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THE WORLD BANK ECONOMIC REVIEW

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THE NEXT ISSUE OF THE WORLD BANK ECONOMIC REVIEW will be based on a conference on the role and interests of the developing countries in the multilateral trade negotiations, which was held recently in Bangkok, Thailand, under the auspices of the Thailand Development Research Institute and the World Bank. The guest editor will be the organizer of the conference, Jagdish Bhagwati.

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Public Debt Guarantees and Private Capital Flight

Jonathan Eaton

Significant amounts of private capital have flowed out of several of the more heavily indebted developing countries. This outflow, often called "capital flight," largely escapes taxation by the borrowing-country government, and it has generated concern about the prospects for future servicing of the debt. Imperfect contract enforcement may lead to implicit or explicit government guarantee of foreign debt. The model developed below demonstrates that a government policy of guaranteeing private debt can in turn generate more than one outcome. One such outcome replicates the allocation under perfect contract enforcement: national savings are invested domestically and foreign debt is repaid. The tax obligation implied by potential nationalization of private debt, however, can also lead to another outcome in which national capital flees, and foreign debt may not be repaid.

A striking feature of several of the large debtor countries is the extent to which private capital outflows have eroded net inflows. Based on different methodologies, Dooley, Helkie, Tryon, and Underwood (1986) and Cuddington (1986a) provide estimates of the outflows (see table 1). They find that up to a half or more of the increase in the gross indebtedness of Argentina, Mexico, and Venezuela during 1974–82 was offset by private capital outflows.[1]

These outflows have increased the cost to these countries of raising revenue to service debt and have consequently generated concern about the prospects for debt repayment. The outflows mean that borrowing by these countries added much less to domestic resources than was initially thought. This is reflected in the decline in domestic fixed capital formation between 1980–81 and 1982–84 in six of the eight countries for which data are given in table 1. In addition, funds invested abroad frequently escape the tax base of the borrowing-country government. For this reason these outflows have been referred to as "capital flight."

1. Recent data provided by Dooley (1986), Cuddington (1986b), and Cumby and Levich (1986) support the conclusion that capital flight from these countries has been substantial.

The author is at the University of Virginia and the National Bureau of Economic Research and was a consultant to the Development Research Department of the World Bank while writing this article. He has benefited substantially from comments by seminar participants at Yale University, the Board of Governors of the Federal Reserve System, and the University of Kentucky.

Table 1. *Capital Flight, Domestic Investment, and Nationalization of the Debt in Selected Countries, 1974–82*

Country	*Total change in external debt ($ billion)* (1)	*Total implicit capital outflow ($ billion)* (2)	*Total capital flight ($ billion)* (3)	*Capital flight: percentage change in external debt* (4)	*Percentage change in gross domestic fixed capital formation*[a] (5)	*June 1982: percentage of U.S. bank exposure owed by the public sector* (6)	*September 1984: percentage of U.S. bank exposure owed by the public sector* (7)
Argentina	32.6	20.2	15.3	47.0	−36.0	31.1	49.5
Brazil	93.5	11.4	0.2	0.0	−20.0	29.1	47.0
Chile	15.4	0.0	−1.9	−1.3	−34.0	18.2	37.9
Korea, Rep.	33.6	5.9	0.6	2.0	n.a.	n.a.	n.a.
Mexico	82.6	36.3	32.7	40.0