving. Assume that annual health care expenditures on AIDS patients equals a given per-patient cost, m , multiplied by the number of patients, $a_t L_t$.⁸ A fraction, x , of the annual AIDS-related medical costs is financed out of saving, and the remaining portion ($1 - x$) is reflected in a reduction of other current expenditures.⁹ The value of x presumably lies between 0 and 1 if only the direct health care costs of AIDS are considered. If other channels through which AIDS may affect saving are considered, however, x may be greater than 1. With these assumptions, total domestic saving is:

$$(5) \quad S_t = s_0 Y_t - x m a_t L_t$$

where s_0 is the domestic saving rate out of GDP without AIDS. By assuming that s_0 remains unchanged as the prevalence of AIDS rises, all but the direct dissaving effect of AIDS is ignored. This specification of total domestic saving implies that the saving rate (the ratio of domestic saving to GDP) falls as the prevalence of AIDS or the health care cost per patient, or both, rises. For notational simplicity in the analytical model, the saving rate is written as a negative function of the prevalence of AIDS:

$$(6) \quad s = s(a_t) \quad \text{where} \quad \partial s / \partial a < 0.$$

In addition to domestic saving, capital accumulation may be financed by foreign capital inflows. The ratio of capital inflows to GDP is assumed to equal s^* in both the no-AIDS and the AIDS scenarios. Assuming that foreign capital inflows are in the form of foreign aid, the model can ignore any capital outflows representing returns to foreign-owned capital.

Capital Accumulation

As in the Solow (1956) growth model, the change from period to period in the ratio of capital to labor ($k = K/L$) can be written as:

$$(7) \quad \Delta k = [s(a) + s^*] f(k, a) - n(a) k - \theta k$$

8. The constant per-patient medical cost implies that there are no scale economies in caring for AIDS patients. This implication seems indisputable when considering decentralized care systems (home care) for AIDS patients, but it may or may not be realistic for centralized provision of AIDS care.

9. In part, reductions in other current expenditures may reflect reductions in health costs that are not related to AIDS as AIDS-related expenses rise.

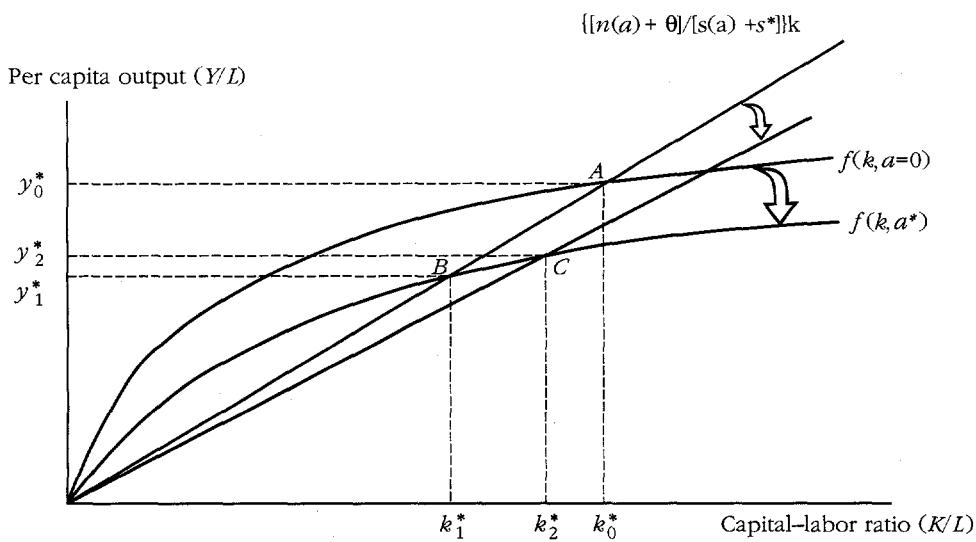
where $f(k, a)$ is production per worker. The total saving rate is denoted by $s(a) + s^*$ and the capital depreciation rate by θ . The first term in equation 7 shows that, as the prevalence of AIDS increases, its negative impact on labor productivity and national saving will tend to reduce the rate of capital formation. These effects tend to reduce the ratio of capital to labor over time. Working in the other direction (as reflected in the second term in equation 7), however, is the negative longer-term effect of AIDS on the labor force growth rate, which tends to raise k over time. The ultimate effect of these offsetting influences on the steady-state ratio of capital to labor, k^* , is found by setting capital accumulation per capita to 0 in equation 7:

$$(8) \quad y^* \equiv f(k^*, a^*) = \frac{n(a^*) + \theta}{s(a^*) + s^*} k^*.$$

The equilibrium ratio of capital to labor, k^* , and the corresponding output per worker, y^* , are shown in figure 1, which plots the left- and right-hand sides of equation 8. The point where the two loci intersect represents the steady-state values of y^* and k^* .

Using the model as summarized by figure 1, it is possible to analyze the effect of an exogenous rise in the prevalence of AIDS, a_t , on GDP per capita and the ratio of capital to labor. First, the increase in the prevalence of AIDS shifts the aggregate production function downward (as shown) because of the negative effect of deteriorating health on labor productivity. Later, the rising share of younger, less-experienced workers exacerbates this downward shift of the production function. The negative productivity effect, taken in isolation, reduces both output

Figure 1. *The Effect of AIDS on Per Capita Output and the Capital-Labor Ratio*



put per capita and the ratio of capital to labor in the new steady state (and along the transition path). Second, the AIDS epidemic ultimately reduces the labor force growth rate, which tends to flatten the $[(n + \theta)/(s + s^*)]k$ locus in figure 1. Working in the other direction is the negative effect of AIDS on the saving rate and hence the rate of capital accumulation, which tends to steepen the $[(n + \theta)/(s + s^*)]k$ locus. In principle, either the population growth rate effect or saving rate effect could dominate, so the $[(n + \theta)/(s + s^*)]k$ could become steeper or flatter. The new y^* and k^* are found where the new production function $f(k, a^*)$ intersects the new $[(n + \theta)/(s + s^*)]k$ locus. Clearly, per capita income and the ratio of capital to labor may be higher or lower with the spread of AIDS.

The simulation exercises in the following section trace out the time paths of the y and k (as well as other macro) variables between 1985 and 2010. Detailed demographic output from Bulatao's (1990) epidemiological-demographic simulation model for Tanzania is used in macroeconomic projections for the no-AIDS and AIDS cases. The simulations shed some additional light on the direction and range of plausible magnitudes of the macroeconomic effects of AIDS. Furthermore, they describe the transition path of the economy between 1985 and 2010 as the AIDS epidemic worsens, rather than just compare the steady states with and without AIDS. (Of course, the Tanzanian economy will not yet have reached a with-AIDS steady state by 2010.)

III. SIMULATION EXERCISES

The basic demographic input for the macro simulation model includes Bulatao's (1990) projections for the number of persons in each five-year age cohort in each year from 1985 through 2010 in both his no-AIDS scenario and his modified standard AIDS scenario. The latter scenario should be interpreted as a worst-case scenario because it is based on the assumption that only 15 percent of the adult population is monogamous. Although the simple analytical model in section II assumes that the entire population is in the labor force, the simulation exercises divide the population into five-year age cohorts. The labor force is assumed to be comprised of working-age adults, defined as people who are ages 15 to 64.¹⁰ Bulatao's projections on total AIDS cases in the adult population are used to calculate variable a_t , the proportion of the working-age population with AIDS.¹¹

10. This assumption is necessitated by the lack of detailed information about the labor force in Tanzania. Available evidence, however, suggests that the labor force participation rate is greater than 90 percent, so the assumption should be reasonable.

11. The demographic simulations of Bulatao specify the number of HIV-positive individuals in the population. The number of AIDS cases is determined by using assumptions about the rate of progression to the AIDS illness. In the simulation exercises below, a_t reflects only actual AIDS cases. It excludes people who are HIV-positive but asymptomatic on the presumption that productivity does not deteriorate and medical bills do not mount until the onset of AIDS-related illness.

The AIDS simulations differ from those of the no-AIDS scenario in several ways. First, the prevalence of AIDS in adults, a_t , rises from 0.09 percent in 1985 to 3.15 percent in 2010, whereas a_t is (by definition) always 0 in the no-AIDS case. Second, the size of the population is smaller in the AIDS scenario because of higher mortality rates. Third, the age structure shifts in favor of the younger age cohorts, resulting in a lower average age of the work force in the AIDS scenario.¹²

Assumptions Used in the Simulations

Both child and adult cases of AIDS are considered in the calculation of the annual medical costs of treating AIDS patients. In light of the figures discussed in section I, the annual cost of treating an adult AIDS patient, m_a , is assumed to be (constant 1980) T Sh3,230. The corresponding figure for children with AIDS, m_c , is T Sh2,467.

Historical data on GDP, gross fixed investment, foreign capital inflows, and gross domestic saving were used to get rough orders of magnitude for the key parameters and starting values for the macro variables in the model.¹³ Gross investment was roughly 21 percent of GDP during 1966–80, of which 11 percent was financed by domestic saving. The remaining 10 percent, therefore, was financed by foreign saving.¹⁴ The simulations assumed that foreign capital inflows would continue at their historical rate of 10 percent of GDP and that, in the no-AIDS scenario, domestic saving would remain at its historical norm. Because of the lack of empirical information about the effect of AIDS on domestic saving, a range of values for the α parameter in equation 5 was considered.

Given the estimates of the initial capital stock,¹⁵ the labor force, and the shares of labor and capital, the scaling constant in the production function was chosen to ensure that the value of 1985 GDP implied by the production function matched the actual value. The assumed rate of technological change was then adjusted to achieve a rate of growth in per capita output under the no-AIDS scenario equal to roughly 0.5 percent between 1990 and 2000 (the rate forecast in World Bank 1990a for Sub-Saharan Africa). This adjustment was made to generate a no-AIDS case that seemed plausible. The analysis then compared the

12. Bulatao's projected time series of the working-age population in the two cases are reproduced in Cuddington (1991b, tables 1 and 2).

13. Macroeconomic data were obtained from Tanzania (1979, 1981) except for the 1985 GDP, which is from World Bank (1990b).

14. World Bank (1990b) reports a higher fraction of total investment that is foreign-financed. During 1968–88, foreign capital inflows (measured by the resource balance) represented roughly 17 percent of GDP. This figure implies a domestic saving rate of 5 percent. In the simulation model, only the total (domestic plus foreign) saving ratio matters, not its breakdown.

15. Estimates of the capital stock are typically unavailable in developing countries. Therefore, several different methods were used to estimate the economy's overall ratio of capital to output (K/Y) in 1985. (See Cuddington 1991b for details.) Using a value of 3 (chosen after some experimentation) and the actual value of the 1985 GDP, an estimate of the capital stock in 1985 was obtained. The capital stock in subsequent years was calculated by adding new investment and subtracting depreciation at an assumed rate of 5 percent.

Table 1. *Macroeconomic Indicators in the AIDS Scenario in Tanzania*

<i>AIDS costs met from reduced saving, x (fraction of annual AIDS-related medical costs)</i>	<i>Indicator</i>	<i>Labor productivity lost per AIDS case, z (fraction of work year lost)</i>				
		0.0	0.5	1.0	1.5	2.0
0.0	GDP in 2010 (millions of 1980 Tanzanian shillings)	89,859	88,708	87,555	86,399	85,241
	Average growth rate of GDP, 1985–2010 (percent)	3.3	3.3	3.2	3.2	3.1
	Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.20	2.17	2.14	2.11	2.08
	Average per capita growth rate of GDP, 1985–2010 (percent)	0.7	0.6	0.6	0.5	0.5
	Savings rate in 2010 (percentage of GDP)	0.11	0.11	0.11	0.11	0.11
0.5	GDP in 2010 (millions of 1980 Tanzanian shillings)	88,415	87,275	86,131	84,985	83,836
	Average growth rate of GDP, 1985–2010 (percent)	3.3	3.2	3.2	3.1	3.0
	Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.16	2.13	2.11	2.08	2.05
	Average per capita growth rate of GDP, 1985–2010 (percent)	0.6	0.6	0.5	0.5	0.4
	Savings rate in 2010 (percentage of GDP)	0.09	0.09	0.09	0.09	0.09
1.0	GDP in 2010 (millions of 1980 Tanzanian shillings)	86,909	85,778	84,644	83,508	82,369
	Average growth rate of GDP, 1985–2010 (percent)	3.2	3.1	3.1	3.0	3.0
	Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.13	2.10	2.07	2.04	2.01
	Average per capita growth rate of GDP, 1985–2010 (percent)	0.6	0.5	0.5	0.4	0.3
	Savings rate in 2010 (percentage of GDP)	0.08	0.08	0.08	0.08	0.08

results under the no-AIDS scenario with those under the AIDS scenario to determine the net effect of AIDS on the economy.

Simulation Results

There is obviously considerable uncertainty regarding the choices of two key parameters: the fraction of the annual AIDS-related medical costs financed out of saving, x , and the annual proportion of labor lost per AIDS-stricken worker as a result of absence or reduced productivity on the job, z . To date no estimate of the effect of AIDS on private or public saving is available. A rough order of magnitude for z can be obtained using Pallangyo and Laing's (1990) estimate that the average adult AIDS patient in Tanzania experiences 286 days of illness. If

Table 1. (continued)

AIDS costs met from reduced saving, x (fraction of annual AIDS-related medical costs)	Indicator	Labor productivity lost per AIDS case, z (fraction of work year lost)				
		0.0	0.5	1.0	1.5	2.0
1.5	GDP in 2010 (millions of 1980 Tanzanian shillings)	85,332	84,210	83,086	81,960	80,831
	Average growth rate of GDP, 1985–2010 (percent)	3.1	3.1	3.0	3.0	2.9
	Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.09	2.06	2.03	2.00	1.98
	Average per capita growth rate of GDP, 1985–2010 (percent)	0.5	0.4	0.4	0.3	0.3
	Savings rate in 2010 (percentage of GDP)	0.06	0.06	0.06	0.06	0.06
2.0	GDP in 2010 (millions of 1980 Tanzanian shillings)	83,677	82,564	81,450	80,334	79,215
	Average growth rate of GDP, 1985–2010 (percent)	3.0	3.0	2.9	2.9	2.8
	Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.05	2.02	1.99	1.96	1.94
	Average per capita growth rate of GDP, 1985–2010 (percent)	0.4	0.4	0.3	0.2	0.2
	Saving rate in 2010 (percentage of GDP)	0.04	0.04	0.04	0.04	0.04

Note: The following assumptions underlie the calculations in the AIDS scenario:

Value	Parameter
39,131	GDP in 1985 (millions of 1980 Tanzanian shillings)
3	Capital-output ratio in 1985 (K/Y)
0.7	Labor's share of output (β)
0.008	Productivity growth rate ($\gamma - 1$)
0.05	Depreciation rate (θ)
0.11	Initial savings rate (s)
0.10	Rate of capital inflow (s^*)
3.23	Medical cost of treating an adult AIDS patient for one year, m_a (thousands of 1980 Tanzanian shillings)
2.47	Medical cost of treating a child AIDS patient for one year, m_c (thousands of 1980 Tanzanian shillings)

Source: Author's calculations.

Table 2. Macroeconomic Indicators in the No-AIDS Scenario in Tanzania

Indicator	Value
GDP in 2010 (millions of 1980 Tanzanian shillings)	104,448
Average growth rate of GDP, 1985–2010 (percent)	3.9
Per capita GDP in 2010 (thousands of 1980 Tanzanian shillings)	2.19
Average per capita growth rate of GDP, 1985–2010 (percent)	0.7
Savings rate in 2010 (percentage of GDP)	0.11

Note: The parameter values in table 1 also apply here, except that $m_c = m_a = 0$.

Source: Tanzania (1979, 1981) and World Bank (1990b).

adult AIDS patients live approximately one and a half years but are absent from work for 286 days, the productivity loss can easily reach 50 percent (x would equal 0.5) even if the patients and their family members are fully productive on all other days.

Sensitivity analysis was used to identify the range of plausible estimates for the macroeconomic consequences of the AIDS epidemic. Simulations of the AIDS scenario were run using alternative values (ranging from 0 to 2) for the two key AIDS-related parameters in the model, namely, the annual labor productivity lost per AIDS patient, z , and the proportion of AIDS-related medical expenditures that comes out of reduced saving, x , rather than current consumption. Table 1 projects what GDP and its average growth rate, per capita GDP and its average growth rate, and the saving ratio will be in 2010 under alternative (x, z) assumptions.¹⁶ To assess the macroeconomic consequences of AIDS, these figures should be compared with the projections for the no-AIDS case, shown in table 2. For example, consider the plausible AIDS scenario in which the productivity of those with the disease is cut in half ($z = 0.5$) and half of the medical expenditure for AIDS patients is financed by reducing domestic saving ($x = 0.5$). In this case real GDP grows at an average rate of roughly 3.2 percent a year (compared with 3.9 percent without AIDS), so that the level of real GDP by 2010 is (constant 1980) T Sh87 billion (compared with T Sh104 billion). That is, under the AIDS scenario in which both x and z are 0.5, the economy is approximately 16 percent smaller by 2010 than it would be if there were no AIDS epidemic. The effect of AIDS on per capita income is much smaller. Per capita income grows 0.6 percent a year in the AIDS scenario, compared with 0.7 percent in the no-AIDS scenario. By 2010 in the AIDS scenario, growth in per capita GDP is roughly 2.7 percent smaller than in the no-AIDS scenario (2.13 compared with 2.19).

The parameter values in tables 1 and 2 give a range of plausible estimates for the economic effects of the epidemic. The presence of AIDS reduces the average real GDP growth rate in 1985–2010 from 3.9 percent to a range of 2.8 to 3.3 percent, depending on the chosen (x, z) parameters. Not surprisingly, real GDP is lower in each future period in the AIDS scenario because of the smaller, less-experienced work force. The size of the economy by 2010 is reduced by 15 to 25 percent, from a real GDP of (constant 1980) T Sh104 billion without AIDS to a range of T Sh79 billion to T Sh89 billion in the various AIDS scenarios.

The effect of AIDS on per capita GDP is more moderate: per capita GDP in 2010 ranges from 0.5 percent larger to 11 percent smaller than it would be without AIDS. Per capita GDP is forecast to grow at an average annual rate of 0.7 percent in the no-AIDS scenario, compared with 0.2 to 0.7 percent in the various AIDS cases. The more plausible outcomes, near the upper left of the matrix, exhibit the lowest declines in per capita GDP.

16. See Cuddington (1991b) for tables and graphs showing the time profiles of selected variables with and without AIDS.

The estimated effects of AIDS on future GDP are large, but there are several reasons why the estimates may be too conservative. Output losses related to AIDS will be larger under any of the following circumstances: (a) if there are significant scale economies in production (rather than constant returns to scale, as assumed here); (b) if there is a large positive production externality generated by human capital, as discussed in Lucas (1988), among others; (c) if account is taken of the lost educational investment when young workers die shortly after completing their schooling; (d) if AIDS infection rates are higher among the highly educated or urban members of society who have higher than average productivity; and (e) if AIDS treatment diverts health resources from the treatment of other diseases or general prophylactic efforts, causing the death toll from non-AIDS causes to rise. These points will presumably be addressed in future research on AIDS.

IV. CONCLUDING REMARKS

This article has developed a framework for analyzing the macroeconomic consequences of the AIDS epidemic by comparing no-AIDS and AIDS scenarios to isolate the effects of the disease on the growth path of the economy. The macroeconomic consequences of various policy options for the health sector could, in principle, be compared by using the same approach. A policy's impact on the size and composition of the labor force would first have to be simulated by using epidemiological and demographic models. The output from these models plus information on the effects of alternative programs on budgets and savings could then be used as inputs in macroeconomic models, such as the one presented here. When considering policies to control and cope with a devastating disease such as AIDS, it is imperative to account for the direct effects of the disease on individuals' well-being through increased morbidity and mortality rates as well as the indirect effects of the disease on worker productivity and hence the potential to earn income. If linked to an epidemiological and demographic simulation model, a macroeconomic model such as the one described here should be able to analyze the effect of various interventions in the health sector on the productive capacity of the economy. To the extent that such interventions reduce the rate at which the disease spreads, one would expect macroeconomic outcomes that lie between the extremes of the no-AIDS and AIDS scenarios.

Finally, the sensitivity of the findings presented here to the assumptions regarding saving points to the urgency of careful reconsideration of government budget priorities. In economies in which the public sector bears a large proportion of medical costs, the government must make difficult decisions about how to finance medical expenditures as AIDS-related spending rises. To what extent should other current or capital expenditures, or both, be cut? The demographic shifts caused by AIDS will, of course, factor into these decisions. In light of the negative consequences of AIDS on the labor force, policy initiatives to restore productivity and maintain the stock of human capital will be critical for achieving economic growth with high levels of employment.

**APPENDIX. COMPARING THE GROWTH MODEL AND HUMAN CAPITAL
APPROACHES TO MEASURING THE ECONOMIC IMPACT OF DISEASE**

A common methodology used by health economists to assess the total indirect costs of premature death is the human capital approach. King and Smith (1988) provide a thorough review of the literature using this approach. For an application to the AIDS epidemic, see Over, Bertozzi, and Chin (1989). The human capital approach typically estimates the value of productivity lost (because of AIDS-related illness or death, for example) by computing the present value of the stricken individual's future earnings under certain assumptions about his or her life-cycle wage profile and future participation in the labor force. The earnings stream is typically discounted to the time of death or initial illness.

It is useful to compare the human capital approach to the growth model approach developed here. Both approaches allow for the reduced productivity of sick workers (represented by $z > 0$ in the model in the text). Furthermore, this productivity loss may depend on the age of the worker (indicated by equation 3 in the present context). Using these inputs, the human capital approach focuses on estimating the cost of individual cases of the disease in terms of present value. Furthermore, the human capital approach does not recognize that part of the income lost as a result of AIDS-related deaths would have been saved, thereby contributing to domestic capital formation. Thus, the negative impact on the economy's productive capacity is ignored in assessing the cost of AIDS. Similar assumptions can be introduced into my model by setting the labor share, β , at 1, so that differential saving effects play no role in determining the workers' ratio of output to income. With $\beta = 1$, the production function becomes linear in labor input, which is in effect the assumption implicit in the marginal analysis of the human capital methodology. When β is not equal to 0, by contrast, the production function exhibits diminishing marginal productivity of labor—which would make assumptions of constant income losses per worker invalid. Yet this assumption is implicit in the use of the human capital approach when valuing the total economic loss caused by a multitude of AIDS-related deaths.

Finally, the growth model approach highlights the total effect of the AIDS epidemic on various macroeconomic aggregates (including income lost) over time as the epidemic worsens. Steady-state effects can also be calculated, as shown above. Although it would be straightforward to calculate the present value of the total income lost because of the epidemic—as of some rather arbitrary point in time—this is not the main purpose of the growth model methodology.

One might argue that the human capital approach is better suited to estimating the marginal benefit of preventing a single case of HIV infection (as in, for example, Over, Bertozzi, and Chin 1989). The growth model approach, by contrast, is ideal for assessing the reductions in saving and worker productivity that would result in a lower per capita income despite the lower population growth rate brought on by AIDS.

REFERENCES

- The word "processed" describes informally reproduced works that may not be commonly available through library systems.
- Bulatao, Rodolfo A. 1990. "The Demographic Impact of AIDS in Tanzania." World Bank, Population and Human Resources Department, Washington, D.C. Processed.
- Cuddington, J. T. 1991a. "Modelling AIDS in a Dualistic, 'Labor Surplus' Economy." Georgetown University, Department of Economics, Washington, D.C. Processed.
- . 1991b. "Modelling the Macroeconomic Effects of AIDS with an Application to Tanzania." Working Paper 91-17. Georgetown University, Department of Economics, Washington, D.C. Processed.
- de Beyer, Joy. 1990. "The Incidence and Impact on Earnings of Formal Training Provided by Enterprises in Kenya and Tanzania." *Economics of Education Review* 9(4):321-30.
- King, E. M., and J. P. Smith. 1988. *Computing Economic Loss in Cases of Wrongful Death*. Santa Monica, Calif.: Rand Corporation.
- Lucas, R. E. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22:3-42.
- Masson, Paul, and Ralph Tryon. 1990. "Macroeconomic Effects of Projected Population Aging in Industrial Countries." IMF Staff Papers 37(3, September): 453-85.
- Over, Mead, Stefano Bertozi, and James Chin. 1989. "Guidelines for Rapid Estimation of the Direct and Indirect Costs of HIV Infection in a Developing Country." *Health Policy* 11:169-86.
- Pallangyo, K., and Richard Laing. 1990. "Background Study on Alternative Approaches to Managing the Opportunistic Illnesses of HIV-Infected Persons: Costs and Burden on the Tanzanian Health Care System." World Bank, Southern Africa Department, Washington, D.C. Processed.
- Scitovsky, A. A., and Mead Over. 1988. "AIDS: Costs of Care in the Developed and the Developing World." AIDS 2 (Suppl. 1), S71-S81.
- Solow, R. M. 1956. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics* 70 (February): 65-94.
- Tanzania, Bureau of Statistics. 1979. *National Accounts of Tanzania, 1966-76*. Dar es Salaam.
- . 1981. *National Accounts of Tanzania, 1966-80*. Dar es Salaam.
- World Bank. 1990a. *World Development Report 1990*. New York: Oxford University Press.
- . 1990b. *World Tables*. Washington, D.C.
- . 1992. *Tanzania: AIDS Assessment and Planning*. World Bank. Washington, D.C.

Trade Reform in the Partially Liberalized Economy of Turkey

Glenn W. Harrison, Thomas F. Rutherford, and David G. Tarr

Recent reforms in trade policy in Turkey have produced a foreign trade regime that exhibits very little antiexport bias on average. A quantitative, multisectoral general equilibrium model of the Turkish economy shows that piecemeal trade policy reform, based on first-best rationales that are appropriate for highly distorted economies, would not now be appropriate. Further tariff reductions must be coordinated with export subsidy reductions to attain significant welfare benefits. The dispersion of distortions, especially export subsidies, is more important than their level. A policy of harmonizing tariffs to the common external tariff of the European Community has virtually no effect on welfare.

Turkey undertook a major liberalization of trade policies in the 1980s. Import quotas have become virtually nonexistent, the Turkish lira has been made convertible, and tariffs have generally been lowered so that the average nominal tariff rate is less than 10 percent. Given these changes and remaining export subsidies, Turkey has, on average, removed the antiexport bias from its external incentive regime.

The impact on Turkey of its import-substitution trade policies in the 1970s and of its trade liberalization in the early 1980s has been the subject of several earlier studies, notably Baysan (1984); Baysan and Blitzer (1988, 1991); Rodrik (1988b); and Grais, de Melo, and Urata (1986). Although few analysts object to the reduction in import barriers and the real exchange rate depreciation as an aid to exporters, the effectiveness of more direct export incentives has been questioned by Milanovic (1986), Rodrik (1988a), and Arslan and van Wijnbergen (1990). The welfare effects of either the direct or indirect incentives, however, have not been estimated.

Starting with the relatively liberal trade regime of Turkey in the late 1980s, we use a 40-sector computable general equilibrium model to consider several fur-

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ther trade liberalization options that are now open to the Turkish government. The first option is across-the-board liberalization. Under this option, Turkey would completely reduce or remove its trade distortions, that is, its import tariffs and export subsidies. The second option is to consider sectoral liberalizations of tariffs or export subsidies. In this connection, we evaluate the reduction of tariffs and export subsidies that Turkey implemented during the late 1980s. The final option is the principal trade policy change Turkey is planning to implement: harmonization of its tariff structure to the common external tariff of the European Community (EC). This option is part of Turkey's effort to continue to press its case for membership in the EC.

The evaluation of removing trade barriers yields what is perhaps our most important finding: first-best rules of thumb that may be appropriate for highly distorted economies are not necessarily appropriate for economies that have liberalized as much as Turkey. (Other developing countries that achieved a relatively liberal trade regime in the 1980s include Chile, Indonesia, Mexico, and Poland.) In particular, piecemeal across-the-board tariff reductions in Turkey are not always beneficial from a welfare perspective and generally must be coordinated with export subsidy reductions to ensure welfare gains. The counterfactual assumption that the tariff level of Turkey is at the level of 1985 (about twice the 1989 level of our benchmark model) reintroduces an antiexport bias in the external incentive regime. In this case piecemeal tariff reduction to the 1989 tariff level is beneficial.

We show that, because there is no antiexport bias, the principal distortions remaining in the trade regime derive from the dispersion of external incentives. The primary source of this dispersion is the export subsidy structure. Neutrality of external incentives is therefore able to achieve a high proportion of the benefits of full external liberalization.

As Turkey turned away from import substitution in the early 1980s, it adopted strong export promotion measures. We estimate that Turkey's policy in the late 1980s of reducing direct export incentives yielded very substantial welfare benefits. We also show that the policy of applying export subsidies in individual sectors with high tariffs, as a way to encourage exports in a sector that may otherwise rely only on the highly protected domestic market, is particularly counterproductive. The reason is that at the multisector level the distortion that the export subsidy adds by encouraging too many resources into the protected sector dominates the reduction in the overall antiexport bias.

If Turkey harmonizes its tariff to the common external tariff of the EC, there will be only small welfare changes. Whether these changes result in gains or losses will depend on how "harmonization" is done, because the EC and Turkey have different interpretations of what such a harmonization would mean. The welfare changes will be losses if the interpretation of the EC is followed, or gains if the interpretation of Turkey is followed. Harmonization to EC tariffs will require Turkish tariffs to be lowered from already low levels in the presence of export subsidies almost as large as the existing average effective tariff rate.

Beyond small reductions in the tariffs, the export subsidies become the dominant distortion to the trade regime, and the economy becomes too export oriented. Harmonization to the EC tariff structure can be a welfare-enhancing policy, however, if accompanied by a policy of removing or reducing export subsidies.

We exploit the ability of a "simulation laboratory" to control for revenue effects by adopting an explicit "replacement tax," that is, a tax that enables government revenue to remain constant. We allow the value added tax (VAT) or a lump-sum tax to serve as replacement taxes for any changes in revenue. Given the structure of our model for Turkey (the model has no untaxed goods) and the range of replacement taxes, we find that the VAT produces results extremely close to a lump-sum replacement tax. In other words, the VAT has a relatively small marginal excess burden in this model.

Section I outlines the model, including the procedures used to empirically estimate the model to the Turkish economy using 1985 input-output data and 1989 protection data. Section II reports the results of the policy simulations. Finally, section III draws conclusions for policy. Appendix A presents the equations of the model, and appendix B subjects the conclusions to systematic sensitivity analysis.

I. A MODEL FOR A SMALL OPEN ECONOMY

Our small open economy (SOE) model is designed for trade policy analysis with a large number of sectors. The model is a generic, static general equilibrium model of a single economy along the lines of de Melo and Tarr (1992: ch. 3). The equations of the model are in appendix A. A description of the data set, the elasticities used, and more general features of the model may be found in Harrison, Rutherford, and Tarr (1992).

The General Structure of the Model

Goods are produced using labor, capital, and intermediate inputs. In export sectors a composite output is produced that distinguishes between goods destined for domestic and for export markets. This tradeoff is characterized by a constant elasticity of transformation frontier. Production is characterized by constant returns to scale. Producers behave competitively, selecting output levels such that marginal cost equals the given market price. Although the model allows increasing or decreasing returns to scale and imperfect competition, these features are not utilized here.

Final demand by private households arises from nested constant elasticity of substitution utility functions. At the top level, different types of goods enter in a constant elasticity aggregate. All income elasticities are unity. At the next lower level, composite imported goods trade off with corresponding domestic products, and there are possibly different elasticities of substitution by commodity. Imports from different sources substitute for one another at a lower nest in utility to form a composite import good for each sector. To capture the effects of

geographically discriminatory protection policies, we allow imports and exports to bear different tariffs or subsidies, depending on their source or destination. This feature allows us to study policies such as harmonization or accession to a free trade area, albeit without any terms of trade effects.

Given the level of aggregation in the model, the data contradict the homogeneous product model assumption because they reveal that there are imports, exports, and domestic production in most sectors. Although at a more disaggregated level we would like fewer sectors with both imports and exports in the same sector, our assumption of product differentiation between imports and domestic production (the "Armington" assumption) as well as between exports and domestic production will explain these data.

Government expenditures and investment demand are exogenous. Government expenditures are funded by net tax revenues. There are three components of government income in addition to import tariffs and export subsidies: VATS on factor inputs to production, ad valorem production subsidies or excise taxes on production output, and lump-sum taxes on domestic consumers. In a counterfactual scenario one or more of the tax instruments adjusts endogenously to balance government (net) tax revenues with expenditures. This equal-yield constraint is accommodated through an endogenous proportional adjustment of VAT rates or lump-sum transfers. Thus the welfare effects of changes in trade policy explicitly incorporate the appropriate marginal excess burden of raising government revenue from other sources. Walras's law is satisfied because private consumption equals the income from primary factors plus transfers to consumers by the government (from taxes and import and export quota rents), and public consumption is balanced with the value of public endowments and tax revenue net of transfers.

World market import and export prices are given, that is, import supplies and export demand are infinitely elastic. This implies that the model affects a simple closure with respect to foreign trade so that the economy experiences no endogenous changes in the terms of trade. The current account balances the value of exports and imports, taking into account exogenously specified capital inflows.

There is only one private household in the model. Dixit and Norman (1980: 78–80; 1986) have shown, however, that providing there are aggregate (real) income gains from trade liberalization and accepting some weak conditions (that hold in our model), it is possible to effect Pareto-efficient reforms for multiple households by taxing commodities.¹ The SOE model is generated with the GAMS software developed by Brooke, Kendrick, and Meeraus (1988); it is solved with the MPS/GE software developed by Rutherford (1989).

1. Dixit and Norman (1986) show that if the government imposes commodity and factor taxes that restore autarchy prices for all consumer goods and factors of production (and therefore leave all consumers no worse off), but does so in a situation where firms face the undistorted prices, then the government will have positive revenues (more precisely, positive accumulation of commodities) in a free-trade equilibrium.

The Turkish SOE Model

We employed the 1985 Turkish input-output table distinguishing 64 production sectors. We aggregated the 64 sectors to 40 sectors by individually adding or aggregating each of the smallest 24 sectors into the sectors closest to them. The 24 sectors account for only 5.1 percent of the value added to the economy in 1985. Table 1 displays the names of the 40 sectors. Given that one of the trade policy options that we sought to evaluate was the neutrality of external incentives, we were anxious not to bias results by aggregating the model excessively. Aggregating further (at least according to the criteria of value added) would have biased the model toward showing smaller welfare costs from disperse incentives because benchmark export subsidies would be less disperse in the benchmark equilibrium solely as an artifact of the process of aggregation. An alternative to employing a disaggregated model, which would reduce aggregation bias, is to use an explicit decision-theoretic metric to select sectors to be aggregated, an approach advocated by Harrison and Manning (1987). This approach aggregates sectors having similar levels of protection and export subsidies. Given that the current state of modeling technology does not constrain us to aggregate significantly, we elected not to do so.

The column headings in table 1 are the policy instruments in the Turkish model. Domestic distortions consist of the VAT and production subsidies. The VAT rates listed in table 1 vary a great deal across sectors. One reason is that there is some slight statutory difference in the rates. More important, however, is that the rates are derived from observed collections in 1985, the year the VAT was barely introduced. There were a great many administrative difficulties in collection procedures, yielding different observed collection rates. Foreign trade distortions consist of import tariffs and export subsidies. The revenue instruments are tariffs and the VAT. There are no import quotas or voluntary export restraints (VERS) in the Turkey model, reflecting their virtual absence from the economy in 1989, the benchmark year for the tax and trade policies.

Turkish export subsidies consist of indirect measures (such as duty drawback and the waiver of corporate income tax and VAT obligations) and direct budgetary transfers for exports of eligible products. Using benchmark import and export shares as weights, the average import tariff in the model is 8.1 percent and the average export subsidy is 7.4 percent. There is considerable dispersion in these rates across sectors, and this dispersion turns out to be important for our welfare evaluation of the distortionary effects of tariffs and subsidies.

The structure of the export subsidy rates across sectors is adapted from Milanovic (1986, table VII.4). As explained in Harrison, Rutherford, and Tarr (1992), we regard the rates in table 1 as appropriate because they are somewhat low if one accounts for indirect export subsidies available through the tax code without sectoral discrimination and high only if direct budgetary subsidies are considered. We also performed simulations with larger export subsidy rates that reflect the earlier years. Regarding tariff dispersion, nine sectors account for 79

Table 1. *Sectors and Policies in the Turkish Model*

Production sector	Tariff		Export subsidy	VAT	Production subsidy
	1985	1989			
Agriculture	4.1	6.0	0.0	0.9	4.2
Air transport	n.a.	n.a.	n.a.	2.3	0.0
Alcoholic beverages	22.0	72.3	8.2	4.7	0.0
Animal husbandry	15.6	6.0	0.0	0.9	0.0
Building construction	n.a.	n.a.	n.a.	16.5	0.0
Cement	3.9	2.6	18.0	7.5	0.0
Coal mining	0.7	0.7	0.0	7.8	3.4
Communication	2.5	6.3	2.8	2.0	0.0
Electrical machinery	35.3	11.0	29.7	9.4	0.0
Electricity	n.a.	n.a.	n.a.	3.6	2.0
Fabricated metal products	46.4	10.0	69.7	12.8	0.0
Fertilizers	1.3	2.5	15.7	2.5	0.9
Financial institutions and insurance	n.a.	n.a.	n.a.	9.7	0.0
Fisheries	23.5	34.9	0.0	0.3	0.0
Forestry	20.5	3.9	0.0	1.1	0.0
Gas manufacture and waterworks	n.a.	n.a.	n.a.	3.4	0.0
Glass and glass products	63.0	31.8	16.9	5.2	0.0
Iron and steel	16.3	4.6	21.4	20.1	0.0
Machinery (except electrical)	20.2	10.5	9.6	6.0	0.6
Manufacture of other food products	38.7	30.1	8.2	15.0	0.0
Meat processing	13.7	4.2	8.2	1.8	0.0
Motor vehicles and equipment	24.6	20.1	15.1	25.8	0.0
Other chemical products	19.8	15.7	15.7	11.4	2.4
Other construction	n.a.	n.a.	n.a.	4.5	0.0
Other land transport	n.a.	n.a.	n.a.	3.6	0.8
Other nonmetallic mineral production	27.1	32.5	0.0	9.5	0.0
Ownership of dwellings	n.a.	n.a.	n.a.	2.0	0.0
Personal and professional services	0.6	0.0	0.0	18.9	0.0
Petroleum refineries	150.7	16.2	0.0	15.7	0.0
Public services	n.a.	n.a.	n.a.	0.0	0.0
Restaurants and hotels	n.a.	n.a.	n.a.	9.2	0.0
Rubber products	49.8	25.3	20.0	7.7	0.0
Sugar	16.9	32.3	8.2	8.4	9.0
Textiles	26.2	19.4	13.5	14.1	0.0
Tobacco	52.1	57.3	0.0	2.4	0.0
Vegetable and animal oils and fats	2.9	3.9	8.2	12.1	0.6
Water transport	n.a.	n.a.	n.a.	2.3	2.8
Wearing apparel	8.3	22.8	13.5	12.8	0.0
Wholesale and retail trade	n.a.	n.a.	n.a.	10.5	0.0
Wood and cork products	23.0	13.7	1.6	13.6	0.0

n.a. Not applicable because the product was not traded.

Note: Tariffs are the percentage of the value of imports, export subsidies are the percentage of the value of exports, and production subsidies are the percentage of the value of production.

percent of the total tariff revenue: electrical machinery, 7.3 percent; iron and steel, 4.2 percent; machinery (except electrical), 13.4 percent; motor vehicles and equipment, 14.1 percent; other chemical products, 20.7 percent; other nonmetallic mineral production, 5.2 percent; petroleum refineries, 6.1 percent; textiles, 4.5 percent; and tobacco, 3.5 percent.

Estimates of elasticities had to be assembled for primary factor substitution, import demand, import source, domestic demand, and the transformation of domestic supply into domestic and exported products. Virtually all of the elasticity values were selected from a literature search, as described in Harrison, Rutherford, and Tarr (1992). Elasticity estimates are subject to a margin of error. Our "remedy" for this problem, which is endemic to any large-scale model of this kind, was to undertake systematic sensitivity analyses of the major results with respect to plausible bounds on these elasticities. (Harrison and others 1993 and Harrison and Vinod 1992 review the major issues in undertaking such analyses.) Even if we were unable to specify a point estimate with any precision, our priors over the likely bounds that these elasticities could take were quite strong. To the extent that our major conclusions are robust to perturbations over these bounds, we do not see our uncertainty over the specific values of these elasticities as a weakness of the model.² We report the results of these sensitivity analyses, which involve 1,000 simulations for each counterfactual policy, in appendix B. They allow us to conclude that our main results are robust, at least with respect to plausible uncertainty over elasticities.

II. POLICY ANALYSIS

We present our results by examining the principal trade policy options currently facing Turkey: across-the-board liberalization, sectoral liberalization, and harmonization with the external tariff of the EC.

Across-the-Board Liberalization

Quantitative restraints have been virtually eliminated in Turkey, and tariffs have been lowered, but some export subsidies remain. Does it enhance welfare to continue to reduce tariffs across the board while leaving export subsidies in place? Conversely, as a second-best measure to reducing the tariff, would it be beneficial to increase export subsidies to offset the antiexport bias of the tariff? We first consider the theory and conventional policy advice on this question in the context of the arguments for export subsidies.

The classic argument for export subsidies rests on the theoretical foundation of the Lerner (1936) symmetry theorem, which states that a tax on imports is equivalent to a tax on exports. It follows that if a two-sector economy has an unremovable import tax in the import-competing sector, it can offset the result-

2. Any effort that could generate better bounds on these point estimates would help to generate policy conclusions that carry greater credibility, even if those conclusions will still be probabilistic in nature.

ing antiexport bias with an export subsidy to the exporting sector.³ Based largely on this argument, Balassa (1989) argues that for most developing countries an antiexport bias will likely prevail, even after tariff reduction and devaluation, which call for export promotion measures. Krueger (1984: 528) has noted that many "export promotion" measures employed by policymakers in developing countries are nothing more than partial offsets to the overall bias in the regime toward import substitution. Large export subsidies, however, generally create problems and are thus typically not recommended. These problems may include budgetary problems for the government and various types of rent-seeking behavior, such as falsifying export documents, lobbying to seek higher subsidy rates, and exporting a product and then reimporting it to obtain the subsidy.

Nogues (1990), for example, has shown that in Argentina export subsidies lead to fraud, corruption, and rent seeking. He concludes that in Latin America the level of import protection has been so dominant that the provision of fully offsetting subsidies would introduce budgetary problems and rent-seeking behavior that would be counterproductive and clearly inferior to the first-best policy of reducing the import protection. Based on evidence such as this, Thomas, Nash, and associates (1991) have concluded that large export subsidies should not be recommended.

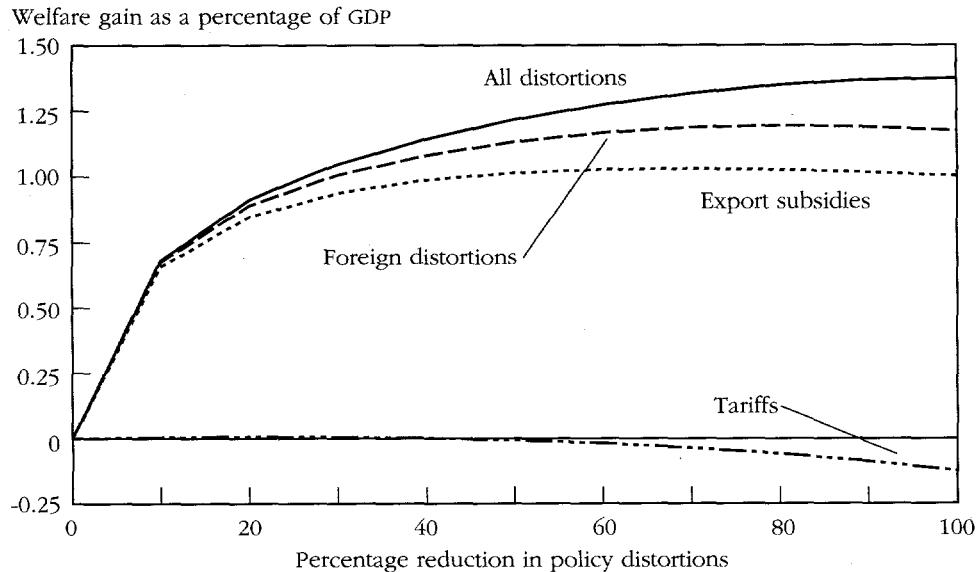
Export subsidies per se in the manufacturing sector are proscribed by the General Agreement on Tariffs and Trade (the GATT); those who argue for export subsidies suggest the use of export subsidies that are legal under the GATT. Thus Balassa (1989) has recommended that developing countries rebate, both to direct and to indirect exporters, the import duties and indirect taxes on exports and that they provide, as well, preferential export credit and export insurance in the absence of private insurance. These "duty drawback" schemes have the effect of automatically linking tariff and tax reform with export subsidy reform.

Welfare effects of across-the-board reductions in tariffs and export subsidies. Figure 1 displays the welfare effects of reducing tariffs and export subsidies across the board. Reductions of tariffs alone cause some welfare gains initially, but these deteriorate into a welfare loss for reductions greater than 40 percent. This welfare loss is attributable to the Lerner symmetry effect. The average tariff is only slightly above the average export subsidy, so there is only a slight antiexport bias in external incentives. When tariffs are progressively reduced in a piecemeal manner, external incentives eventually become biased toward exports.

The benefits of export subsidy reductions continue up to a 70 percent reduction and are much more substantial at about 1 percent of gross domestic product

3. Alternative theoretical justifications for export subsidies are in Itoh and Kiyono (1987) on nontraditional exports, Brander and Spencer (1985) and Eaton and Grossman (1986) on strategic policy considerations and oligopolistic industries, Krugman (1988) on positive externalities, and Romer (1989) on imports of new technologies. Because our model is a static, perfectly competitive model with no terms of trade effects, we abstract from all these arguments.

Figure 1. *Welfare Effects of Simulated Across-the-Board Trade Liberalization in Turkey*



(GDP) because there is significantly greater dispersion in benchmark export subsidies. In this model the Turkish economy would gain about 1 percent of GDP from providing neutral incentives to all export sectors but less than 0.2 percent from tariff uniformity.⁴ The process of taking an across-the-board reduction in export subsidies has the simultaneous effect of also reducing the dispersion in export subsidies, and it is the reduction in dispersion that is driving the result of figure 1 for export subsidy reduction.

Because of the offsetting effects of tariffs and export subsidies, reducing export subsidies and tariffs jointly leads to even greater welfare gains than just reducing export subsidies does. Similarly, because of the presence of domestic distortions, reductions in foreign distortions fail to generate welfare gains at the margin when they reach the 80 percent level. Only when all distortions are removed is the optimal policy to reduce export subsidies and tariffs jointly by 100 percent. This is the first-best policy. Removing all domestic as well as foreign distortions results in further, small enhancements of welfare.

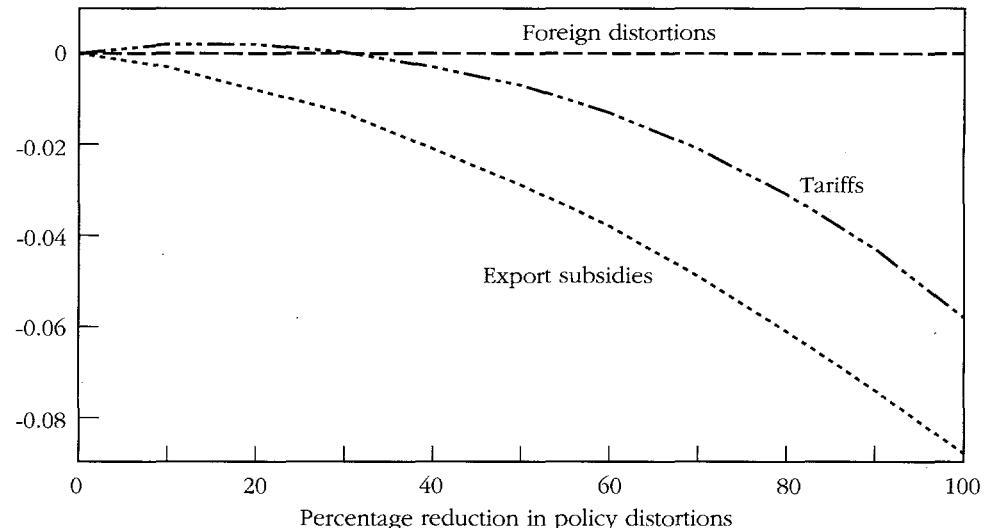
4. Our model is ill-suited for analyzing the question of optimal commodity taxation. Because there is no labor-leisure choice in our model, and all goods are taxable, the optimal nondiscriminatory commodity tax is uniform (see Atkinson and Stiglitz 1980). Because import taxes do not tax the domestic variety of the good, however, there are 40 untaxed goods in our model when import taxes are employed; hence, there are optimal departures from uniform import taxation. Our results show that the existing pattern of import taxes in Turkey is inferior to a uniform pattern of import taxation.

Dispersion in the export subsidy regime. We performed further simulations, depicted in figure 2, to bolster our interpretation that the dispersion in the export subsidy regime is the principal cause of the gains from reducing export subsidies. We eliminated the dispersion in export subsidies and import tariffs before reducing the level of the policy. In this case the results are much more consistent with the practical rule of thumb derived from the Lerner symmetry theorem. The average benchmark tariff of 8.1 percent is slightly higher than the average export subsidy of 7.4 percent, indicating a slight import bias in this new benchmark with uniform tariffs and export subsidies. Reductions in export subsidies result in welfare losses even at the margin because the regime becomes biased further toward imports. There is a very slight welfare gain from reducing tariffs by as much as 30 percent, with the maximal gain occurring at around the 10 percent level, when import tariffs just offset export subsidies exactly. When tariffs are reduced by more than 30 percent, the welfare losses are much larger, paralleling the losses obtained from reducing export subsidies alone. The welfare effects of reducing the level of foreign distortions, given that tariffs and subsidies are both initially neutral, are small compared with a welfare gain of 1.2 percent from providing a neutral external incentive regime.

The reason that neutral external incentives yield welfare benefits almost as large as full liberalization is that Turkey starts from a trade regime that is not significantly biased toward import substitution or export promotion. Other

Figure 2. *Welfare Effects of Simulated Trade Liberalization from Neutral Initial Distortions in Turkey*

Welfare gain as a percentage of GDP



things being equal, the more the economy is protected and the greater the antiexport bias, the smaller the proportion of the welfare benefits of liberalization that neutral external incentives will achieve.

We performed some additional experiments to verify this interpretation. We benchmarked our model to the tariff rates prevailing in 1985, which were reported in table 1. Averaging 17.6 percent, these rates were about double those applying in 1989, weighted by 1985 shares of imports. Although the average 1985 tariff rate is somewhat small compared with rates of nominal protection in many developing countries, it does introduce an antiexport bias into the Turkish external regime. A piecemeal reduction in the 1985 tariff rates to the level of 1989 results in an increase in Turkish welfare of 0.07 percent of GDP, and the benefits of uniformity (of all distortions) are reduced from 99.9 to 94.1 percent of the benefits of fully removing all external and domestic distortions. These results also show that the tariff reductions that Turkey undertook in the late 1980s enhanced welfare.

If the external incentive regime were biased toward import substitution (that is, if the economywide average level of import protection exceeded the average level of export promotion), as is common in developing economies, then piecemeal lowering of import protection would improve welfare. The important lesson is that when a country has liberalized imports as much as Turkey, while at the same time maintaining significant export subsidies, further import liberalization must be balanced with further reductions in export subsidies.⁵ Similarly, these results support the view that some small export subsidies are efficient if a country starts from an import regime that is significantly protected.

To the extent that export or production subsidies in Turkey are effected by a "duty drawback" on customs duties on imports or VAT, interaction effects such as we have examined will be built into any liberalization of those subsidy schemes. In other words, anything that lowers tariffs would endogenously lower export subsidies, generating these beneficial interaction effects. This may well be an unplanned advantage of using such drawback schemes.

Counterfactual simulation from higher export subsidies. The strong export promotion measures adopted by Turkey in the early 1980s have been questioned as excessive. We counterfactually scaled up all export subsidies to levels estimated to prevail in earlier years in Turkey and simulated the effects of the Turkish policy of lowering export subsidies toward the level of 1989. Doing so tilts the external incentives toward export promotion but greatly increases the dispersion in the export subsidies. We estimated that the Turkish export subsidy reduction policy of the late 1980s yielded very substantial welfare benefits.

We performed simulations with three new export subsidy rates of 2.0, 2.62, and 3.4 times the export subsidies of our original benchmark equilibrium. These new rates corresponded to export subsidies of 14.8, 19.4, and 25.2 percent, which were reported as the export subsidy rates prevailing in Turkey in 1988,

5. Similar results for the Polish economy are discussed by Tarr (1990).

1985, and 1986, respectively. As a percentage of GDP, the welfare benefits of reducing the export subsidies to the level of our original benchmark equilibrium are 3.6, 6.5, and 12.1 percent, respectively, the higher welfare benefits corresponding to reduction of the higher export subsidies. The welfare benefits of reducing export subsidies increase more than proportionately to the scalar multiple of the export subsidy because the quantity of resources distorted increases with the price distortion of the subsidy and acts multiplicatively on the price distortion in calculating the welfare costs. These estimates are rather large compared with most estimates of the welfare benefits of trade liberalization in models with constant returns to scale. This finding runs contrary to the conventional wisdom that only models with increasing returns to scale will achieve large welfare benefits from trade liberalization and is due to the fact that without specific factors in our model the elasticity of supply in the sectors receiving export subsidies is very large. Thus, the export subsidy induces a large amount of resource movement. Interestingly, the welfare effects of subsidy reduction are only slightly affected by rebenchmarking with 1985 tariff rates, reflecting the fact that the dispersion of the export subsidy is of primary importance in these results.

Distributional effects across sectors. Finally, we assessed distributional effects of across-the-board liberalization by noting which sectors are the biggest winners and losers when all foreign and domestic distortions are removed. The six sectors with the largest increase in total value added (with the absolute increase in their percentage of total value added) are air transport, 1.4; other land transport, 0.23; ownership of dwellings, 0.11; personal and professional services, 0.25; restaurants and hotels, 0.23; and wholesale and retail trade, 1.25. From table 1, none of these sectors received either export subsidies or import tariffs. Moreover, the six sectors are primarily nontraded goods, and the incentives to the nontraded goods sectors will improve after the tariffs and export subsidies are removed.

The six sectors with the largest decrease in total value added (with their absolute decrease in their percentage of total value added) are agriculture, -0.83; fabricated metal products, -0.36; iron and steel, -0.45; other chemical products, -0.18; textiles, -0.40; and wearing apparel, -0.32. Except for agriculture, these sectors lose their substantial export subsidies, which explains the decline in their shares. In agriculture, the loss of the production subsidy induces the loss of the share in value added. Because nominal export subsidies are concentrated in manufacturing industries, there has been some debate over the claim that export subsidies in Turkey have an "antiagriculture" bias. We tested this claim by examining value added in agriculture before and after the export subsidies were removed. We defined "agriculture" broadly as consisting of nine sectors in our model: agriculture, animal husbandry, fisheries, forestry, manufacture of other food products, meat processing, sugar, tobacco, and vegetable and animal oils and fats. Defining agriculture as solely the sector "agricul-

ture" in table 1 would not change the following conclusions. Value added in the broadly defined agricultural sector increases by 1.2 percent after all export subsidies were completely removed. Alternatively, if both export subsidies and import tariffs are completely removed, value added in agriculture declines by 0.7 percent.

Sectoral Liberalization

Krueger (1984, p. 528) has noted that in some developing countries firms have been required or induced to export in return for privileges accorded in the domestic market. Presumably the argument is that the sector is not motivated to export without the export subsidy or requirement because the sector receives a relatively high price on the domestic market as a result of the import protection.

On the contrary, however, an export subsidy will not offset the effect of a high tariff. Rather it will exacerbate the problem of misallocating too many resources to the protected sector. We investigated the impact on the Turkish economy of removing or reducing tariffs or export subsidies, or both, from individual sectors. Given piecemeal policy change in a particular sector, the interaction with the VAT in the sector will become important. In particular, if a sector enjoys a high tariff and high export subsidy, excessive resource allocation to the sector will be reduced by a high VAT.

Table 2 summarizes the welfare effects of piecemeal reform in individual sectors. The results show the consequences of removing existing export subsidies and import tariffs one sector at a time, leaving protection in all other sectors at benchmark levels. The column titled "tariff and export subsidy" simultaneously removes both tariffs and export subsidies in the sector. The first three columns represent total removal of the policy, whereas the last two columns, labeled "marginal reform," report results for scenarios in which sectoral tariffs and export subsidies are reduced by 10 percent. To provide a consistent basis for comparison, we multiplied the welfare effect of these marginal 10 percent reductions by 10 to indicate the welfare consequences of complete reform that would be "predicted" by a marginal analysis. We do not report the "tariff and export subsidy" column for the marginal changes because the results are roughly additive in the two components that are displayed.

The first result on which we focus is the welfare effects of export subsidy and tariff reduction in those sectors for which both the export subsidies are greater than 15 percent and tariffs are above average. From table 1, there are six sectors in this group: electrical machinery, fabricated metal products, glass and glass products, motor vehicles and equipment, other chemical products, and rubber products. For a marginal reduction in export subsidies, there is a welfare gain in all sectors except motor vehicles. Similarly, for a marginal reduction in tariffs, there is a welfare gain in all sectors except electrical machinery. Motor vehicles experienced the highest VAT rate in the economy at 25.8 percent, which means that export subsidies offset the impact of too little resources in motor vehicles as

Table 2. *Welfare Effects of Simulated Piecemeal Sectoral Reform in Turkey*

Production sector	Complete removal of subsidy or tariff			Marginal reform ^a	
	Export subsidy	Tariff	Tariff and export subsidy	Export subsidy	Tariff
Agriculture	0.000000	-0.000840	-0.000840	0.000000	0.000835
Alcoholic beverages	-0.001730	0.010399	0.008353	-0.000230	0.015240
Animal husbandry	0.000000	-0.001000	-0.001000	0.000000	-0.000310
Cement	0.000930	-0.000010	0.000907	0.005899	0.000237
Coal mining	0.000000	-0.002840	-0.002840	0.000000	-0.002840
Communication	-0.001410	-0.000960	-0.002410	-0.001310	-0.000410
Electrical machinery	0.024585	-0.011380	0.013431	0.101528	-0.003870
Fabricated metal products	0.769165	0.008477	0.767100	5.693816	0.010337
Fertilizers	0.002663	-0.001050	0.001471	0.013099	-0.000910
Fisheries	0.000000	0.000166	0.000166	0.000014	0.000992
Forestry	0.000000	-0.000590	-0.000590	0.000000	-0.000340
Glass and glass products	0.000280	0.000427	0.000579	0.010503	0.001970
Iron and steel	0.191486	-0.096300	0.131224	0.617817	-0.089550
Machinery (except electrical)	-0.010280	-0.006420	-0.015410	0.005135	0.001286
Manufacture of other food products	-0.018640	0.002069	-0.016130	-0.009620	0.005472
Meat processing	-0.001960	-0.000340	-0.002300	0.000560	-0.000220
Motor vehicles and equipment	-0.012730	-0.017150	-0.030660	-0.007540	0.015335
Other chemical products	0.003322	-0.028500	-0.026600	0.028970	0.013773
Other nonmetallic mineral production	0.000000	-0.000720	-0.000720	0.000000	0.003740
Petroleum refineries	0.000000	0.000403	0.000403	0.000000	0.003821
Rubber products	0.000104	0.000380	0.000209	0.006920	0.002601
Sugar	0.001557	0.000057	0.001614	0.003080	0.000157
Textiles	-0.070480	-0.008660	-0.079150	0.006692	0.009843
Tobacco	0.000000	0.029122	0.029122	0.000000	0.052881
Vegetable and animal oils and fats	-0.007360	-0.002240	-0.009760	0.002079	-0.001440
Wearing apparel	-0.078830	-0.004260	-0.087360	-0.013090	0.010655
Wood and cork products	-0.002380	-0.005380	-0.007760	-0.002310	-0.000610

Note: The values in the table are the changes in welfare (using the equivalent variation measure) as a percentage of GDP.

a. Tariffs and export subsidies are initially reduced by 10 percent; the results are multiplied by 10 to indicate the welfare consequences of a complete reform that would be predicted by using a marginal analysis.

Source: Authors' estimations.

a result of the VAT. In electrical machinery, there is also an above-average VAT rate; moreover, the tariff rate, which is close to the average rate in the benchmark, is also offsetting the VAT at the margin. Because welfare increases from export subsidy reduction, these results support the view that using high export subsidies in sectors with above-average tariffs is counterproductive.

Theory suggests that the distortion costs of a tariff or subsidy increase more than proportionally with the size of the tariff or subsidy because the quantity of resources misallocated also increases and acts multiplicatively on the tariff or subsidy in calculating the value of the distortion costs. Thus the greater the export subsidy, the greater the benefits of export subsidy reduction at the margin. The concentration of high export subsidies in a few sectors in Turkey is likely to be a problem for this reason. Examining the three cases of export subsidies above 20 percent—electrical machinery, fabricated metal products, and iron and steel—there are indeed substantial benefits from reducing the export subsidy at the margin, even though for iron and steel the tariff rate is below average. The same general policy conclusion also holds for the seven sectors with tariffs greater than 30 percent.

In many sectors there are welfare losses from reductions in tariffs or export subsidies, or both, either in terms of marginal or complete liberalization. In addition, in several sectors marginal liberalization can be beneficial in welfare terms and yet complete liberalization can be harmful.⁶ These results are explained by the fact that after some point further reduction of tariffs or export subsidies results in a bias in incentives against the sector, given that tariffs and export subsidies remain in place in the rest of the economy.

Harmonization with the EC

Turkey has long aspired to becoming a member of the EC. As part of the negotiations with the EC on this matter, Turkey has adopted a policy of harmonizing its tariff structure with the Common External Tariff (CET) of the EC. There has been some dispute, however, as to exactly what harmonization would mean.

Turkey's "effective (nominal) tariff" consists of a statutory customs duty and a series of import surcharges, such as stamp taxes and wharf charges. The customs duty varies across sectors, but the surcharges are generally uniform. We refer to the sum of the customs duty and the surcharges as the "total duty" to be applied to dutiable imports.

Turkey exempts a significant portion of imports from duties, however, through a number of mechanisms including duty drawbacks and the investment code. The result of these exemptions is that the share of imports that is dutiable varies greatly across sectors. Hence the effective (nominal) tariff is the product of the total duty and the share of imports that is dutiable in each sector. This effective duty is the best measure of the nominal protection in each sector.

These distinctions become crucial in attempting to implement a political commitment to "harmonize the tariff structure." Turkey initially interpreted harmonization to mean that it would levy a zero customs duty and reduced import

6. With respect to export subsidies, examples (in table 2) include machinery (except electrical), meat processing, textiles, and vegetable and animal oils and fats. With respect to tariffs, examples include machinery (except electrical), motor vehicles and equipment, other nonmetallic mineral production, textiles, and motor vehicles and equipment.

surcharges on imports from the EC. According to this interpretation of harmonization, the customs duty on non-EC imports would be set equal to the CET of the EC, and all import surcharges on non-EC imports would remain unchanged. The net effect of this interpretation, as far as the EC was concerned, was that the EC would face positive tariffs on exports to Turkey. Instead, the EC may have expected "harmonization" to mean that goods from the EC would be imported duty-free into Turkey.

After negotiation with the EC, Turkey has considered revising the harmonization policy to accord better with the initial expectations of the EC. According to this view all surcharges would be incorporated into the customs duty, and only this single total tariff would apply to imports. The total tariff on EC imports would be zero and would be equal to the CET on non-EC imports.

Assuming the continued use in Turkey of exemptions from import duties, the effective (nominal) tariff on non-EC imports would be lower than the CET that the EC itself applies on those imports. That is, after harmonization Turkey would be applying lower average tariffs than the EC does.

Given the political importance of harmonization with the EC, we considered the effects of each interpretation. With either interpretation of the CET and with VAT as the replacement tax, the change in welfare from CET harmonization is small. Under Turkey's interpretation of the CET, Turkey's welfare would increase by 0.007 percent of GDP. Under the EC's interpretation of the CET, Turkey's welfare would be reduced by 0.024 percent of GDP.

CET harmonization reduces Turkey's average tariff. For small reductions in the tariff, such as those implied by the Turkish version of harmonization, there is a slight gain in welfare. As explained above, further uncoordinated reductions in the tariff level from the already low level eventually result in welfare losses. Thus, although the difference is slight, the EC version of harmonization results in a loss simply because the tariff reduction is larger.

Alternatively, by combining CET harmonization with removal of export subsidies Turkey can expect to obtain significant welfare gains from EC tariff harmonization. This result follows from our analysis of the joint effects of removing tariffs and export subsidies in figure 2, along with our interpretation of CET harmonization as a de facto across-the-board reduction in tariffs. Irrespective of the final policy package, the main policy lesson here is that the welfare effects of quibbling over the proper interpretation of CET harmonization are in the second order of smalls.

III. CONCLUSIONS

The principal trade liberalization exercise currently being considered by Turkey is harmonization to the common external tariff of the EC. We find that harmonization would have little beneficial effect on welfare compared with several other options. It is important to accompany a harmonization policy with export subsidy reduction to achieve significant benefits.

The most important policy conclusion from our analysis concerns the fragility of first-best rules of thumb as to the welfare benefits of piecemeal trade policy reforms for countries that have reduced trade barriers as much as Turkey has but that have retained export subsidies. The results of trade policy reforms then depend crucially on both the level and the dispersion of import tariffs and especially of export subsidies. In other words, it is not the case that any partial movement toward the first-best trade policy for Turkey will result in some fraction of the welfare gains from that first-best package. Of course this is a restatement of well-known second-best results. What is new, however, is an attempt to assess the quantitative significance of these effects for Turkey. In doing so we are able to gain some insights into which particular distortions have more or less severe second-best effects.

APPENDIX A. AN ALGEBRAIC FORMULATION OF THE MODEL

The model is formulated as a system of nonlinear equations corresponding to the three classes of equilibrium conditions associated with an Arrow-Debreu general equilibrium: price-cost relations for producers, supply-demand balance for commodity and factor markets (including balance of payments), and income-expenditure balance for domestic consumers and government. The model is generated using the GAMS programming language. It is solved using the software of Rutherford (1989), which employs the modified Newton (SLCP) algorithm created by Mathiesen (1985). A central set of variables (prices, activity levels, and income levels) characterizes the economic equilibrium. All important notation is summarized in table A-1.

Technology, Preferences, and Market Clearance Conditions

Domestic production is an aggregate of domestic and exported varieties of goods with a constant elasticity of transformation:

$$(A-1) \quad Y_i = \phi_i(D_i, X_i) = (\delta_{D_i} D_i^{(\epsilon_i-1)/\epsilon_i} + \delta_{X_i} X_i^{(\epsilon_i-1)/\epsilon_i})^{\epsilon_i/(\epsilon_i-1)}.$$

This relation can be interpreted as implying differences in the technical processes associated with production for domestic and export markets. The elasticity of transformation defined by ϵ_i will be lower for goods that are highly differentiated and higher for goods that are relatively homogeneous. The specification of this elasticity may be influenced by the intended time frame of the analysis. In the short run it is more difficult to transform plants between domestic and export-oriented products.

Imports from different trading partners trade off with domestic varieties in intermediate demand, investment demand, and final demand. For simplicity (and because of data limitations) we assume that the import composition and import-domestic substitution possibilities in investment, intermediate, and final demand are identical. Under these conditions we can represent inputs as though they were composed of a single import-domestic aggregate for each commodity.

Table A-1. Notation Used in the SOE Model

Variable or parameter	Definition
<i>MA Variables</i>	
C_i	Private consumer demand for good i
D_i	Domestic sales of good i
f_{ki}	Variable input of primary k in sector i
f_k^i	Fixed input of primary k in sector i
K_i	Capital inputs to sector i
L_i	Labor inputs to sector i
M_i	Composite import of good i
m_{ir}	Import of good i from region r
p_i	Price of domestic produced good i
p^X	Export price of good i (exogenous)
p_r^M	Import price of good i from region r (exogenous)
S_i	Armington aggregate of domestic supply and imports
V_i	Value added function for variable factors
W	Welfare index for the representative domestic consumer
w_k	Factor prices k
X_i	Export of good i
x_{ki}	Intermediate inputs of good k in sector i
Y_i	Domestic production of good i
π_i	Price of domestic import good i composite
τ_T	Replacement tax multiplier on lump-sum transfers
τ_v	Replacement tax multiplier for factor taxes
τ_t	Replacement tax multipliers for tariffs
<i>Parameters</i>	
a_{ij}	Intermediate input requirements, good i in sector j
B	Current account balance (net capital inflows)
E_k	Endowment of factor k
F_k	Primary factor supplies
G_i	Government demand for good i from region
I_i	Final demand for output of sector i for investment purposes
s_i	Elasticity of substitution in consumption in sector i between imports from different regions
s_i^P	Rate of production subsidy for good i
s_i^X	Export subsidy rate for good i
T	Lump-sum tax on consumers
t_{ir}	Import tariff rate on commodity i from region r
v_i	Tax rate on factor inputs to sector i
ϵ_i	Elasticity of transformation between domestic production and exports in sector i
σ_i	Elasticity of substitution between domestic consumption and aggregate imports in sector i

The aggregation of domestic and imported varieties is characterized by a nested constant-elasticity function of domestic and imported goods:

$$(A-2) \quad S_i \equiv \psi_i(D_i, M_i) = (\alpha_{D_i}^{1/\sigma_i} D_i^{(\sigma_i-1)/\sigma_i} + \alpha_{M_i}^{1/\sigma_i} M_i^{(\sigma_i-1)/\sigma_i})^{\sigma_i/(\sigma_i-1)}$$

where M_i represents a composite import from two or more regions, r :

$$M_i \equiv \left(\sum_r \beta_{ir} m_{ir}^{(s_i-1)/s_i} \right)^{s_i/(s_i-1)}.$$

The market clearance condition for domestic supply balances output from the Armington aggregation function with intermediate, investment, and final demand. This condition is

$$(A-3) \quad S_i = \sum_j a_{ij} Y_j + G_i + I_i + C_i$$

in which Y_j is the activity level of sector j ; a_{ij} is the input requirements of good i in sector j ; and G_i , I_i , and C_i are components of final demand associated with government, investment, and final consumption.

Variable inputs to production include primary factors as well as intermediate inputs of commodities. These are combined in a linearly homogeneous nested Leontief-CES form:

$$(A-4) \quad Y_i = \min \left[\frac{x_{1i}}{a_{1i}}, \frac{x_{2i}}{a_{2i}}, \dots, \frac{x_{ni}}{a_{ni}}, \frac{V_i(f_i) + \sum_k f_{ki}^F}{a_{VA}} \right]$$

where

$$V_i(f_i) = \left(\sum_k \delta_{ki} f_k^{(\sigma-1)/\sigma} \right)^{\sigma/\sigma-1}.$$

In this equation x_{ki} represents intermediate inputs of good k in sector i , f_{ki} is the variable input of primary factor k in sector i , $V_i(\cdot)$ represents the value-added function for variable factors, f_i represents primary factor inputs to variable cost in sector i , and f_{ki}^F represents the input of factor k to the formation of fixed costs in sector i (taken as zero in the present model).

Domestic welfare is defined by consumption levels of market goods:

$$(A-5) \quad W = U(C_1, \dots, C_n).$$

The current account (B) is balanced at international prices (p_i^X and p_i^M), taking into account exogenous capital flows:

$$(A-6) \quad \sum_i p_i^X X_i + B = \sum_{ir} p_{ir}^M m_{ir}.$$

The prices that appear in this equation are exogenous parameters, the international prices of imports and exports. This constraint has an associated variable, which is the "real exchange rate." The model, however, contains no monetary instruments and determines only relative prices.

Factor markets always clear with flexible prices:

$$(A-7) \quad \sum_i f_{ki} + f_{ki}^F = F_k.$$

Income-Expenditure Balance

Consumer income includes primary factor earnings plus foreign capital inflows less transfers. Final demand is modeled by budget-constrained utility maximization by a representative agent. The budget constraint is:

$$(A-8) \quad \sum_i \pi_i C_i = \sum_k \omega_k E_k + B - \tau_T T.$$

In this equation ω_k represents the market price of primary factor k , B represents the foreign exchange balance, and $\tau_T T$ represents the level of lump-sum transfer.

Unlike private households, government demands are held constant in all simulations. The government budget constraint is accommodated through endogenous scaling of one of the three government tax instruments so that revenue balances with expenditure. Government income consists of five components: (1) lump-sum transfers from households, T ; plus (2) import tariffs, t_{ij} ; plus (3) VATS on factor inputs to production, v_i ; less (4) production subsidies, s_i^P ; less (5) export subsidies, s_i^X . The government budget is

$$(A-9) \quad \begin{aligned} \sum_i \pi_i G_i &= \tau_t T + \tau_t \sum_{ir} p_{ir}^M t_{ir} m_{ir} \\ &\quad + \tau_v \sum_{ik} v_i \omega_k f_{ki} \\ &\quad - \sum_i s_i^P (p_i D_i + p_i^X X_i) \\ &\quad - \sum_i s_i^X p_i^X X_i. \end{aligned}$$

In the government budget equation, parameters that endogenously adjust to balance income and expenditure are τ_T for lump-sum transfers, τ_t for tariffs, and τ_v for VATS. In any given equilibrium only one of these parameters departs from the default value of unity.

Price-Cost Balance

Producers price at marginal cost. In production the marginal cost of supply for sector i (c_i) is defined by

$$(A-10) \quad c_i Y_i = \sum_j \pi_j x_{ji} + (1 + \tau_v v_i) \sum_k \omega_k f_{ki}.$$

With constant-returns-to-scale technology and no barriers to entry, excess profits go to zero. Producers then equate marginal cost with market price gross of subsidy, providing the following zero-profit condition:

$$(A-11) \quad (1 + s_i^P)(p_i D_i + p_i^X X_i) + p_i^X X_i s_i^X = c_i Y_i.$$

In this equation the first term represents the value of output gross of production subsidy, and the second term captures the effect of the export subsidy.

The import aggregation always equates price with marginal cost. This means that the value of domestic supply equals the cost of domestic inputs plus imports gross of tariffs and rents:

$$(A-12) \quad \pi_i S_i = p_i D_i + \sum_r (1 + \tau_t t_{ir}) p_{ij}^M m_{ir}.$$

APPENDIX B. SENSITIVITY ANALYSIS

How robust are the major policy conclusions to the many assumptions of our numerical model? This question is answered partially by considering a systematic sensitivity analysis of the main results with respect to the elasticities in the model. We appreciate that there are many other assumptions that remain fixed as we just vary elasticities, but we regard those extensions as beyond the scope of this study. For example, an important question is how our results might change as we examine alternative market structure assumptions or move from a static framework to a growth setting. We plan to examine these extensions using the SOE model, but we do not believe that they can be treated briefly enough to be included here.

The sensitivity analysis uses the procedures developed by Harrison and Vinod (1992). Essentially these procedures amount to a Monte Carlo simulation exercise, in which a wide range of elasticities are independently and simultaneously perturbed from their benchmark values. These perturbations follow prescribed distributions, such as a *t*-distribution with a specified standard deviation and degrees of freedom, or a uniform distribution over a specified range. The exact distributional assumptions used are documented in Harrison, Rutherford, and Tarr (1992). The MPSS software used to implement the Monte Carlo simulations is documented in Harrison (1990).

For each Monte Carlo run, we solve the counterfactual policy with the selected set of elasticities. This process is repeated until we arrive at the desired sample size, in our case 1,000. The results are then tabulated as a distribution, with equal weight being given (by construction) to each Monte Carlo run. The upshot is a probability distribution defined over the endogenous variables of interest. In our case we focus solely on the welfare effects of each policy.

The policies that we examine and the results of the sensitivity analysis are reported in table B-1. The "sample size" column refers to the number of Monte Carlo runs that were actually completed. In each case we have at least 1,000 runs, which should be enough to obtain a reliable picture of the distribution of results. The "point estimate" column shows the welfare effect of the policy when all elasticities are set equal to their benchmark, or point estimate (PE), values. These are the results reported and discussed in the results section of the text. The point estimate is the change in welfare caused by the policy as a percentage of GDP.

**Table B-1. Descriptions of the Policy Simulations and Results
of the Sensitivity Analysis for Turkey**

Simulation	Sample size	Change in welfare (percentage of GDP) ^a			
		Point estimate	Mean	Median	Standard deviation
1. Set tariffs equal to a uniform value of 8.1 percent for all sectors.	1,000	0.161	0.210	0.210	0.030
2. Set export subsidies equal to a uniform value of 7.4 percent for all sectors.	1,000	1.073	0.841	0.866	0.114
3. Set all foreign trade distortions (tariffs and export subsidies) equal to their average benchmark values.	2,662	1.173	1.005	1.034	0.118
4. Set all domestic and foreign distortions equal to their average benchmark value.	1,041	1.373	1.301	1.307	0.139
5. Liberalize tariffs by setting them to zero across the board.	1,000	-0.125	-0.218	-0.211	0.108
6. Liberalize export subsidies by setting them to zero across the board.	1,000	1.004	0.844	0.875	0.117
7. Liberalize export subsidies by 20 percent across the board.	1,000	0.848	0.751	0.782	0.129
8. Liberalize foreign trade distortions by setting them to zero across the board.	1,000	1.174	1.003	1.030	0.122
9. Liberalize all distortions by setting them to zero: the "first-best" policy.	1,000	1.374	1.299	1.308	0.144
10. Set tariffs and export subsidies to their uniform values and then liberalize tariffs.	1,000	-0.058	-0.167	-0.172	0.033
11. Set tariffs and export subsidies to their uniform values and then liberalize export subsidies.	2,000	-0.088	-0.050	-0.050	0.020
12. Liberalize the VAT by setting it to zero across the board.	1,000	-0.342	-0.097	-0.090	0.085

Note: All simulations (the last six columns of the table) use a lump-sum tax replacement.

a. Using the equivalent variation measure.

b. Probability that the welfare increased under the counterfactual policy.

c. Probability that the welfare effect under the counterfactual policy, using perturbed elasticities, is greater than or equal to the welfare effect obtained under the counterfactual policy point estimate.

The remaining columns report the results of the sensitivity analysis proper. The mean, median, and standard deviation are given to provide simple indicators of the location and dispersion of the distribution of welfare results. The skewness and kurtosis statistics that are necessary to gain a more complete impression of the distribution are not reported in the table. In all cases we find that there is indeed significant skewness in the distribution, but insignificant kurtosis. The skewness in these distributions manifests itself in a systematic

Prob. $\geq 0^b$	Prob. $\geq PE^c$	Symmetric confidence interval around the median			
		50 percent		75 percent	
		Lower bound	Upper bound	Lower bound	Upper bound
1.000	0.97	0.190	0.230	0.180	0.250
1.000	0.00	0.710	0.930	0.650	0.960
1.000	0.03	0.870	1.090	0.800	1.120
1.000	0.33	1.200	1.400	1.110	1.460
0.010	0.22	-0.310	-0.140	-0.360	-0.100
1.000	0.03	0.700	0.930	0.650	0.960
1.000	0.38	0.570	0.850	0.520	0.870
1.000	0.04	0.860	1.090	0.800	1.120
1.000	0.34	1.180	1.400	1.100	1.460
0.000	0.00	-0.190	-0.130	-0.200	-0.120
0.001	0.98	-0.066	-0.034	-0.074	-0.025
0.135	1.00	-0.170	-0.020	-0.210	0.000

difference between the mean and median reported. Thus comparison of these two statistics indicates the direction of the skewness.

Why do we get such significant skewness in the distributions? There are two general reasons why this might occur: induced skewness as a result of our explicit distributional assumptions, and intrinsic skewness in the (implicit) function linking the set of elasticities and welfare. Each can be evaluated.

The explicit assumptions made in our sensitivity analysis result in a large

number of skewed distributions for production activities that have benchmark Leontief technologies. The activities that fall into this category combine intermediate inputs and value added. In this case we allow perturbations of 0.25, 0.5, 0.75, and 1.0, as well as the benchmark value of zero. To see if this is the source of the skewness, we can remove these perturbations for these activities and rerun the sensitivity analysis to see if the skewness disappears. We have done this for the uniformity policy simulation (making all export subsidies uniform) and find that it does not account for the skewness.

The other possible reason for skewed results is more subtle than the presence of skewed distributional assumptions but could well be more important. It has to do with the "asymmetry" of the implicit function that takes a given set of elasticities and generates the welfare effect. It is perfectly possible that equi-sized perturbations of a given elasticity can have different absolute effects on welfare.⁷ We can evaluate this source of skewness with respect to blocks of elasticities of the same type by setting those elasticities equal to their PE value. We do this for the simulation of uniformity of policy and with respect to each elasticity block. No single block can account for the skewness. We conclude that there is no single block of elasticities that is causing this skewness.

The "probability" columns indicate the qualitative policy results. The "welfare increased" column shows the probability from the empirical distribution that welfare increased in the counterfactual policy. This gives a measure of the confidence that we have the sign right when we look at the point estimate welfare effect, the mean, or the median. Similarly, the next column shows the probability that a welfare effect greater than or equal to the PE welfare effect was obtained. If the PE result perfectly represents the location of the distribution of results, this value should be around one-half; this would be the case if the PE result exactly equaled the reported median result. A value lower (higher) than one-half indicates that the distribution generally lies below (above) the PE result.

Finally, to gain a better sense of the confidence to be attached to the PE or mean result, we report lower and upper bounds from 50 and 75 percent symmetric confidence intervals around the median result. These confidence intervals show the smallest and largest values that lie within 50 or 75 percent of the distribution centered on the median. Thus a 50 percent confidence interval between 1.1 and 2.3 can be interpreted to mean that 50 percent of the Monte Carlo runs produced welfare results between these values.

Six observations can be made from these sensitivity analyses regarding our policy conclusions.

7. For example, our sensitivity analysis allows equal increases and decreases in the elasticity of substitution between domestically produced and imported goods in our Armington aggregate. However, it is plausible that increasing this elasticity from 2 to 3 has very little impact on welfare, whereas reducing it from 2 to 1 has a large impact. The source of our priors on this is no more than visual and casual inspection of isoquants with the relevant elasticities of substitution: once the elasticity gets above 2 it stays pretty flat, but dropping it down to 1 adds significant curvature.

First, the welfare gains from the first-best liberalization policy are robust to uncertainty over elasticities. The median and PE estimates are of the same order of magnitude—around 1.3 percent.

Second, the welfare gains from reform of export subsidies are not as large as they were with the PE elasticities. This applies to the policy of uniformity as well as to the policy of liberalization. In each case the welfare gains drop to around 0.87 percent, rather than to the initial results of 1.0 percent or so when PE elasticities are used. It is noteworthy, however, that just reducing export subsidies by 20 percent continues to generate a relatively large fraction of the welfare gains from the complete liberalization of export subsidies. Given the decline in welfare gains as a result of the uniformity and liberalization policies, this fraction is even larger than before. The higher fraction confirms the policy conclusion that it is important to have the highest export subsidies reduced, at the very least.

Third, there continues to be a welfare loss from unilateral liberalization of tariffs. This loss increases from 0.1 percent of GDP to around 0.2 percent when we allow for uncertainty over elasticities.

Fourth, the welfare gains from moving toward uniformity of foreign distortions or of all distortions appear to be very robust.

Fifth, the welfare losses obtained when tariffs or export subsidies are liberalized from a benchmark in which all foreign distortions are uniform are qualitatively robust. The welfare loss for tariff liberalization is somewhat larger than before, strengthening our earlier policy conclusion in this respect.

Finally, the welfare effects of removing the VAT with a lump-sum replacement are even “more neutral” than before. Rather than a welfare loss of 0.342 percent, we now find a median welfare loss of only 0.09 percent, with a standard deviation of approximately the same value. This confirms the earlier finding that the existing VAT serves well as a practical alternative to the lump-sum tax as a distortion-free replacement tax.

REFERENCES

The word “processed” describes informally reproduced works that may not be commonly available through library systems.

- Arslan, Ismail, and Sweder van Wijnbergen. 1990. “Turkey: Export Miracle or Accounting Trick?” wps 370. World Bank, Latin America and the Caribbean Regional Office, Washington, D.C. Processed.
- Atkinson, Anthony, and Joseph Stiglitz. 1980. *Public Economics*. New York: McGraw-Hill.
- Balassa, Bela. 1989. “Subsidies and Countervailing Measures: Economic Considerations.” In Bela Balassa, ed., *Subsidies and Countervailing Measures: Critical Issues in the Uruguay Round*. Discussion Paper 55. Washington D.C.: World Bank.
- Baysan, Tercan. 1984. “Some Economic Aspects of Turkey’s Accession to the EC: Resource Shifts, Comparative Advantage, and Static Gains.” *Journal of Common Market Studies* 23: 15–34.

- Baysan, Tercan, and Charles Blitzer. 1988. "Turkey's Trade Liberalization in the 1980s and Prospects for Its Sustainability." Paper presented at the Conference on Turkey's Economic Development in the 1980s. Harvard University, Cambridge, Mass. Processed.
- _____. 1991. "The Timing and Sequencing of a Trade Liberalization: The Case of Turkey." In D. Papageorgiou, M. Michaely, and A. Chokski, eds., *Liberalizing Foreign Trade*, vol. 6. Cambridge, Mass.: Blackwell.
- Brander, James, and Barbara Spencer. 1985. "Export Subsidies and International Market Share and Rivalry." *Journal of International Economics* 18: 83-100.
- Brooke, Anthony, David Kendrick, and Alexander Meeraus. 1988. *GAMS: A User's Guide*. Redwood City, Calif.: Scientific Press.
- de Melo, Jaime, and David Tarr. 1992. *General Equilibrium Analysis of U.S. Foreign Trade Policy*. Cambridge, Mass.: MIT Press.
- Dixit, Avinash K., and Victor Norman. 1980. *Theory of International Trade*. Welwyn, U.K.: Nisbet.
- _____. 1986. "Gains from Trade without Lump-Sum Compensation." *Journal of International Economics* 21: 111-22.
- Eaton, Jonathan, and Gene Grossman. 1986. "Optimal Trade and Industrial Policy under Oligopoly." *Quarterly Journal of Economics* 101: 383-406.
- Grais, Wafik, Jaime de Melo, and Shujiro Urata. 1986. "A General Equilibrium Estimation of the Effects of Reductions in Tariffs and Quantitative Restrictions in Turkey in 1978." In T. N. Srinivasan and John Whalley, eds., *General Equilibrium Trade Policy Modeling*. Cambridge, Mass.: MIT Press.
- Harrison, Glenn W. 1990. "The Sensitivity Analysis of Applied General Equilibrium Models with MPSS: User's Guide." University of South Carolina, Department of Economics, Columbia. Processed.
- Harrison, Glenn W., Richard Jones, Larry Kimbell, and Randall Wigle. 1993. "How Robust Is Applied General Equilibrium Modelling?" *Journal of Policy Modelling* 15 (1): 99-115.
- Harrison, Glenn W., and Richard J. Manning. 1987. "Best Approximate Aggregation of Input-Output Systems." *Journal of the American Statistical Association* 82 (December): 1027-31.
- Harrison, Glenn W., Thomas Rutherford, and David Tarr. 1992. "Piecemeal Trade Reform in Partially Liberalized Economies: An Evaluation for Turkey." WPS 951. World Bank, Country Economics Department, Washington, D.C. Processed.
- Harrison, Glenn W., and H. D. Vinod. 1992. "The Sensitivity Analysis of Applied General Equilibrium Models: Completely Randomized Factorial Sampling Designs." *The Review of Economics and Statistics* 79 (May): 357-62.
- Itoh, Motoshige, and Kazuharu Kiyono. 1987. "Welfare-Enhancing Export Subsidies." *Journal of Political Economy* 95: 115-37.
- Krueger, Anne O. 1984. "Trade Policies in Developing Countries." In Ronald Jones and Peter B. Kenen, eds. *Handbook of International Economics*. Amsterdam: North Holland.
- Krugman, Paul. 1988. "Endogenous Innovations, International Trade, and Growth." Paper presented at the SUNY-Buffalo Conference on Development. Massachusetts Institute of Technology, Department of Economics, Cambridge, Mass. Processed.
- Lerner, Abba. 1936. "The Symmetry between Import and Export Taxes." *Economica* 3: 306-13.

- Mathiesen, Lars. 1985. "Computation of Economic Equilibria by a Sequence of Linear Complementarity Problems." *Mathematical Programming Study* 23. Amsterdam: North Holland.
- Milanovic, Branko. 1986. *Export Incentives and Turkish Manufactured Exports, 1980-84*. World Bank Working Paper 768. Washington, D.C.
- Nogues, Julio. 1990. "The Experience of Latin America with Export Subsidies." *Weltwirtschaftliches Archiv* 126: 97-114.
- Rodrik, Dani. 1988a. "Some Policy Dilemmas in Turkish Macroeconomic Management." In T. Aricanly and D. Rodrik, eds., *Turkey's Economic Development in the 1980s: Changing Strategies for the Next Decade*. New York: Macmillan.
- . 1988b. "Imperfect Competition, Scale Economies, and Trade Policy in Developing Countries." In R. Baldwin, ed., *Trade Policy Issues and Empirical Analysis*. University of Chicago Press.
- Romer, Paul. 1989. "What Determines the Rate of Growth of Technological Change?" WPS 279. World Bank, Country Economics Department, Washington, D.C. Processed.
- Rutherford, Thomas F. 1989. "General Equilibrium Modelling with MPS/GE." University of Western Ontario, London, Ontario. Processed.
- Tarr, David. 1990. "Second-Best Foreign Exchange Policy in the Presence of Domestic Price Controls and Export Subsidies." *The World Bank Economic Review*. 4:175-93.
- Thomas, Vinod, John Nash, and associates. 1991. *Best Practices in Trade Policy Reform*. New York: Oxford University Press.

A Medium-Term Framework for Analyzing the Real Exchange Rate, with Applications to the Philippines and Tanzania

Kathie L. Krumm

A competitive official real exchange rate is important to external balance and sustainable medium-term growth in developing countries. This article presents a methodology for estimating the appropriate real rate and provides a basis for evaluating the extent to which the prevailing rate is misaligned. In particular, the medium-term equilibrium real exchange rate is evaluated by estimating the effects of structural factors on the trend observed for a country's real rate compared with the rates of its major trading partners, taking into account the effects of macroeconomic policy. Structural factors include terms of trade, external capital flows, and trade policy, plus other factors relevant to the circumstances of individual countries. The implied change in the medium-term equilibrium real rate is compared with that of a historical reference period. The application of this methodology to two developing countries, the Philippines and Tanzania, illustrates how it can complement and improve upon other analytic approaches, such as those using purchasing power parity and analysis of parallel rates. This approach is complemented by an analysis of the relation between a country's real exchange rate and those of its major competitors.

The importance of a competitive official real exchange rate to external balance and sustainable medium-term growth has been recognized by policymakers in several developing countries. This article presents a methodology for estimating the appropriate real rate over the medium term, paying particular attention to changes in the structural determinants of that rate. The application of the methodology to two developing countries, the Philippines and Tanzania, illustrates how it can complement other analytic approaches.

The concept of the equilibrium real exchange rate has deepened in recent years. The traditional notion of a market equilibrium rate, or short-term equilibrium rate, is that it is the rate that balances current supply and demand in the absence of official intervention. In the post-Bretton Woods era of floating ex-

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change rates for the major international currencies, the perceived misalignment of rates has led to the refinement of the concept of a more fundamental or long-run equilibrium real exchange rate (Williamson 1985). This concept is equivalent to the one used in developing-country literature, namely, the rate such that current account balances (current and future) are compatible with long-run sustainable capital flows for external equilibrium and that the nontradable goods market clears with employment at its natural level for internal equilibrium (Edwards 1988, 1989).

Structural or fundamental factors determine the appropriate rate over the medium term. The real exchange rate prevailing at any point in time, however, is determined by both structural and short-run factors. Macroeconomic policy may alter the path of the real exchange rate in the short run independently of the directions indicated by the underlying structural factors. Therefore macroeconomic policy needs to be taken into account in managing the exchange rate. Nonetheless, the focus of this article is on the fundamental position referred to as the medium term, which extends beyond short-run fluctuations caused by macroeconomic policy.

The medium-term equilibrium real rate is evaluated by estimating the effects of structural factors on the trend in a country's observed real rate in relation to the rates of its major trading partners, taking into account the effects of macroeconomic policy. This methodology draws heavily on the work of Williamson (1985) as applied to exchange rates among industrial countries. Based on comparisons of price indexes with major trading partners and these structural changes, the change in the equilibrium real rate from the level in a reference period is estimated for the Philippines and Tanzania. Analysis of the appropriateness of prevailing rates can take account of such estimates of equilibrium shifts in relation to historical periods. The country cases aim to illustrate the methodology and, hence, intentionally refer to 1986. Policy analysis would need to make use of estimates in structural change up to the present.

The structural influences considered in this article that affect the medium-term equilibrium rate are changes in terms of trade, external capital flows, trade policy, agricultural export marketing efficiency, and the import intensity of industry. Similar work on the determinants of the real exchange rate is contained in Cavallo and Cottani (1985) and Edwards (1988) for middle-income countries, Pinto and van Wijnbergen (1986) for Sub-Saharan African countries, and Elbadawi (1989) for Sudan. Edwards, and Pinto and Van Wijnbergen use pooled cross-country samples to identify significant structural factors rather than analyze policy in a particular country. Cavallo and Cottani, and Elbadawi estimate the significance of factors for individual countries. I use a methodology applicable for individual countries but extend the approach taken in earlier empirical work by using it to evaluate the medium-term equilibrium rate and to provide a basis for evaluating the extent to which the prevailing rate is misaligned.

This methodology can be most useful in the context of an adjustable peg exchange rate regime for two reasons. First, it provides a useful extension to the

trade-weighted purchasing power parity measure (PPP), which commonly is the starting point for assessing exchange rate policy. The methodology encompasses the PPP concept while extending explanatory factors beyond differential inflation. The empirical and theoretical motivation for extending the PPP concept to a broader equilibrium real exchange rate concept is well established in the literature on both fluctuations in major international currencies and the exchange rate policy of developing countries (Williamson 1985; Harberger 1986; Edwards 1988). Second, it provides a useful complement to other indicators of equilibrium, such as parallel market rates, which generally are highly sensitive to short-run changes and reflect capital account instability. Although the empirical evidence presented here indicates that specific estimated magnitudes need to be used cautiously, the analysis provides a framework for thinking about the role of the real exchange rate and the adjustments in the medium-term strategy that may be necessary in response to further structural changes.

A complementary approach examines recent real exchange rate trends and policies in major competitor countries. Such examination is especially important in cases where the trading partner analysis does not include important competitor countries and hence could misstate the relative competitiveness of the economy. For example, the price structures of the other developing countries of Asia in relation to that of the Philippines do not enter the trade partner analysis because of their small trade share. Yet they are critical for evaluating the competitive position of the Philippines in the economies with which it trades the most. For the Philippines, the results indicate far less competitiveness in the major competitors approach than in the trading partner analysis.

I. THEORETICAL AND EMPIRICAL ISSUES OF THE MAJOR TRADING PARTNERS METHODOLOGY

The issue of the real exchange rate is of interest because it indicates the signals being sent to the economy that facilitate adjustment. The real exchange rate is broadly defined as a relative price that summarizes the degree of competitiveness of the external sector of a country, for both exports and import substitutes. The concept of the real exchange rate has been developed considerably in recent years. The traditional approach was based on some notion of purchasing power parity. Owing much to the early work of Australian economists Salter (1959) and Swan (1960), the more modern economic interpretation of the real exchange rate emphasizes the distinction between tradable goods and nontradable goods in the context of open economy macroeconomic models. In this article the concept of the real exchange rate is the relative price of tradables. A variety of measures can be used to estimate the real exchange rate, where the choice is based on theoretical considerations as well as on the availability of data (Edwards 1988; Maciejewski 1983).

The empirical work by necessity relies on observed exchange rates. The relation between the conceptual equilibrium rate and the observed rate is compli-

cated by the presence of multiple observed exchange rates in most countries. This is particularly so when the official pegged nominal exchange rate regime coexists with an illegal black market amidst widespread activity in the parallel market. To address this difficulty, the estimation is limited to a historical period in which the divergence among observed rates is minimal. In addition, the sensitivity of the analysis to using the official observed real rate is assessed by comparing it with the parallel observed real rate. In countries where the empirical work would be severely limited by this constraint, the methodology outlined here would need to be extended to integrate the factors explaining the divergence between official and unofficial rates (Elbadawi and Kamin 1990; O'Connell and Kaufmann 1991).

It is important to distinguish gaps between the official and parallel rates during the period of estimation from gaps between the estimated medium-term equilibrium rate and observed official rate for the current period. Once the appropriate medium-term equilibrium exchange rate for the current period has been estimated, an observed gap between that rate and the prevailing official real exchange rate becomes a useful indicator of potential misalignments in the official rate.

Measurement of the prevailing real exchange rate involves observation of multiple price indexes and trade weights. To obtain a proxy for the relative price of tradables, wholesale price indexes of the major trading partners are multiplied by the relevant average bilateral exchange rates (official and parallel), trade-weighted by their 1980 share of trade. The relative price of tradables appears in the numerator of the index so that a depreciation corresponds to an increase in the index and an appreciation corresponds to a decrease. Overall prices, for both tradables and nontradables, appear in the denominator. In contrast to the conceptual ratio of prices of tradables to nontradables, using the ratio of prices of tradables to overall prices avoids the problem of measuring nontradables alone and at the same time moves in the same direction as the conceptual ratio. The consumer price index is a proxy for overall prices. Other measures constructed for comparative purposes and detection of measurement problems include the import-weighted real exchange rate and the trade- and import-weighted ratios of domestic consumer prices to consumer prices in trading partner countries (derived from the PPP concept).

Historical Reference Periods

The traditional PPP approach to real exchange rate misalignment is to compare the current PPP measure with that of a historical period when the rate was presumed to be in equilibrium. The procedure used here also relies on a somewhat arbitrary choice of historical period, but it makes appropriate allowances for real economic changes in the interim period (between the reference period and the current period, 1986). Two factors are important in selecting the historical base. First, demand pressure has a greater effect on the current account in the home country than in foreign markets. In addition to controlling for short-run

macroeconomic factors in the real exchange rate analysis, it is useful to choose a reference period in which cyclical demand pressures were relatively normal. Second, because this is an equilibrium analysis, the period needs to be characterized by a sustainable balance of payments, given the structural factors at that time. Because of the relative scarcity of capital in most developing countries, this sustainable balance of payments position would most likely reflect a current account deficit matched by steady net capital inflows and the absence of pressure on, or build-up in, international reserves.

The Macroeconomic Policy Variable in the Real Exchange Rate Equation

A real exchange rate equation is used to isolate the effects of structural variables that are expected to maintain their impact over the medium term. The equation includes macroeconomic policies that have an impact on the prevailing or short-term rate. Prevailing real exchange rates respond to both real and monetary variables. In the context of a pegged exchange rate regime, which characterized both countries in the case studies, excessive monetary expansion puts pressure on domestic prices, resulting in temporary real appreciation. Loose fiscal policy also is reflected in excessive expansion of domestic credit. A monetary impact associated with an inconsistent set of macroeconomic policies will be short term, however, because there will be incipient pressure on the prevailing rate. Hence, the medium-term equilibrium real exchange rate is a function of real structural variables only.

The inability of macroeconomic policies to prevent the rate from moving back toward equilibrium in the medium term has been analyzed widely in the literature (see, for example, Rodriguez 1978, Connolly and Taylor 1984, and Khan and Lizondo 1987). A macroeconomic policy mix that leads to temporary appreciation (or depreciation) inconsistent with underlying structural factors will lead to losses in foreign reserves. The loss in reserves will occur through an increased demand for imports, a decreased supply of exports, or capital movement (where possible) in anticipation of offsetting depreciation or through changes in desired real balances. The loss in reserves may have a negative impact on the money supply. More commonly, however, the nominal exchange rate would be adjusted to relieve the disequilibrium balance of payments crisis. Inconsistent macroeconomic policies, creating excessive demand pressures, may persist over a long period, but the pressure to depreciate the real exchange rate also would persist. Hence, the impact of the inconsistent policies is temporary or short term. The only way to validate an appreciation would be to change one of the structural policy variables. For example, trade restrictiveness could be increased to maintain external balance. The impact on the medium-term equilibrium real exchange rate of such structural responses would be part of the estimation of changes in the real exchange rate caused by changes in structural factors. Increased trade restrictiveness can accommodate inconsistent macroeconomic policy, but such accommodation would generate the high economic costs of income contraction.

For the methodology outlined here, monetary and fiscal variables are combined into one macroeconomic-policy-stance variable, V . It is defined as the percentage change in domestic credit over and above the percentage change in growth of gross domestic product (GDP), foreign inflation, and the nominal effective exchange rate:¹

$$V = \hat{D} - \hat{Y} - P_f - \hat{E}$$

where D is domestic credit, Y is GDP, P_f is foreign inflation, and E is the exchange rate.² The historical reference period is selected on the basis of a neutral macroeconomic policy stance, in which the value of V is approximately zero.

Estimating Changes in Structural Factors

The remainder of this subsection focuses on estimating the implied shift in the equilibrium real exchange rate caused by changes in structural factors, namely, the combination of the shifts estimated for each of the structural factors. Structural factors can be both exogenous, such as the terms of trade, and policy-induced, such as trade policy. Although factors that are the result of inappropriate sectoral policy have an impact on the equilibrium real exchange rate, their reflection in exchange rate policy should be viewed as an interim measure until the underlying policy framework can be reformed. The likely direction of the relation between the various structural factors and the real exchange rate is identified here in a manner suggested by the literature.

In the case studies that follow, the estimation of the shifts for the individual structural factors has three steps. The first step indicates the magnitude of the change in the structural factor for the country concerned, often in terms of a range over the medium term, in relation to the reference period. The second step notes the coefficient estimated for that structural factor in the regression analysis of the real exchange rate, including the extent of its significance and consistency with the literature. The third step estimates the implied shift as the product of the coefficient and the corresponding change in the structural factor.

The structural factors considered are the major factors identified in the theoretical literature as being amenable to empirical analysis. They are the terms of trade, external capital flows or the underlying factors affecting them, and trade policy. It is more difficult to obtain proxies for other factors that may be important, such as technical progress.

The theoretical literature indicates that the relation between the terms of trade and the real exchange rate is the result of income and substitution effects that depend on the source of the terms of trade variation. The likely result is that a

1. See Cavallo and Cottani (1985) and Edwards (1989). Additional or alternative formulations include the direct fiscal impact and government consumption. These did not perform well in the Philippine and Tanzanian case studies.

2. The nominal effective exchange rate appears in both the dependent and independent variables, but, given its exogeneity, it does not induce spurious correlation.

deterioration in the terms of trade leads to a real depreciation and that an improvement leads to an appreciation.³ For example, a fall in the price of exports or a rise in the price of imports lowers disposable income, generating a higher excess supply of nontradables, downward pressure on the price of nontradables, and, hence, a real depreciation. Or put another way, to balance the external accounts, the economy would have to produce more and consume fewer tradables, implying a relative increase in the price of tradables or a real depreciation.

Another important factor in exchange rate determination is the external capital flows picture. In much of the literature, capital flows are treated as exogenous (see, for example, McKinnon 1976 and Harberger 1984). This treatment is particularly appropriate in developing countries. The flows frequently consist largely of exogenously determined foreign aid or transfers from abroad. They also include capital flight that is a result of political uncertainty, which is exogenous to the analysis here. As the mirror image of real resource transfers, the increased flows will increase demand for both tradables and nontradables. Whereas tradables prices are given by world prices, nontradables prices would rise in response to the increased demand. Sustainable inflows are only consistent with a real appreciation that leads to further real resource transfer. Put in another way, for foreign inflows to be utilized, economic agents need to be encouraged to use more tradables in relation to nontradables through a relatively lower price of tradables or a real appreciation.

Although capital flows in the literature on small open economies often are treated as endogenous (Dornbusch 1980), one of the factors to which they respond is the extent of controls on the capital account and policies aimed at controlling the level of foreign borrowing. Capital account restrictions could be considered another structural variable. But in fact the adjustments have been guided to achieve a certain capital account position, such as restrictions on, or encouragement of, commercial borrowing. Because of this role and without any more precise proxy for capital account controls and foreign borrowing strategy, the lagged capital account is sometimes used as a proxy (Edwards 1989). This alternative interpretation of the capital account variable in the analysis also would be associated with real exchange rate appreciation, because capital account controls would be expected to reduce capital outflows or increase net inflows. To the extent that external capital flows are endogenous, the results would be biased in an undetermined direction. Without instrumental variables, however, the standard way of handling this through lagged variables would not reflect the true causality of the contemporaneous capital flow variable, resulting in misspecification.

3. It is possible that a deterioration in the terms of trade could lead to a real appreciation, for example, if the substitution effect dominates the income effect for an import price increase. This could be the case if imports are competitive and have many domestic substitutes or if importables represent a low proportion of the production of tradables. In the long run, the result also depends on the capital-labor intensities of the different sectors.

Another factor of importance in the historical analysis of different countries and one that is frequently amenable to econometric analysis is trade policy. The generally accepted view in the literature is that a trade liberalization characterized by a reduction of tariffs (in a small country) will result in an equilibrium real depreciation.⁴ Import demand is expected to increase as the price of imports declines in line with lower tariffs or the removal of quantitative restrictions, generating a trade deficit. To restore external balance, the trade liberalization will need to be accompanied by an increase in the relative price of tradables or a real depreciation. This effect is likely to be stronger on the real exchange rate proxy than on the theoretical real exchange rate because the proxy has the tariff rate itself in the numerator.

Additional structural factors relevant to the circumstances of individual countries can be included in the analysis whenever proxies are available for estimation. One such factor is the import intensity of the manufacturing sector. Higher import intensity is expected to increase the demand for foreign exchange and put more pressure to depreciate on the real exchange rate. Another factor is the efficiency of export marketing. An inefficient marketing structure is equivalent to lower export prices and a worsened terms of trade and, hence, is expected to result in a more depreciated exchange rate. Other factors, such as infrastructure deterioration, likely also are important in Tanzania, but relevant proxies are not available for estimating purposes.

The literature on the equilibrium real exchange rate cited above confirms that the real exchange rate needs to respond to several structural developments. Although the focus here is the equilibrium rate, the effect of short-run demand pressures is accounted for, based on an assumption of a cyclically normal macroeconomic policy stance, as in the reference period. The effects of the structural factors then are aggregated. The analysis of how structural changes have affected the equilibrium real exchange rate for individual economies can provide some additional guidance to the prevailing exchange regime policy. Such guidance is obtained by comparing the extent of actual real depreciation or appreciation with the magnitudes suggested by the empirical work.

II. CASE STUDIES USING THE MAJOR TRADING PARTNERS METHODOLOGY

The change in the equilibrium real exchange rate is estimated for the Philippines and Tanzania, based on changes in structural factors from their levels in a reference period. The equilibrium rate used here is based on the trading partners methodology. First, the historical reference period is selected. Second, the structural factors are identified, and the impact of the change in each structural factor

4. This result may not hold, however, in the presence of intermediate goods and negative effective protection or, as in the terms of trade case, for the long run if exportables are less capital-intensive than nontradables or importables, or for the short run if substitution effects dominate income effects. See Johnson (1966) on intermediate goods, Jones (1965) on factor intensities, and Dornbusch (1974) on demand substitution.

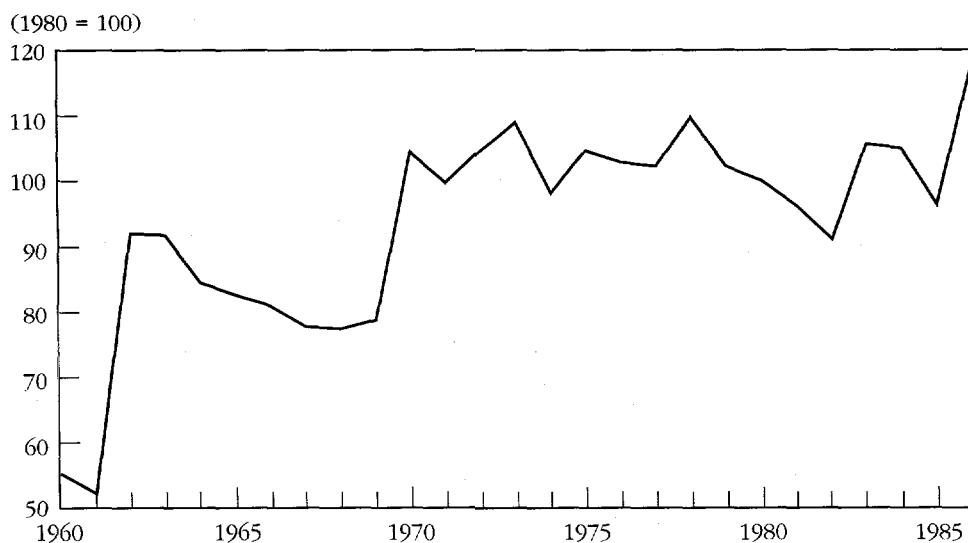
on the real rate is estimated. And third, the effects of the structural factors are aggregated to obtain an extrapolated equilibrium real exchange rate. In each case study the "current" period or the year for which the rate is estimated is 1986.

The Philippines

In general it is useful to derive alternative measures of the real exchange rate for comparison and for testing the robustness of results. In the Philippines, however, the indexes do not differ widely. The trade-weighted ratio of domestic consumer prices to partner wholesale prices is used here because of its conceptual advantages. Given that the margin between the black market and official exchange rates during the period of analysis is not significant, the official exchange rate is used in converting foreign prices into domestic equivalents to construct a proxy for prices of tradable goods. The trend in the prevailing real exchange rate is summarized in figure 1 and in appendix table A-1.

Historical reference period. To estimate a country's medium-run equilibrium rate in relation to the rates of its trading partners, the first step is to identify the real exchange rate prevailing during a reference period. The historical reference period should be characterized by consistent macroeconomic policies or cyclically normal demand pressure, and a sustainable current account, given the structural traits of the economy. In the Philippines, 1972-73 was selected as the

Figure 1. *The Real Exchange Rate in the Philippines, 1960-86*



Note: The real exchange rate index is from the trading partner methodology using the Philippine CPI and weighted trading partner WPI. An increase in the index represents a depreciation in the real exchange rate.

Source: IMF (various issues -a and -b).

reference period from which to measure changes in the long-run equilibrium real exchange rate. During 1972–73, demand pressures were relatively normal. From 1970 through 1972, the government was following rather tight monetary and fiscal policies. Beginning in 1973, policies became more expansionary and were accompanied by an inflationary trend that was largely "imported." Nonetheless, the years 1972–73 were relatively cyclically neutral. From the mid-1970s to the early 1980s, policy remained quite expansionary, and, by 1984 to 1986, macroeconomic policies had begun to adjust to the foreign exchange crisis and were increasingly austere. Likewise, the real exchange rate during 1972–73 was matched by a sustainable current account balance in light of underlying capital flows. In 1972 and 1973 the current account excluding net interest payments was in a slight surplus. It generally is agreed that current account deficits of the level that characterized the late 1970s and early 1980s are not sustainable.

Structural factors. The second step is to identify the new structural developments affecting the equilibrium real exchange rate in the interim (between the reference period and 1986) and to estimate the implied change in the rate. The short-run influences from macroeconomic policy are successfully isolated, with a significant negative impact of the macroeconomic-stance variable confirmed by the regression analysis.⁵ Other variables, such as government consumption, were included to account for the direct nonmonetary fiscal impact, but these variables did not perform as well.

After the reference years, several factors changed, with important implications for the real exchange rate. The following are addressed in this exercise: terms of trade, underlying external capital flows, and commercial policy. The results of the regression analysis on the real exchange rate for these structural factors as well as for the short-run variable are given in table 1.

Since the early 1970s, the terms of trade of the Philippines have deteriorated sharply. The oil price shocks raised import prices, and the prices of major export commodities also have suffered. By 1984, the terms of trade deteriorated by 44 percent from their 1972–73 levels.⁶ What is relevant for this exercise is the assumption on the future trend in the terms of trade. The assumption is that the terms of trade will stabilize over the medium term, the oil price decline being offset by continued downward pressures on the prices of key exports, especially sugar, with no improvement in other major commodity exports. The empirical work confirms a negative relation between the terms of trade and the real exchange rate, that is, that a deterioration is accompanied by a real depreciation, as shown in table 1. This estimated relationship can be used to assess

5. In 1985 the Philippines introduced a floating exchange rate regime. In this case, domestic monetary expansion puts pressure on the exchange rate, resulting in real depreciation, and domestic monetary contraction results in real appreciation. This development reverses the expected sign of the variable, but it occurred after the period of estimation.

6. The terms of trade evidenced a sharp but temporary export commodity boom in 1973.

Table 1. Determinants of the Real Exchange Rate for the Philippines

Period	Structural factors			Short-run factor: monetary and exchange rate indicator	R ²	DW
	Terms of trade	Trade liberal- ization	Capital flows			
1966-84	-0.2** (-2.2)	n.a.	4.3** ^a (2.4)	-0.3** (-2.8)	64	1.0
1966-84	-0.5** (-6.2)	0.4* (1.6)	n.a.	-0.7** (-4.2)	77	1.6
1966-84	-0.3** (-2.7)	0.5** (2.2)	0.01** ^b (1.8)	-0.7** (-4.5)	82	2.3

n.a. Not applicable.

Note: All variables are in log linear form or ratio. *t*-statistics are in parentheses. ** indicates significant at the 95 percent level and * at the 90 percent level. For definitions of variables see appendix table A-1. The coefficients for the constant and the government consumption variable are not reported in the regressions.

a. Measured as net transfer as a percentage of GDP.

b. Measured as the log of net transfer in real terms.

Source: Author's estimations.

changes in the equilibrium real exchange rate. For example, historically, a 10 percent change in the terms of trade was consistent with a real exchange rate change in the range of 2 to 4 percent. Thus, the 45 percent deterioration from 1972-73 to 1986 would imply a shift (a depreciation) in the equilibrium real exchange rate from that period of about 9 to 18 percent.

With regard to the external capital picture for the Philippines, the case study focuses on external flows. These are determined largely by exogenous foreign aid decisions as well as various adjustments to restrictions on, and incentives for, commercial borrowing. Compared with the historical reference period (1972-73), there was a large stock of external debt by 1986, implying sizable interest payments of about 6 percent of gross national product (GNP) yearly. At the same time, it is expected that the Philippines will continue to attract aid and commercial borrowing of about 2 percent of GDP. This situation implies a current account surplus excluding interest of about 4 percent of GNP, comparable to the surpluses in 1972 and 1973 of 1.5 and 5.6 percent, respectively.

Although the current surplus is generated for very different underlying reasons than it was in the past, it does not imply any structural real exchange rate change for the forecasted period in relation to the reference period. The empirical results in table 1 indicate a significant role for capital flows in determining the real exchange rate during the period of empirical analysis. At the same time, the coefficient indicates a role opposite to that expected. The opposite result in the Philippines is explained by the capital intensity (and therefore import intensity) of the projects financed by foreign borrowing. The assumption made here is that the current capital flows picture is similar to that of the reference period. Therefore, because the medium-term equilibrium exchange rate is predicted based only on changes in relation to the reference period, the analysis of the medium-

term equilibrium real exchange rate does not use the estimated coefficient on capital flows.⁷

Commercial policy is an important structural factor to be analyzed as the government continues its efforts to liberalize trade. An index of liberalization (on a scale of 1 to 20) calculated by Shepherd and Alburo (1991) is used in the estimation. In the comparator 1972-73 period, the Philippines was judged to have a relatively high degree of trade liberalization, measuring 13. In line with the government endorsement of the trade liberalization strategy, the index is expected to increase over its level in 1985 (which was 12). It is assumed that the index will increase by 8 to 16 percent, to 14 or 15. The real exchange rate evidenced a positive relation with this measure of commercial policy, as shown in table 1. Based on the increase in the index and a real exchange rate elasticity of about 0.4, the long-run equilibrium exchange rate would depreciate about an additional 3 to 6 percent to maintain external balance consistency.

Extrapolating the equilibrium real exchange rate. The final step is to aggregate the effects of the three major structural influences in the Philippines, implying that the equilibrium real exchange rate would be depreciated by about 12 to 24 percent from its 1972-73 base. The terms of trade deterioration implies a 9 to 18 percent depreciation. Despite its significance in explaining changes during the period, the predicted capital flows variable is similar to the reference period and implies no change. And the commercial policy liberalization is consistent with a 3 to 6 percent depreciation. This extent of depreciation can be compared with the prevailing rate during 1986 (see table A-1), providing an alternative guide post for the direction of exchange rate management in the Philippines.

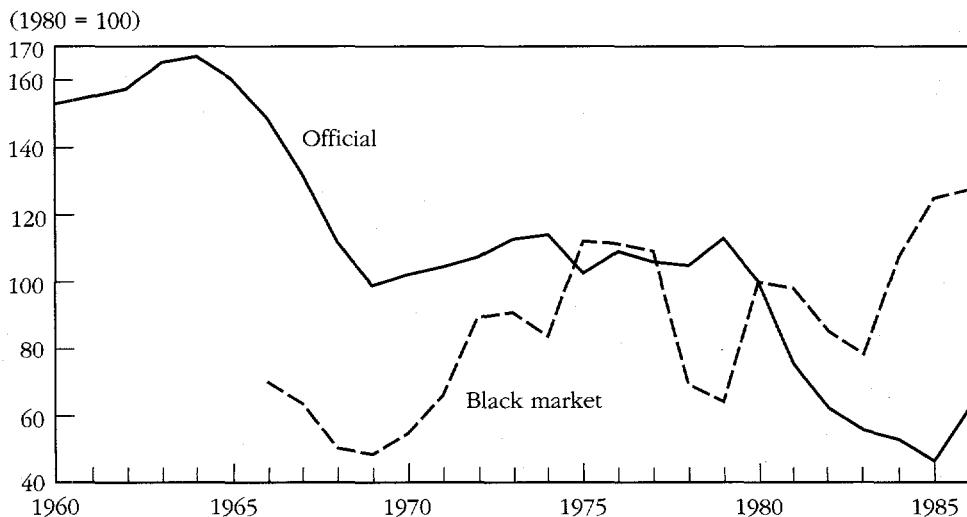
The Philippines case study illustrates the usefulness of the methodology in estimating the medium-term equilibrium exchange rate. Most of the variables are consistently significant and largely explain variations in the real rate. Nonetheless, the results must be used cautiously. The estimated parameter values have a wide range and are not very robust with respect to specification of the equation. In addition, the capital flows variable has the opposite sign from what is expected.

Tanzania

For Tanzania, as for the Philippines, alternative measures of the real exchange rate were made for comparison and for testing the robustness of results. To test the robustness of the results with respect to alternative specifications, sensitivity analysis was done on the real exchange rate to confirm that the choice of 1980 as the base year and the choice of the trade weights did not make any significant difference when compared with a base year of 1970 or 1985. Another concern

7. The medium-term equilibrium real exchange rate would differ should the capital flows assumption be modified. For example, if the Philippines received additional import-intensive project aid on the order of magnitude of 1 percent of GDP, the empirical analysis indicates that the equilibrium real exchange rate would be depreciated by a further 4 percent in relation to the reference period.

Figure 2. *The Official and Black Market Real Exchange Rate Indexes in Tanzania, 1960–86*



Note: The real exchange rate index is from the trading partner methodology using the Tanzanian CPI and weighted trading partner WPI. An increase in the index represents a depreciation in the real exchange rate.

Source: IMF (various issues –a and –b).

for Tanzania is the quality of the price data. Because of the growing divergence between the prices captured by the consumer price index (CPI) and market prices in the early 1980s, the analysis excludes observations after 1982.⁸ The GDP deflator was examined as an alternative proxy for price changes, but it was unsatisfactory, especially in the earlier period. Hence, the analysis proceeds with the trade-weighted ratio of domestic consumer prices to partner wholesale prices.

For translating foreign prices into domestic equivalents, the prevailing rate as measured by the black market nominal exchange rate is used as well as the official nominal rate. The two rates are shown in figure 2 and in appendix table A-2. Because of the growing excess demand characterizing the official exchange market in the late 1970s, the historical empirical analysis using the official rate extends from the early 1960s to 1978 only. In 1978 the parallel market premium was about 70 percent. The alternative analysis using the black market rate is used for the period after 1978 until the early 1980s, when the official CPI increasingly reflects less of the underlying price pressures in the economy.

Historical reference period. For Tanzania, 1965–66 was selected as the base period from which to measure changes in the equilibrium real exchange rate.

8. For the price data in the final year of the analysis (1986), the CPI is adjusted by using complementary data, as noted in the footnote to appendix table A-2.

Table 2. Determinants of the Real Exchange Rate for Tanzania

Period	Terms of trade	Structural factors			Short-run factor: monetary and exchange rate indicator	R ²	DW
		External capital flows	Import intensity of manufacturing sector	Inefficiency in marketing agricultural exports			
<i>Dependent variable: Real effective official exchange rate</i>							
1962-78	-0.23 (-1.0)	-0.05** (-4.3)	n.a.	n.a.	-0.003** (-1.6)	67	1.1
1962-78	-0.23 (-0.9)	-0.05** (-3.4)	0.001 (0.2)	n.a.	-0.003* (-1.5)	67	1.2
1962-78	-0.34 (-1.3)	-0.30** (-2.3)	n.a. (n.a.)	0.03 (0.1)	-0.002 (-1.3)	48	1.3
1962-78	-0.12 (-0.4)	-0.05** (-2.9)	0.02 (0.4)	-0.01 (-0.6)	-0.003 (-1.2)	68	1.1
<i>Dependent variable: Real effective black market exchange rate</i>							
1966-81	-0.50* (-1.5)	-0.01 (-0.1)	0.02** (4.4)	n.a.	-0.007** (-2.7)	71	1.8
1966-81	-0.50 (-1.1)	0.03 (0.9)	n.a.	0.03** (2.1)	-0.005 (-1.4)	43	1.0
1966-81	-0.46 (-1.3)	-0.10 (-0.3)	0.02** (3.2)	-0.01 (-0.5)	-0.007** (-2.6)	72	1.9

n.a. Not applicable.

Note: All variables are in log linear form or ratio. t-statistics are in parentheses. ** indicates significant at the 95 percent level and * at the 90 percent level. For definitions of variables see appendix table A-2. The coefficient for the constant term is not reported in the regressions.

Source: Author's estimations.

Cyclical demand pressures were relatively normal: government budget deficits were in the range of 1 percent of GDP, money growth was moderate, and weather patterns showed a relatively poor year in 1965 and a relatively good year in 1966. The movement of the nominal effective exchange rate, which can affect measurement of the real exchange rate in the short run, was also stable during this period. Likewise, the real exchange rate during the 1965–66 period was matched by a sustainable current account balance in light of the underlying capital flows picture of that time. Tanzania was not experiencing any balance of payments difficulties. Finally, the unofficial black market for foreign exchange was characterized by about a 20 percent premium, a reasonable premium in light of capital restrictions, thus indicating relative balance in the remainder of the official market.

Structural factors. The results of the regression analysis on the real exchange rate, including the structural factors and the short-run variable, are given in table 2. The expected negative relation between the macroeconomic-policystance variable and the real exchange rate is confirmed as highly significant.⁹ It is not surprising to find that the prevailing real rate, as measured by the black market rate, is even more sensitive to short-term macroeconomic policy than the rate as measured by the official rate. The structural factors that are amenable to empirical analysis for Tanzania are terms of trade, underlying external capital flows, import intensity of the manufacturing sector, and agricultural exports marketing efficiency.

The terms of trade in Tanzania are projected to be less favorable than they were in the mid-1960s. For illustrative purposes, the terms of trade index (1980 base), which was 139 in 1965–67, is assumed to decline to about 110. As reported in table 2, the negative relation between the terms of trade and the real exchange rate is confirmed, albeit not consistently significant. Historically, a 10 percent change (decrease) in the terms of trade was consistent with a real depreciation in the range of 2 to 5 percent. Thus, the 20 percent deterioration assumed to have occurred from 1965 to 1966 would imply a shift (a depreciation) in the equilibrium real exchange rate from that period of about 4 to 10 percent.

The Tanzanian economy has had a major structural shift in its external capital flows situation. These flows are dominated by aid flows, and hence the treatment of external capital flows as an exogenous variable is entirely appropriate. Although the economy is not expected to have as sizable external capital inflows as in the late 1970s, the net capital transfers are projected to be equal to about 10 percent of GDP initially. This projection still compares favorably to the situation prevailing in the mid-1960s, when external capital flows accounted for only 1 percent of GDP.

Because of the largely concessional nature of the inflows, with the majority of transfers in pure grant form, the capital flows situation is not expected to

9. No sufficient long-data series on government consumption and fiscal deficits were available to test alternative macroeconomic policy variables.

exacerbate the current debt problem. The expected relationship between capital flows and the real exchange rate, as measured by the official rate, is confirmed very significantly by the historical Tanzanian analysis, but the coefficient is quite small, as indicated in table 2. The implied appreciation of the equilibrium exchange rate from the improvement in sustainable capital flows of 3 to 7 percentage points is estimated at 1 to 3 percent. The relation between the prevailing real exchange rate as measured by the black market rate and official capital flows is not significant. The black market rate, however, is likely sensitive to, or in fact a result of, unofficial movement of capital not captured in the official measurement.

In Tanzania an important development is that the import intensity of the manufacturing sector has increased significantly during the period, that is, between the reference period and 1986. Data on this structural factor are available for several years, and interpolation has been used to complete the data series.¹⁰ This positive relation is confirmed by the analysis, being significant in the determination of the real black market rate in particular. The results in table 2 are based on international shadow prices, but those for domestic prices produce similar results. It is assumed that the physical structure of Tanzanian industry cannot be changed rapidly and that some time is needed for the import intensity to adjust once price incentives are restored. Thus, imported inputs representing 60 percent of total inputs is reasonable for the next few years, an increase from the 22 percent in the mid-1960s. With a coefficient of 0.2, the implied depreciation in the real exchange rate from this structural change is close to 1 percent.

To strengthen the external sector of Tanzania, the efficiency of agricultural export marketing has been mentioned as critical. This structural characteristic has changed considerably since the reference period, with the export marketing authorities exhibiting considerable inefficiency. A proxy for export marketing efficiency is developed by constructing a variable based on the average ratio of the overhead costs to final sales revenues of five major export authorities. Data on overhead are available for the cashewnut, tea, cotton, sisal, and tobacco authorities for 1978 to 1985. To extend the series back to the mid-1960s, the relation between the overhead ratio and per capita export production is calculated for 1978-85, and this relation is assumed to hold for the earlier years.

A more inefficient export marketing structure (a higher overhead ratio) is expected to result in a more depreciated exchange rate or negative relation. For the official real exchange rate, the relation is mixed but not significant; for the black market real exchange rate, it is positive and significant. This is not totally surprising, because the deterioration in export marketing efficiency accelerated only in the late 1970s, when the wedge between the official and black market

10. The imported input cost as a percentage of total cost at domestic prices was 52.5 in 1984, 21.9 in 1973, and 15.1 in 1961. At shadow prices reflecting international prices, the percentage was 70 in 1984 and an estimated 35 percent in 1973 (based on an estimate of the exchange rate overvaluation at the time) and 15 percent in 1961.

rates widened and the official rate presumably reflected less of the market equilibrium. Nonetheless, the export marketing inefficiency variable increased from 30 percent in the mid-1960s to more than 40 percent currently. However, with a small coefficient of about 0.04, this increase implies a real depreciation of about 1 percent from the historical base.

Change in the restrictiveness of the trade regime, for imports in particular, was a factor in Tanzania. However, the empirical evidence available to measure the change in policy, namely, the average level of tariffs, is not useful because of the predominance of quantitative restrictions. Given the likely importance of trade policy to the evolution of the real exchange rate, further work to construct a proxy for quantitative restrictions would be highly desirable. In addition, recall that the divergence between the official and black market rate in the more recent period is largely accommodated by restrictions on official imports. The divergence between the rates made identification of a prevailing exchange rate difficult, which necessitated limiting the observations to earlier periods. Inclusion of official trade restrictions would allow an extension of the time series used for estimation into the more recent period, where changes in fundamentals (structural factors) were pronounced. Further work along these lines was carried out by the Bank of Tanzania (1990). However, the proxies for trade restrictiveness did not perform well.

Extrapolating the equilibrium real exchange rate. In practice, further work would be required to improve the statistical significance of the results. It is useful, however, to analyze how estimated results would be used to extrapolate the equilibrium rate. Aggregating the influence of the four measured structural influences in Tanzania, the equilibrium real exchange rate would be depreciated by about 5 to 9 percent from its 1965–66 level. The deterioration in the terms of trade results in a 4 to 10 percent depreciation, the increased external capital flows result in a 1 to 3 percent appreciation, the increased import intensity of the manufacturing sector results in a 1 percent depreciation, and the deterioration in the efficiency of marketing agricultural exports results in a 1 percent depreciation.

In general, the comparison of the estimated equilibrium rate with the prevailing rate would be straightforward. The current CPI measurement, however, is unrepresentative in Tanzania and requires adjustment. The current CPI measurement underestimates the actual price level because the CPI includes the controlled prices of goods that are not available at those prices. Table 3 lists several of those goods with their weights in the CPI and the price adjustment required to create a revised index. The revised consumer price index is used to calculate the December 1986 real exchange rate index in appendix table A-2.

III. THE MAJOR COMPETITORS METHODOLOGY

In many cases, the real exchange rate trend in relation to the trend for trading partners is a comprehensive summary of the competitiveness of a developing

Table 3. *Adjustments to the Tanzanian National Consumer Price Index*

Commodity group	Weight (percentage of total exports)	Adjustment (percentage increase in weight)	Weighted adjustment (percent)
Sugar	6.7	125	8.4
Rice	4.8	100	4.8
Maize flour	4.6	50	2.3
Rents	3.3	150	5.0
Beer	1.1	85	0.9
Others	1.0	100	1.0
Electricity	1.0	100	1.0
Cigarettes	1.0	85	0.9
Nonalcoholic beverages	0.5	100	0.5
Total weighted adjustment			24.8

Note: The adjusted index is 25 percent higher than the official index of September 1986, the major adjustments being in the food category. The CPI includes food purchased both at shops at the official price even if unavailable and at markets at the market price. The shop prices of sugar, rice, and maize have been increased 125, 100, and 50 percent, respectively, to reflect the market prices as measured by a survey carried out by Ndulu and Hyuha (1986). Rents were increased 150 percent to reflect the gap between controlled government housing prices and private market conditions. In addition, the price of khangas, soap, salt, and batteries (under the category "Others") were increased to reflect the results of the Ndulu and Hyuha survey. Tariffs on electricity were increased 100 percent to reflect proposed increases that would improve the financial balance of the electric company. The prices of cigarettes and nonalcoholic beverages were increased 85 and 100 percent, respectively, based on the situation in Dar es Salaam in December 1986. Finally, an annualized inflation rate of 30 percent is assumed for the last quarter of 1986 to estimate a price index as of the end of 1986.

Source: Ndulu and Hyuha (1986) for sugar, rice, maize flour, and others, which includes soap, salt, and batteries; author's calculations for the other commodity groups.

country's export and import substitutes. In many cases, however, the country does not trade with its major competitors but rather competes against them in third markets, often those of industrial countries. Hence, in addition to examining real exchange rate trends in relation to major trading partners, it is necessary to examine the competitive position of the real exchange rate compared with that of major competitors.

Nontraditional exports are an important element in the growth strategy of the Philippines. The major competitor countries for exports from the Philippines, other than its traditional commodity exports of sugar and coconut products, are its East Asian neighbors. It is primarily in the nontraditional areas that export potential is greatest. Given the trends in the costs of labor in the Philippines compared with the sharply rising labor costs in many other East Asian economies, such as the Republic of Korea and Taiwan, the Philippines is particularly well placed to expand its market share for many labor-intensive products. Other countries, such as Indonesia and Thailand, will be competing based on an economic structure more similar to that of the Philippines. Thus, the competitiveness of the Philippines as reflected in its real exchange rate compared with the real exchange rates of other East Asian economies is critical.

To estimate the competitiveness of the real exchange rate in the Philippines compared with its East Asian competitors, three indexes are calculated for

1980–86 based on available data. The first uses CPI comparisons, and the second and third use proxies for the prices of tradables, the wholesale price index (wpi), and the unit value of exports. The weights for seven East Asian economies—Hong Kong, Indonesia, Korea, Malaysia, Singapore, Taiwan, and Thailand—are based on each country's share of the region's total non-oil exports. Wage comparisons would also be useful but are not made because of data limitations.

As shown in table 4, as of 1986 the real exchange rate of the Philippines had not depreciated significantly in relation to the exchange rates of its East Asian competitors. Although the CPI-based index shows a depreciation of 11 percent, the index based on the unit value of exports indicates a 15 percent appreciation (recall that an increase in the index represents a depreciation and a decrease in the index an appreciation). From 1984 to 1986, the currencies of all the major East Asian competitors, except for Hong Kong, steadily depreciated in real terms. For the Philippines, however, the real depreciation was a recent trend and the passive result of a policy of maintaining the nominal peso/dollar rate while the dollar sharply depreciated against the yen.

The real exchange rate in the Philippines has evidenced a significant real depreciation in relation to the real exchange rates of its major trading partners. This depreciation moves the exchange rate in the appropriate direction, given the structural developments since the early 1970s. The Philippines has not improved its competitiveness position in relation to its major competitors, however, suggesting the need for more active exchange rate policy and a set of macroeconomic policies consistent with further real depreciation of the currency.

*Table 4. The Real Effective Exchange Rate in the Philippines Compared with Its East Asian Competitors, 1980–86
(1980 = 100)*

Year	Consumer price index	Wholesale price index ^a	Unit value of exports ^b
1980	100.0	100.0	100.0
1981	99.9	98.8	94.8
1982	99.0	95.6	88.6
1983	112.3	107.0	96.7
1984	112.5	106.1	96.6
1985	101.4	94.7	84.5
1986	111.0	100.4	84.9

a. The wpi is not available for Hong Kong, Malaysia, and Taiwan; therefore, the CPI is used.

b. The unit value of exports is not available for Taiwan; therefore, the CPI is used.

Note: The values in the table are indexes calculated from the ratio of the relevant index in the Philippines to a weighted average aggregate index for its East Asian competitors. An increase in the index represents a depreciation of the exchange rate; a decrease in the index represents an appreciation. The weights for the competitors are based on each economy's share of the group's total non-oil exports. The economies and weights are: Hong Kong 19, Indonesia 6, Republic of Korea 17, Malaysia 13, Singapore 19, Thailand 7, and Taiwan 19.

Source: IMF (various issues—b) and data from the Taiwan Consulate.

For Tanzania, comparisons with major competitor countries are less straightforward to measure and are not made here. First, Tanzania has a diversified group of traditional export commodities, each with a different group of major competitors, which complicates the construction of an appropriate index. Second, the development of its nontraditional or potential exports is important for the export growth of Tanzania. It is not clear, however, that the major competitor countries to be examined for comparative purposes are more appropriately neighboring countries or another set. Further work to design a real exchange rate index based on major competitors would be a useful extension to the analysis outlined here.

IV. CONCLUSIONS

The analysis of the real exchange rate plays an increasingly important role in the design of medium-term strategies consistent with healthy external sectors. This article presents an analytical technique for determining a range for this pivotal relative price by focusing on the magnitude of the impact of structural changes from a historical reference period.

This methodology for determining a range of estimates for the real exchange rate can be a useful complement to other work being done within individual countries. The trading-partner-based measure that incorporates the expected magnitude of the impact of structural changes improves upon the trade-weighted PPP measure that is commonly the starting point for analyzing exchange rate policy. In the case studies, the magnitude of the difference between the medium-term equilibrium exchange rate suggested by the methodology and that based on PPP alone is significant, namely, 12 to 24 percent for the Philippines and 5 to 9 percent for Tanzania. Also, the trading-partner-based measure provides a useful complement to other indicators of equilibrium, such as parallel market rates, which generally are highly sensitive to short-run changes and reflect capital account instability. For example, for Tanzania, the equilibrium rate suggested in the analysis lies between the prevailing official and black market rates. Furthermore, for the Philippines, the competitor-based measure suggests that the trading-partner-based measure, despite taking into account structural changes, underestimates the real depreciation required for competitiveness and external balance.

The two countries that were analyzed here illustrate the versatility of the approach. In both cases, terms of trade and capital flows were important influences that could be measured. Other influences, that is, commercial policy in the Philippines and the import intensity of manufacturing and agricultural marketing efficiency in Tanzania, also are incorporated into the analysis. The analysis of the effects of structural change on the real exchange rate in the Philippines compared with its trading partners is complemented by a comparison of the competitiveness of the real exchange rate in the Philippines in relation to major East Asian competitors.

Any results would need to be used with caution. As in other analyses of the real exchange rate, the selection of a proxy for the prevailing real exchange rate is subject to several methodological concerns, as discussed in section I. Such concerns would be, for example, the observation of multiple exchange rates as well as multiple price indexes and the difficulty of measuring prices of nontradables. Although not arbitrary, the choice of reference period can affect results. For the methodology developed here in particular, the case studies indicate the sensitivity of the results to the specification of the problem. The estimated coefficients vary by an order of magnitude of more than 2 for some variables under various specifications, for example, terms of trade for the Philippines. Important variables are omitted from the analysis because of the unavailability of proxies, for example, trade policy in the Tanzania case study. Some independent variables are not consistently significant, for example, terms of trade for Tanzania. These limitations need to be taken into account in evaluating the implications of the estimation.

Nonetheless, this is a potentially powerful methodology. The results presented in the case studies are not meant to provide hard numbers on which to base decisions. Rather, the analysis provides a framework for thinking about the role of the real exchange rate and the adjustments in the medium-term strategy that may be necessary in response to further structural changes.

Table A-1. *The Real Exchange Rate and Key Developments in the Philippines, 1960-86*

Year	Nominal exchange rate (pesos/dollar) ^a (1)	Real effective exchange rate index (1980 = 100) ^b (2)	Consumer price index (1980 = 100) (3)	Terms of trade index (1980 = 100) ^c (4)	Index of trade liberalization (5)	Current account (excluding interest) as a percentage of GNP (6)	Current account as a percentage of GNP (7)	Capital flows as a percentage of GNP ^d (8)	Monetary and exchange rate indicator ^e (9)
1960	2.01	55.27	14.76	213.28	4.00	—	-0.60	—	—
1961	2.02	52.21	15.40	193.29	8.00	—	-0.88	—	30.70
1962	3.73	92.00	15.91	192.32	13.00	—	0.66	—	-77.95
1963	3.91	91.74	17.20	189.77	13.00	—	3.59	—	10.61
1964	3.91	84.47	18.72	186.58	13.50	—	1.55	—	11.78
1965	3.91	82.63	19.29	186.65	13.50	—	2.04	—	0.33
1966	3.90	81.01	20.23	185.24	13.50	—	2.23	—	6.23
1967	3.90	77.77	21.38	184.37	14.00	—	-0.57	—	16.84
1968	3.90	77.43	21.81	179.50	14.00	-2.69	-3.26	—	4.67
1969	3.90	78.79	22.10	176.96	11.00	-2.26	-2.82	—	8.17
1970	5.90	104.35	25.48	173.21	8.00	0.95	-0.68	1.69	-42.58
1971	6.43	99.66	30.93	161.19	13.00	1.15	-0.03	-0.50	-9.52
1972	6.67	104.59	33.47	145.77	13.00	1.49	0.06	1.40	-3.06
1973	6.79	108.98	39.01	165.13	13.00	5.60	4.43	-0.75	-17.50
1974	6.79	98.10	52.34	166.92	13.00	-0.38	-1.41	1.77	13.27

1975	7.25	104.61	55.88	127.98	12.50	-4.37	-5.85	2.58	12.13
1976	7.44	102.78	61.02	113.29	12.50	-4.69	-6.12	5.03	12.21
1977	7.40	102.18	67.06	103.57	12.50	-2.50	-3.64	3.76	4.60
1978	7.37	109.74	71.98	113.92	12.50	-2.72	-4.55	2.74	3.66
1979	7.38	102.18	84.60	118.92	12.00	-2.94	-5.06	2.29	8.93
1980	7.51	100.00	100.00	100.00	12.00	-2.64	-5.41	2.30	5.23
1981	7.90	96.21	113.08	87.99	13.00	-1.79	-5.36	1.79	11.88
1982	8.54	91.06	124.64	85.58	14.00	-3.08	-8.15	1.30	17.04
1983	11.11	105.67	137.14	89.32	12.00	-2.24	-8.07	2.04	1.05
1984	16.70	105.00	206.18	87.21	9.00	3.30	-4.02	-0.32	-36.29
1985	18.61	96.31	253.81	81.42	—	7.10	0.03	0.06	-15.95
1986	20.39	117.34	257.62	—	—	—	—	—	—

— Not available.

a. Official market rate in period average.

b. Based on trade-weighted exchange rates and using trading partners' wholesale price index and the Philippines' consumer price index. The weights of the major trading partners are 42 for the United States, 37 for Japan, 7 for Germany, 6 for the Netherlands, 4 for the Republic of Korea, and 4 for the United Kingdom.

c. Ratio of export to import unit value indexes.

d. Net transfers as a percentage of GDP.

e. Domestic credit growth minus foreign inflation, real GNP growth, and changes in nominal effective exchange rate.

Source: For columns 1–4, 6, 7, and 9, IMF (various issues—b); for column 2, IMF (various issues—a); for columns 5–8, World Bank data; for column 5, Shepherd and Alburo (1991).

Table A-2. *The Real Exchange Rate and Key Developments in Tanzania, 1960-86*

Year	Nominal exchange rate				Consumer price index (1980 = 100) ^d	Terms of trade index (1980 = 100)				Import intensity of manufactured goods ^f (9)	Agricultural export marketing efficiency ^g (10)	Monetary and exchange rate indicator ^h (11)
	Real effective exchange rate ^c					Ratio of export to import unit value index	Ratio of export to import price index	Capital account as a percentage of GDP ^e				
	Official rate ^a (1)	Parallel rate ^b (2)	Official rate (3)	Parallel rate (4)		(6)	(7)	(8)				
1960	7.14	—	153.09	—	—	127.41	157.04	—	—	31.37	—	—
1961	7.14	—	155.31	—	—	129.30	159.38	-4.13	15.1	31.85	—	—
1962	7.14	—	157.45	—	—	141.62	174.56	0.79	15.1	32.85	—	—
1963	7.14	—	165.33	—	—	144.99	178.72	-2.62	15.1	30.21	—	—
1964	7.14	—	167.09	—	—	123.80	152.60	-3.74	15.1	30.69	—	—
1965	7.15	—	160.40	—	15.78	118.84	146.48	0.22	15.1	30.16	—	—
1966	7.14	8.64	148.97	70.26	17.33	112.25	136.36	0.61	15.1	30.17	—	—
1967	7.14	8.82	132.23	63.67	19.44	106.91	131.78	-0.47	15.1	30.66	8.46	—
1968	7.14	8.25	111.85	50.36	22.47	112.07	136.07	2.02	15.1	29.21	12.29	—
1969	7.14	9.00	98.94	48.61	26.15	112.60	136.79	0.50	15.1	31.41	25.78	—
1970	7.14	9.82	102.19	54.78	27.07	110.36	136.06	4.97	15.1	30.62	23.71	—
1971	7.14	11.58	104.57	66.11	28.34	90.22	131.60	7.26	15.1	31.01	13.84	—
1972	7.14	15.26	107.45	89.51	30.51	93.55	121.24	6.41	15.1	30.68	-11.34	—
1973	7.02	14.53	112.76	91.02	33.70	84.32	122.18	7.35	22.9	30.66	0.18	—
1974	7.13	13.46	114.10	83.94	40.17	77.71	123.72	5.04	22.9	31.03	56.65	—

1975	7.37	20.58	102.66	112.19	50.81	97.39	105.75	7.04	22.9	34.36	9.60
1976	8.38	21.93	109.17	111.45	54.32	117.17	129.65	2.77	22.9	35.82	-13.07
1977	8.29	21.47	106.12	109.21	60.60	156.97	155.71	3.46	22.9	34.76	-7.19
1978	7.71	13.07	104.96	69.42	67.49	120.88	126.23	4.71	22.9	36.40	36.99
1979	8.20	11.98	112.90	64.22	76.77	116.43	106.63	3.39	22.9	36.30	16.03
1980	8.20	21.02	100.00	100.00	100.00	100.00	100.00	1.32	22.9	41.80	8.27
1981	8.28	27.57	75.68	98.22	125.63	82.12	92.90	3.84	22.9	34.10	26.53
1982	9.28	32.60	62.28	85.53	162.01	73.42	80.57	—	22.9	42.80	13.52
1983	11.14	39.62	55.82	78.53	205.84	79.42	—	—	22.9	53.90	2.67
1984	15.29	77.50	52.99	107.62	280.24	82.44	—	—	52.5	42.50	-8.74
1985	17.47	129.00	46.57	124.92	373.49	76.08	—	—	52.5	46.40	-10.12
1986	32.70	140.00	62.25	127.57	517.70	—	—	—	—	—	—
1986 (Dec)	51.72	160.00	99.18	119.42	670.00	—	—	—	—	—	—

— Not available.

a. Official market rate (Tanzanian shillings/dollar) in period average.

b. Black market rate (Tanzanian shillings/dollar) in period average.

c. Both are based on trading partner's weighted WPI and Tanzania's CPI. The weights of the major partners are 9.4 percent for the United States, 12.1 for Japan, 5.1 for Belgium, 19.0 for Germany, 8.4 for Italy, 10.7 for the Netherlands, 4.1 for Sweden, 27.0 for the United Kingdom, and 4.3 for India.

d. The value for December 1986 is based on adjustments to the September 1986 official CPI described in the text and an additional assumption of annualized fourth-quarter inflation of 30 percent.

e. For 1961-66, negative of current account proxies for capital account.

f. Imported input cost of manufacturing as a percentage of total input cost at international shadow prices.

g. Average overhead as a percentage of sales for five major crop export authorities.

h. Domestic credit growth minus real GDP growth, foreign inflation, and change in nominal effective exchange rate.

Source: For columns 1, 3-6, 8, and 11, IMF (various issues—b); for column 2, International Currency Analysis (1963-83); for columns 2, 7, and 9, World Bank data; for columns 3 and 4, IMF (various issues—a); for column 10, Tanzania, Ministry of Agriculture, Market Development Bureau data.

REFERENCES

- The word "processed" describes informally reproduced works that may not be commonly available through library systems.
- Bank of Tanzania. 1990. "Tanzania: Exchange Rate Study." Dar es Salaam.
- Cavallo, Domingo, and Joaquin Cottani. 1985. "Economic Performance and the Real Exchange Rate in Less-Developed Countries." Background paper for *World Development Report 1986*. World Bank, Washington, D.C. Processed.
- Connolly, Michael, and Dean Taylor. 1984. "The Exact Timing of the Collapse of an Exchange Rate Regime and Its Impact on Relative Price of Traded Goods." *Journal of Money, Credit, and Banking* 16 (May): 194-207.
- Dornbusch, Rüdiger. 1974. "Tariffs and Nontraded Goods." *Journal of International Economics* 4 (May): 117-85.
- . 1980. *Open Economy Macroeconomics*. New York: Basic Books.
- Edwards, Sebastian. 1988. *Exchange Rate Misalignment in Developing Countries*. Baltimore: Johns Hopkins University Press.
- . 1989. *Real Exchange Rates, Devaluation, and Adjustment*. Cambridge: MIT Press.
- Elbadawi, Ibrahim. 1989. "Terms of Trade, Commercial Policy, and the Black Market for Foreign Exchange: An Empirical Model of Real Exchange Rate Determination." Discussion Paper 570. Yale University, Economic Growth Center, New Haven, Conn. Processed.
- Elbadawi, Ibrahim, and Steven Kamin. 1990. "Macroeconomic Aspects of Multiple Foreign Exchange Markets in Developing Countries: Some Methodological Issues." World Bank, Country Economics Department, Washington, D.C. Processed.
- Harberger, Arnold. 1984. "Welfare Consequences of Capital Inflows." CPD Discussion Paper 1984-12. World Bank, Country Policy Department, Washington, D.C. Processed.
- . 1986. "Economic Adjustment and the Real Exchange Rate." In Sebastian Edwards and Liaquat Ahamed, eds., *Economic Adjustment and Exchange Rates in Developing Countries*. University of Chicago Press.
- International Currency Analysis, Inc. Annual. *World Currency Yearbook*. New York.
- IMF (International Monetary Fund). Various issues—a. *Direction of Trade Statistics*. Washington, D.C.
- . Various issues—b. *International Financial Statistics*. Washington, D.C.
- Johnson, Harry G. 1966. "A Model of Protection and the Exchange Rate." *Review of Economic Studies* 33(2)(94, April): 159-63.
- Jones, Ronald. 1965. "The Structure of Simple Macroeconomic Models." *Journal of Political Economy* 73(6, December): 557-72.
- Khan, Mohsin, and Saul Lizondo. 1987. "Devaluation, Fiscal Deficits, and the Real Exchange Rate." *The World Bank Economic Review* 1(2, May): 357-74.
- Maciejewski, E. B. 1983. "Real Effective Exchange Rate Indices: A Re-examination of the Major Conceptual and Methodological Issues." *IMF Staff Papers* 30 (September): 491-541.
- McKinnon, Ronald. 1976. "International Transfers and Nontraded Commodity: The Adjustment Problem." In Danny Leisiger, ed., *International Monetary System and Developing Nations*. Washington, D.C.: AID.

- Ndulu, Benno J., and Mukwanason Hyuha. 1986. "Inflation and Economic Recovery in Tanzania: Some Empirical Evidence." University of Dar es Salaam, Department of Economics. Processed.
- O'Connell, Stephen, and Daniel Kaufmann. 1991. "The Macroeconomics of the Unofficial Foreign Exchange Market in Tanzania." In Ajay Chhibber and Stanley Fischer, eds., *Economic Reform in Sub-Saharan Africa*. Washington, D.C.: World Bank.
- Pinto, Brian, and Sweder van Wijnbergen. 1986. "Exchange Rate Regimes in Africa." World Bank, Country Policy Department, Washington, D.C., and Centre for Economic Policy Research, London. Processed.
- Rodriguez, Carlos. 1978. "A Stylized Model of the Devaluation-Inflation Spiral." *IMF Staff Papers* 25 (May): 76-89.
- Salter, W. E. 1959. "Internal and External Balance: The Role of Price and Expenditure Effects." *Economic Record* 35 (August): 226-38.
- Shepherd, Geoffrey, and Florian Alburo. 1991. "The Philippines." In Demetris Papa-georgiou, Michael Michaely, and Armeane Choksi, eds., *Liberalizing Foreign Trade*, Vol. 2, *The Experience of Korea, Philippines, and Singapore*. New York: B. Blackwell.
- Swan, T. W. 1960. "Economic Control in a Dependent Economy." *Economic Record* 36 (March): 51-66.
- Williamson, John. 1985. *The Exchange Rate System*. Washington, D.C.: Institute for International Economics.

An Institutional Analysis of the Design and Sequence of Trade and Investment Policy Reform

Brian Levy

Countries vary in their political commitment to change and in the capability of their bureaucracies. Policies vary in their organizational and political demands. These institutional variations can be incorporated into the design of trade and investment policy reform. In virtually all countries the presumption should be for reforms to dismantle—not reconfigure—restrictive entry rules and dysfunctional discretionary investment incentives. But there is no single approach, common across countries, through which trade policy reform should proceed. Countries with weak administrative capabilities should push import liberalization to the limits. But politically constrained countries with a stronger administrative capability might consider roundabout reforms that secure outward orientation without full-scale, prior import liberalization.

During the past decade, it has become apparent that efforts to reform trade and investment policy in developing countries have had uneven results. A number of studies have sought to account for this uneven record by going beyond the narrow concerns of the optimal design of economic policies. One approach, reviewed by Paul (1990), has been to highlight problems in "implementation" as the source of weaknesses and to imply that these can be overcome by improving institutional capability. A second approach, exemplified by the burgeoning literature on neoclassical political economy (Colander 1984; Rodrik 1992) has been to probe into the underlying political determinants of a country's ability and willingness to adopt and implement trade and investment policy reforms.

Taken alone, each of these approaches is too narrow. Countries vary both in their political commitment to change and in the organizational capability of public bureaucracies. Moreover, policies vary significantly in their organizational as well as political demands. It follows that the mix and sequence of reforms should be quite different in countries where the political commitment to policy reform is strong but organizational capabilities are relatively weak than in countries that have strong organizational capabilities but only limited political commitment to reform. This article illustrates in some detail how these cross-country variations in institutional capabilities can be most effectively incorporated into the design and sequencing of programs of trade and investment policy reform.

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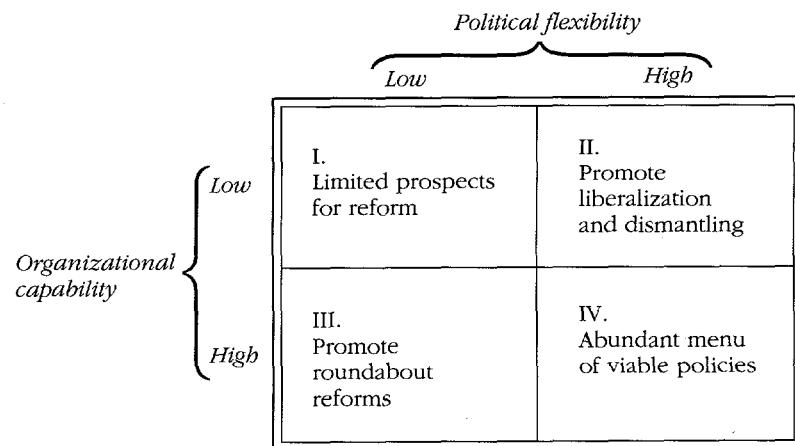
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To begin with definitions, reform faces *political obstacles* insofar as it imposes costs on groups within society—perhaps private actors, perhaps the government bureaucracy itself—that are important to government or insofar as it more broadly threatens the stability of the regime. Reform faces *organizational obstacles* insofar as it imposes tasks on government bureaucracy which that bureaucracy lacks the capability to meet. Figure 1 illustrates how the design of reform programs should be affected by variations in country capabilities in these two dimensions. Two familiar cases are summarized in quadrants I and IV: countries in quadrant IV can choose from a broad menu of viable policies; countries in quadrant I have little prospect of successful reform, regardless of program design.

Quadrants II and III are the more interesting cases. Countries in quadrant III are unlikely to dismantle existing policies in ways that undercut powerful but inefficient interests, even in response to compelling economic analysis. Consequently, reform proposals that directly challenge these interests will be doomed to failure. For these countries, the appropriate starting point is to use their organizational strengths to promote “roundabout” reforms analogous to those initially analyzed by Hirschman (1963). Such roundabout reforms would be policies and programs that provide opportunities for efficient economic actors and so strengthen the constituency for further reform, without challenging head-on the interests that benefit most from inefficient policies. The empirical analysis below details what some of these policies might be and describes countries that have successfully followed this route.

Countries in quadrant II face the opposite dilemma from those in quadrant III: they have the political flexibility to overrule inefficient interests that could lose from economic reform, but they lack the organizational capability to put in

Figure 1. The Impact of Political and Organizational Capabilities on the Design of Reform Programs



place organizationally demanding policies. Reform in these countries should begin by distinguishing firmly between essential and nonessential (even if desirable in principle) policies, institutions, and regulations. The essentials should be continued and should be supported with technical assistance for institutions that are necessary but weak. Beyond that, however, the reform package should emphasize the dismantling—not reorienting—of all that is not essential. Radical dismantling is called for not because it necessarily represents the optimum reform, but because it is the only plausible way to effect real change in the face of limited institutional capacity and pervasive organizational rigidities. Even after the dismantling effort has proceeded as far as possible, the combination of organizational rigidities and a weak private sector could inhibit a supply response. But the analysis here suggests that countries with substantial political autonomy and limited organizational capability have no middle course. There is no realistic alternative to choosing between the certainty of continued stagnation without reform, or nonincremental shrinkage in the size and role of government. And a shrinkage in government may go unrewarded by a positive supply response in the short and medium terms. The empirical analysis below describes some reforms that are organization-light. It also provides examples of how reform efforts in administratively weak countries have been weakened by the inclusion of reforms that are unnecessarily organization-intensive.

I. AN APPLICATION TO TRADE AND INVESTMENT POLICY REFORM

The remainder of the article endeavors to illustrate the empirical relevance of the framework in figure 1. The illustration focuses on some key elements of trade and investment policy reforms for promoting import competition, domestic competition, and production for exports. Ideally, the analysis would begin by constructing indexes of the political and organizational requisites of a variety of policies and of the political flexibility and organizational capabilities of a variety of countries. Thereafter, the analysis would evaluate whether the design of reform packages for individual countries matched the capabilities of those countries. It would then evaluate whether—as predicted—countries with reform packages that matched capabilities performed better (other things being equal) than countries with a mismatch between capabilities and policies. The goals of this study, however, are more modest.

The analysis begins by classifying a variety of specific reforms according to the extent to which they are organizationally (and politically) demanding to implement. Table 1 sorts eight reforms into three levels of organizational intensity. The low level comprises “stroke-of-the-pen” reforms, such as import liberalization or deregulation, which do not depend on ongoing administrative capabilities for their implementation. Such reforms, however, can require substantial preliminary analysis. They may encounter strong political opposition insofar as they expose incumbents to increased competition and reduce rent-seeking opportunities for bureaucrats. The middle level comprises reforms that are inter-

mediate in their administrative difficulty. Intermediate reforms promote exports by creating new institutions to manage wholly new functions (Israel 1987). Although these reforms can be made to work in a relatively straightforward manner in enclaves of export production, they typically fail to upgrade a society's institutional capability more broadly. The high level comprises the reforms that are organizationally most difficult and aim to streamline (or to impose new tasks on) existing institutions. The success of these reforms depends on the smooth operation of existing institutions and their responsiveness to pressures for change. As table 1 summarizes, reforms in this category include efforts at regulatory overhaul (as opposed to deregulation) and efforts to piggyback duty drawbacks and exemptions onto existing customs procedures. Among the reforms included in the second and third levels, only those that are intended to ease entry plausibly pose any direct political threat to powerful incumbents.

The next step examines the actual reform experience of 12 countries: Bangladesh, Ghana, Guinea, Jamaica, Kenya, Mauritius, Mexico, Morocco, Pakistan, the Philippines, Thailand, and Tunisia. The actual reform experience is used to determine whether the results are consistent with the initial presumptions about organizational and political difficulty. The crucial methodological innovation here is to distinguish between the scope, adoption, and implementation of reforms.

- *Program scope* is defined by the extent of the proposed reforms in relation to the gap at the outset of reform between policies in place and the putative policy regime of a fully liberalized economy.

Table 1. The Level of Organizational Intensity Required for Eight Reform Programs and Policies

Policy reform area	Organizational intensity		
	Low (stroke-of-the-pen reforms)	Middle (creation of organizational enclaves)	High (reform of existing organizations)
Promote import competition	Eliminate quantitative restrictions Reform tariff structure		
Promote domestic competition	Eliminate clearance requirements for new entrants Eliminate preferential incentives for selected investments		Create "one-stop" shops to streamline bureaucratic requirements of entry Streamline incentive packages for investment
Promote export production		Establish export processing zones, bonded warehouses, and factories	Provide duty drawbacks or exemptions for direct and indirect exporters

- *Program adoption* refers to the step whereby a government proceeds from agreements made with the World Bank to official public announcements of those commitments.
- *Program implementation* refers to the extent to which announced reforms are indeed carried out.

The scope of a country's reform program is ranked ordinally as limited, moderate, extensive, or very extensive. The categories used to rank both adoption and implementation are limited progress, significant progress, and achieved. Adoption is ranked in relation to proposed scope; implementation is ranked in relation to what was actually adopted. The ordinal judgments about variations among countries in the scope, adoption, and implementation of reforms necessarily include some subjective element. However, Bank staff familiar with the countries confirmed the rankings as reasonable, and the rankings were broadly consistent with the categorizations used for the Bank's (1989) policy paper on policy reform.

It is plausible to hypothesize that, although political obstacles can influence both the design of reform programs and their subsequent implementation, organizational obstacles emerge disproportionately in implementation. Given this hypothesis, a crude test of the relevance of the distinction between political and organizational obstacles is whether, in practice, the reforms identified as organizationally intensive in table 1 run disproportionately into implementation difficulties (as defined above), with shortfalls in other reforms being disproportionately manifested in problems of scope or adoption.

If indeed the distinction between political and organizational obstacles proves to be empirically relevant, the final step is to evaluate the extent to which packages of reform have been designed to be consistent with country capabilities. Does the evidence point to variations across countries in reform packages that are plausibly consistent with underlying capabilities? Does the evidence point to examples of potentially serious mismatches between reforms and capabilities (and hence to opportunities for improving the design of reform packages)? Without explicit, independently derived indexes of country capability, this step necessarily depends on casual judgments about variations in institutional capabilities across countries, and hence is speculative. Even so, the results appear to warrant some confidence for use in policy design of the institutional approach outlined here.

Promoting Domestic Competition

Within the larger set of policies that promote domestic competition, two areas are reviewed from an institutional perspective. The first area comprises the reform of direct bureaucratic impediments to entry by new firms (registration and licensing prerequisites, entry approvals, and the like). The myriad of indirect impediments such as labor laws, building codes, and financing impediments thus fall outside the scope of this analysis. Additional policies relevant for promoting domestic competition that might usefully be reviewed from an institu-

tional perspective but that were beyond the scope of this article include the regulation of monopolistic practices, price controls and the regulation of trading, and the organization of financial intermediation. Table 2 reviews country experience in reforming entry regulation for domestic (but not foreign-owned) firms.

As of 1989 6 of the 12 sample countries had made no efforts to reform entry regulation. In two of these countries—Jamaica and Mexico—bureaucratic obstacles to entry were quite substantial (although Mexico has subsequently undertaken sweeping regulatory reforms). In the remaining four—Mauritius, Morocco, the Philippines, and Thailand—free entry had long been permitted. Three countries that addressed entry obstacles pursued the organization-light reforms highlighted in table 1 of abolishing clearance requirements for all (or some categories of) putative new entrants. Tunisia went furthest by entirely abolishing clearance requirements for all new entrants, and Bangladesh and Pakistan established a negative list that freed entry for all but explicitly restricted categories. Two countries—Ghana and Kenya—pursued the organization-intensive strategy of creating “one-stop” registries. Guinea’s approach was intermediate, eliminating all but a supposedly routine requirement of formal incorporation.

The second area of policy designed to promote domestic competition comprises the reform of investment incentives. Table 3 reviews country experience in reforming investment incentives for domestic (but not foreign-owned) firms. At the outset of reform, incentive schedules in all 12 sample countries discriminated among categories of investments in ways that had little economic rationale. As table 3 details, 9 of the 12 sample countries made some effort to reform their investment regimes. As with entry, there exist both organization-light and

Table 2. Country Experiences with Reform of Entry Regulation

Reform group and country	Reform characteristic		
	Scope	Adoption	Implementation
<i>Group 1. Moderate reforms</i>			
Ghana	Moderate	Achieved	Limited progress
Jamaica	Unaddressed	n.a.	n.a.
Kenya	Moderate	Too soon to tell	Too soon to tell
Mexico	Unaddressed	n.a.	n.a.
<i>Group 2. Extensive reforms, adopted and implemented</i>			
Bangladesh	Extensive	Achieved	Achieved
Mauritius	Unaddressed ^a	Achieved	Achieved
Morocco	Unaddressed ^a	Achieved	Achieved
Pakistan	Extensive	Achieved	Achieved
Philippines	Unaddressed ^a	Achieved	Achieved
Thailand	Unaddressed ^a	Achieved	Achieved
Tunisia	Very extensive	Achieved	Achieved
<i>Group 3. Extensive reforms, with implementation problems</i>			
Guinea	Extensive	Achieved	Limited progress

n.a. Not applicable.

a. Unaddressed reforms were achieved in the sense that entry was free even without reform.

Table 3. *Country Experiences with Reform of Investment Incentives*

Reform group and country	Reform characteristic		
	Scope	Adoption	Implementation
<i>Group 1. No more than moderate reforms</i>			
Bangladesh	Limited	Too soon to tell	Too soon to tell
Jamaica	Unaddressed	n.a.	n.a.
Kenya	Unaddressed	n.a.	n.a.
Morocco	Moderate	Too soon to tell	Too soon to tell
Pakistan	Unaddressed	n.a.	n.a.
Thailand	Moderate	Limited progress	Significant progress
<i>Group 2. Extensive reforms, with implementation problems</i>			
Ghana	Moderate	Achieved	Limited progress
Guinea	Extensive	Achieved	Limited progress
Philippines (under Aquino)	Extensive	Achieved	Too soon to tell
Philippines (under Marcos)	Extensive	Achieved	Limited progress
Tunisia	Extensive	Achieved	Significant progress
<i>Group 3. Very extensive reforms, adopted and implemented</i>			
Mauritius	Very extensive	Achieved	Achieved
Mexico	Very extensive	Achieved	Achieved

n.a. Not applicable.

organization-intensive approaches to investment reform. Two countries—Mauritius and Mexico—pursued the organization-light reform of eliminating all preferential subsidies. Seven countries—Bangladesh, Ghana, Guinea, Morocco, the Philippines (both pre- and post-1986), Thailand, and Tunisia—pursued organization-intensive reforms that sought, in a transparent and efficient way, to target subsidies to a limited number of activities in an effort to compensate for unambiguous market failures.

The results summarized in tables 2 and 3 confirm the earlier conjecture that organization-intensive reforms are more likely than their organization-light counterparts to be subject to problems in implementation. There were no difficulties in implementation in any of the 5 examples of organization-light reforms. By contrast, 5 of 11 cases of organization-intensive reforms made only limited progress in implementation, 2 made significant progress, and for 4 it was too soon to tell; none of the 11 entirely achieved their objectives. There were several problems with implementing organization-intensive reforms.

- In Ghana, new investments remained subject to requirements of prior approval; despite some efforts at streamlining, the approval procedures of Ghana's National Investment Commission remained time-consuming and cumbersome (Paul 1989b).
- In both Ghana and Guinea, procedures for gaining access to investment incentives continued to be lengthy, decisions on occasion remained arbitrary, and ministerial jurisdictions continued to overlap. In Guinea, notwithstanding the formal authority of the National Investment Commission to negotiate incentives, individual ministries continued to negotiate with

firms on a case-by-case basis, putting together incentives packages that included, for example, various duty and tax exemptions.

- Although Guinea committed itself in 1987 to making entry procedures simpler, as of early 1989 incorporation procedures continued to be onerous and time-consuming, individual ministries continued to require prior approval for all investments falling in their domain, and the Ministry of Commerce and Industry continued to require all firms to be licensed to trade (World Bank data).
- The Philippines under Marcos was notorious for favoring political clients in the allocation of investment incentives even after investment incentives were extensively reformed in 1983. Incentives were reformed again under President Aquino in 1987, but as of mid-1989 it was too soon to tell how effective the new round of reforms would be (Haggard 1989; World Bank data).
- Reform of investment incentives has been on the agenda in Thailand since the early 1980s, but has been painstakingly slow. Explicit, increasingly detailed criteria for providing incentives were promulgated by Thailand's Board of Investment in 1983 and 1987, and efforts have been made since 1985 to streamline the procedures for processing applications. But the criteria of eligibility remain too broad to provide much guidance to potential investors (World Bank data).

The implication of these patterns for countries with cumbersome entry regulations and economically irrational investment schedules is clear. Following the examples of Tunisia for reform of entry regulation and Mexico and Mauritius for reform of investment incentives, the presumption in countries with the political flexibility to pursue reforms should be in favor of dismantling counterproductive rules and institutions. This presumption should apply with special force in countries where organizational capabilities are weak.

Promoting Import Competition

Within the larger set of policies that promote import competition, this subsection focuses on efforts to eliminate quantitative restrictions (QRs) and to move from tariff regimes characterized by average-to-high nominal tariffs and high standard deviations toward a lower, more uniform tariff structure. Additional policies relevant to import liberalization that might usefully be reviewed from an institutional perspective but that were beyond the scope of this article include efforts to unify exchange rates and to allocate foreign exchange according to market rather than administrative criteria. Tables 4 and 5 summarize the experience of the 12 sample countries (including 2 entries each for Kenya and the Philippines in table 4) with reform of QRs and tariffs. Before reform, all 12 countries had restrictive trade policies in at least one of the two areas. Evaluating the two tables together reveals that only three countries—Ghana, Mexico, and Morocco—unambiguously achieved significant reductions in import protection through extensive reforms of both QR and tariff policies. And even in these

Table 4. *Country Experiences with Removal of Quantitative Restrictions*

Reform group and country	Reform characteristic		
	Scope	Adoption	Implementation
<i>Group 1. Moderate reforms, adopted and implemented</i>			
Bangladesh	Moderate	Achieved	Achieved
Philippines (under Aquino)	Moderate	Achieved	Achieved
<i>Group 2. Problems with adoption</i>			
Kenya (before 1988)	Extensive	Limited progress	Achieved
Pakistan	Moderate	Significant progress	Achieved
Philippines (under Marcos)	Extensive	Limited progress	Achieved
Tunisia	Extensive	Limited progress	Achieved
<i>Group 3. Extensive reforms, adopted and implemented</i>			
Ghana	Very extensive	Achieved	Achieved
Jamaica	Very extensive	Achieved	Achieved
Mauritius	Very extensive	Achieved	Achieved
Mexico	Very extensive	Achieved	Achieved
Morocco	Extensive	Achieved	Achieved
Thailand	Very extensive	Achieved	Achieved
<i>Group 4. Implementation problems</i>			
Guinea	Very extensive	Achieved	Significant progress
Kenya (since 1988)	Moderate	Significant	Significant progress

Table 5. *Country Experiences with Tariff Reform*

Reform group and country	Reform characteristic		
	Scope	Adoption	Implementation
<i>Group 1. Moderate reforms, adopted and implemented</i>			
Kenya	Moderate	Achieved	Achieved
Mauritius	Moderate	Achieved	Achieved
<i>Group 2. Problems with adoption</i>			
Bangladesh	Moderate	Significant progress	Achieved
Morocco	Extensive	Significant progress	Achieved
Pakistan	Moderate	Significant progress	Achieved
Thailand	Extensive	Limited progress	Achieved
<i>Group 3. Extensive reforms, adopted and implemented</i>			
Ghana	Extensive	Achieved	Achieved
Jamaica	Extensive	Too soon to tell	Too soon to tell
Mexico	Very extensive	Achieved	Achieved
Philippines	Extensive	Achieved	Achieved
Tunisia	Very extensive	Achieved	Achieved
<i>Group 4. Extensive reforms, with implementation problems</i>			
Guinea	Very extensive	Achieved	Limited progress

three countries some items continued to enjoy quite high effective tariff protection. The upper bounds of effective tariff protection were 90 percent for Ghana, 50 percent for Mexico, and 180 percent for Morocco. A modest fraction of domestic production continued to be protected by QRs in Mexico and Morocco.

Setting aside the conundrum that we can be certain of real import policy reform only if both QR and tariff reforms have been undertaken, the tables

reveal that in half the cases (13 of 26 observations), countries pursued programs that were at least extensive in scope and achieved significant progress in their adoption and implementation. As outlined earlier, evaluation of whether reform shortfalls among the remaining half occurred in scope, adoption, or implementation can indicate whether obstacles to reform were political or organizational. For 11 of the 13 cases where major reforms were not achieved, the shortfalls were in scope and adoption—a result supporting the view that the obstacles to import policy reform are political, not organizational, in character (for more details see Levy 1990).

In only two countries—Guinea (in both QR and tariff reform) and Kenya (since 1988 in QR reform)—did difficulties in implementation hinder reform of import policies. As noted earlier, implementation difficulties can, in principle, have their roots in either political or organizational weaknesses. Guinea in particular has been subject to chronic organizational weaknesses and the associated inability of the central government to achieve reasonably consistent behavior from its implementing agencies. Notwithstanding a 1987 decision in Guinea to abolish what had been a near-universal system of import licensing, as of early 1989 the Guinean Central Bank continued to exercise some administrative discretion in allocating foreign exchange for imports. In addition, in isolated instances privatization of state-owned enterprises was accompanied by restrictions on imports in the affected industry. As for Guinea's tariff reforms, a uniform tariff code adopted in 1986 was undermined by tariff exemptions negotiated with firms on an ad hoc basis by individual ministries. Guinean customs operated almost as an independent fiefdom: payoffs were apparently crucial in decisions about whether to reject tariff exemptions agreed upon by individual ministries, and in the degree to which onerous documentary requirements blocked clearance of imported goods.

The evidence summarized in tables 4 and 5 offers some hints about the relation between political constraint and the design of import policy reforms. Four countries—Ghana, Guinea, Mexico, and Morocco—made at least significant progress in adopting reform programs that were at least extensive in scope, a signal that they enjoyed substantial political flexibility (although, as noted, Guinea's failure to implement many of its reforms could be a signal of political as well as organizational constraint). Five countries—Bangladesh, Kenya (since 1988), Mauritius, Pakistan, and the Philippines (since 1986)—made at least significant progress in adopting reform programs that were, however, no more than moderate in at least one of the two areas. Although these patterns might be viewed as signaling insufficient ambition to reform, an institutional approach suggests that they might signal the presence of political constraints that were recognized in the design of the reform programs. Finally, in four countries—Kenya (before 1988), the Philippines (before 1986), Thailand, and Tunisia—extensive programs of reform ran into severe difficulties with adoption, suggesting some mismatch between program design and political realities.

Promoting Export Production

Within the larger set of policies that promote export production, this subsection reviews from an institutional perspective efforts to put in place administrative instruments intended to secure "trade neutrality" for exporters. Trade neutrality is access to imported (or local) inputs free of import duties or other indirect taxes. Rhee (1985) is a pioneering effort to detail how these instruments function. Additional policies to promote exports that might usefully be reviewed from an institutional perspective but that were beyond the scope of this article include direct export subsidies and their administration, mechanisms to secure access to working capital for exporters, and various arrangements to provide technical and marketing support for potential exporting firms.

Not one of the 12 countries in the sample has moved to an entirely liberal import regime with no QRs and low, uniform tariffs. Furthermore, the persistence of import protection among even the boldest reformers points to governmental inability or unwillingness to confront some political obstacles to full liberalization; endless exhortation about the virtues of full liberalization is likely to have limited effect. Yet when locally produced inputs are expensive and of low quality, while imported inputs are either unavailable or subject to high tariffs, the ability of putative exporters to compete in international markets is inhibited. Given these constraints, the short-run task for policy reform is to find ways to encourage exports while finessing political obstacles; the long-run task is to help strengthen a constituency that would gain from further liberal reform. Putting in place instruments to secure trade neutrality is one way to move forward with these tasks. As highlighted in table 1, however, the dilemma is that some of these instruments can be exceedingly organization-intensive.

This dilemma is especially acute because the instruments vary in their ability to meet the objectives of trade neutrality. First, there is the objective of providing the broadest possible access to the export instruments: access for firms that produce for both the domestic and export markets as well as access for specialized exporters, access for indirect exporters (suppliers of inputs of items that are exported) as well as direct exporters, and access for smaller and medium-sized firms as well as for large firms. Second, there is the challenge of providing rapid service to firms: ensuring rapid access to requisite imported inputs and (where relevant) ensuring rapid reimbursement of duties or taxes. Third, there is the challenge of ensuring that the instruments are used solely for the purposes intended. Export processing zones and bonded factories can secure rapid, well-targeted duty- and tax-free access to imported inputs for export firms, but, almost by definition, they promote enclaves, excluding firms that participate in both domestic and foreign markets. In principle, duty drawbacks and exemptions can be utilized by a broad range of firms. But their implementation requires a formidable administrative apparatus, not only to enable applications for drawbacks to be processed rapidly, but also to calculate the many thousand input-output coefficients needed to accurately compute the appropriate magnitudes of duty and tax rebates.

Table 6 summarizes the use of the five instruments of trade neutrality in the sample countries and (albeit based on limited available information) the track record of each instrument. One striking result is that the administratively intensive drawback scheme emerges as the most widely used instrument, with such programs in 10 countries. Exemption programs (also rated as administration-intensive in table 1) were initiated in 7 countries. Bonded factories and export processing zones, both of which are less complicated to administer, have been used somewhat more sparingly—in 7 and 6 countries, respectively.

Whether drawback arrangements have a more far-reaching effect than enclave arrangements depends on the record of implementation. The record summarized in table 6 is not encouraging: only one of nine countries for which information was available had put in place a reasonably well-functioning drawback scheme. The record was somewhat better for exemption arrangements, which functioned well in two countries, moderately well in two more, and poorly in only three. There are several examples of implementation experience with these organization-intensive reforms.

- As of 1988 only 40 companies regularly took advantage of Kenya's duty drawback scheme, even though it had been in place for more than 10 years (World Bank data).
- Imports valuing \$2.8 billion were processed in 1987 through Mexico's temporary import duty exemption scheme, but the duty drawback scheme was used for only \$200 million of imports; the coverage of both schemes was

Table 6. Administrative Experience with Implementation of Instruments of Export Administration

Country	Export processing zones	Bonded factories	Bonded warehouses	Duty or tax drawbacks	Duty or tax exemptions
Bangladesh	Start-up difficulties	None	Good	Weak	Weak
Ghana	None	None	None	None	None
Guinea	None	None	None	None	None
Jamaica	Good after initial difficulties	None	None	Weak	None
Kenya	Too soon to tell	Weak	None	Weak	None
Mauritius	None	Good	None	Weak	Moderate
Mexico	Good	Moderate	Yes ^a	Weak	Moderate
Morocco	None	Yes ^a	None	Yes ^a	Good
Pakistan	None	Too soon to tell	None	Weak before 1986	None
Philippines	Good	None	Good	Weak	Weak
Thailand	Yes ^a	Good	None	Improved over time; good by 1988	Unknown
Tunisia	None	Good	Yes ^a	Weak	Weak

a. System was in place, but there is no information available as to its implementation record.

narrow, with only 463 firms taking advantage of the temporary admissions scheme and 186 firms the duty drawback scheme (World Bank data).

- In the Philippines, drawback and exemption schemes became mired in excessive and discretionary bureaucratic procedures, affording firms only \$12 million in customs and tax rebates in 1985, five years after the schemes were implemented (World Bank data).
- Thailand's implementation of drawback and exemption schemes appears to have improved continually over time, with the ratio between duties returned to firms (through drawback or exemption) and actual duty collection rising from 25 percent in 1983 to 60 percent in 1987 (World Bank data).

The implementation experience was better for enclave arrangements: export processing zones operated well in three of four countries for which information was available, bonded factory schemes worked well in three of five countries and moderately in one, and bonded warehouses worked well in two countries, with no reports of poor performance.

- Net foreign exchange earnings in Jamaica's free zone rose from \$1 million in 1982 to \$32 million in 1987, and employment rose from fewer than 1,000 people to more than 11,000 (World Bank data).
- In Mauritius manufactured exports from specialist export firms expanded rapidly almost immediately after the bonded factory/export processing zone system was established in 1970 and accelerated again in the 1980s in response to a further round of adjustment policies; as of 1988 bonded factories accounted for 59 percent of export value and about 20 percent of Mauritius's employment (Lim Fat 1987, 1989).
- Mexico's border industry (*maquiladora*) program was established in 1964 but took off only after the country's massive 1982 devaluation; by 1988 the program employed almost 400,000 people and accounted for 5.7 percent of export revenue (World Bank data).
- The Philippine bonded warehouse scheme appears to have worked well, especially for garments and textiles firms, which in 1985 channeled \$619 million of exports through these arrangements. The country's export processing zones also have been quite effective (although not necessarily efficient, given the high costs of infrastructure); with 55 firms with exports valued at \$416 million located in them as of 1985 (World Bank data).
- In Tunisia a 1972 reform permitting bonded factories laid the foundation for a 14 percent annual real increase in manufactures exports during the next decade.

The divergent patterns of implementation reinforce the central theme that it is important to match policy instruments with the organizational capabilities of countries. The implementation patterns suggest that comprehensive drawback and exemption instruments, however attractive in principle, should be promoted enthusiastically only in countries with strong organizational capabilities and should be considered with caution in countries where these capabilities are weak.

Casual judgment suggests that Mauritius, Mexico, Morocco, and Thailand are administratively relatively well endowed. Thus, it is not surprising that among the sample countries they are the only ones to have achieved some success with these organizationally complex instruments. By contrast, the results reveal that even countries such as Bangladesh, Jamaica, and the Philippines, which casual judgment would suggest are not especially well endowed administratively, were able to implement enclave arrangements with reasonable success. This pattern suggests that, despite their limitations in principle, export enclave arrangements of one kind or another may indeed help to nurture economic growth in countries with moderate organizational capability but politically constrained import policies.

II. PUTTING THE FRAMEWORK INTO OPERATION

There are three different approaches to incorporating institutional considerations in the design of structural adjustment lending. The first approach is to ignore institutional considerations entirely and design programs on the assumption that public organizational capabilities and the political commitment to reform will be forthcoming. If this approach is taken, the policy changes and subsequent economic responses are likely to be quite different from what the reformers initially intended.

The second approach is to acknowledge the institutional constraints, but to earmark technical assistance for weak institutions only after the reform package has been designed on the basis of other considerations. This approach is clearly preferable to entirely ignoring institutional capabilities. Even so, its potential is limited because it does not address political obstacles to reform and presumes (optimistically) that technical assistance will be sufficient to enhance organizational capability even in the short term.

The third approach is to bring institutional considerations to center stage, designing and sequencing programs in ways that are consistent with the capabilities of the reforming country. Assessments of organizational capabilities within the public sector and of the political preferences and room to maneuver of the national leadership are crucial to any such effort. A body of knowledge is emerging about how to proceed with political and organizational assessments (see, for example, Nelson 1989 and Paul 1989a).

The focus of this article is rather on evaluating political and organizational obstacles to clarify concretely how programs to reform trade and investment policy might usefully be matched to a country's capabilities. Figure 1 highlights alternative approaches to policy reform, each of which can be viable if appropriately matched to country capabilities. Yet even after careful assessments, there may be substantial uncertainty in many countries about the kinds of reform the political and administrative systems will be able to absorb.

For domestic competition (at least for those elements examined in this article), these residual uncertainties complicate only marginally the question of how to proceed with reform. The analysis of country experience reveals that the gains

from organization-intensive "streamlining" reforms are at best modest in relation to the status quo. The analysis also reveals that even organizationally well-endowed countries, such as Mauritius, Mexico, and Tunisia, have preferred to follow the organization-light route of dismantling disabling institutions and regulations. It follows that in virtually all countries the strong presumption should be for reforms to dismantle—not reconfigure—restrictive entry rules and dysfunctional systems of discretionary investment incentives.

By contrast, the analysis implies that there is no single approach, common across countries, through which trade policy reform should proceed. In countries where administrative capabilities are weakest, the export development tools to secure trade neutrality will be unworkable and hence powerless to alter the relative incentives of production for domestic and export markets toward increased outward orientation. In these settings, reform efforts should push to the limit of what is politically feasible to liberalize imports. If many domestic producers appear too weak to withstand the discipline of increased import competition (and if widespread bankruptcies appear politically and economically intolerable), exchange rate undervaluation should be seriously considered as an alternative source of protection in a liberalized trade regime.

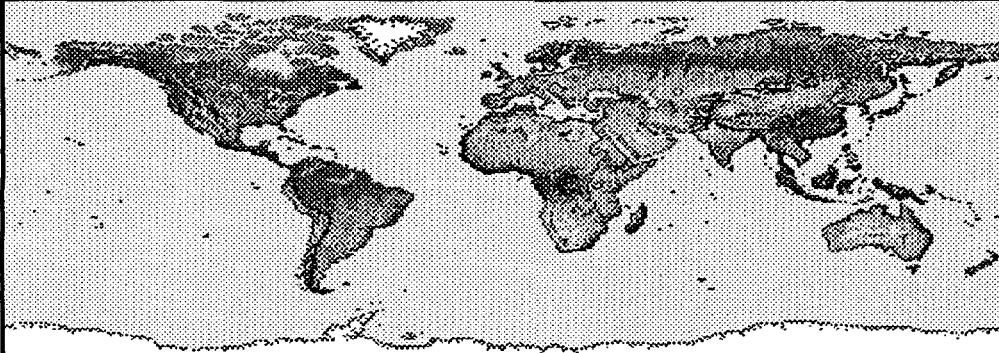
In some countries the administrative capabilities are moderate, but the political limits of import liberalization have unequivocally been reached. In such countries the case might be strong for technical assistance targeted to strengthen the capability of enclave institutions to provide duty-free access to imported inputs that operate entirely separately from the wider bureaucratic apparatus of government. Consistent with this roundabout strategy is the recent establishment of bonded factories in Kenya (and, earlier, enclave efforts in the Philippines and Tunisia). Instruments of trade neutrality can help sustain the dynamic of reform only if they extend participation in export markets beyond specialist exporters, to both indirect exporters and firms that produce for protected domestic markets. It remains unclear whether administrative enclaves can be organized in ways that reach a broad range of firms.

As for countries that are administratively strong, there is by now abundant evidence from East Asia (as well as from Thailand, which is included in this analysis) that skillful use of the instruments to achieve trade neutrality can secure outward orientation without full-scale prior import liberalization (see Rhee 1985, 1989). One clear implication of this analysis is that the East Asian pattern will not be replicable in countries that are administratively weak. But a second implication is that in administratively strong countries it may not be necessary to provoke confrontation with powerful protected interests. These countries can readily move forward with roundabout policies that make intensive use of the instruments of trade neutrality as well as other administration-intensive measures to induce firms to export. As the successful East Asian examples of development reveal, these latter policies—although illiberal in the short-term—can be highly effective in promoting dynamically efficient economic development (Amsden 1989; Johnson 1982; Wade 1990).

REFERENCES

- The word "processed" describes informally reproduced works that may not be commonly available through library systems.
- Amsden, Alice. 1989. *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.
- Colander, David C. 1984. *Neoclassical Political Economy*. Cambridge: Ballinger.
- Haggard, Stephan. 1989. "The Political Economy of the Philippine Debt Crisis." In Joan Nelson, ed., *Economic Crisis and Policy Choice*. Princeton University Press.
- Hirschman, Albert O. 1963. *Journeys toward Progress: Studies of Economic Policymaking in Latin America*. New York: Twentieth Century Fund.
- Israel, Arturo. 1987. *Institutional Development*. Baltimore: Johns Hopkins University Press.
- Johnson, Chalmers. 1982. *MITI and the Japanese Miracle: The Growth of Industrial Policy*. Stanford University Press.
- Levy, Brian. 1990. "The Design and Sequencing of Trade and Investment Policy Reform: An Institutional Analysis." WPS 419. World Bank, Country Economics Department, Washington, D.C. Processed.
- Lim Fat, E. L. M. 1987. "The Mauritius Export Processing Zone." Paper presented at the Enterprise Symposium, UNCTAD VII, Geneva. Processed.
- _____. 1989. "The Mauritius Export Processing Zone: Update." Supplementary data presented at a World Bank seminar, 19 September. Washington, D.C. Processed.
- Nelson, Joan, ed. 1989. *Economic Crisis and Policy Choice: The Politics of Adjustment in Developing Countries*. Princeton University Press.
- Paul, Samuel. 1990. "Institutional Development in World Bank Projects: A Cross-Sectoral Review." WPS 392. World Bank, Country Economics Department, Washington, D.C. Processed.
- _____. 1989a. "Institutional Diagnosis in World Bank Projects." World Bank, Country Economics Department, Washington, D.C. Processed.
- _____. 1989b. "Private Sector Assessment: A Pilot Exercise in Ghana." WPS 199. World Bank, Country Economics Department, Washington, D.C. Processed.
- Rhee, Yung Whee. 1985. *Instruments for Export Policy and Administration: Lessons from the East Asia Experience*. World Bank Staff Working Paper 725. Washington, D.C.
- _____. 1989. "Managing Entry into International Markets: Lessons from the East Asia Experience." Industry Series 11. World Bank, Industry and Energy Department, Washington, D.C. Processed.
- Rodrik, Dani. 1992. "The Rush to Free Trade in the Developing World: Why So Late? Why Now? Will It Last?" National Bureau of Economic Research Working Paper 3947. Cambridge, Mass. Processed.
- Wade, Robert. 1990. *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton University Press.
- World Bank. 1989. "Strengthening Trade Policy Reform: A Policy Paper." Country Economics Department, Washington, D.C. Processed.

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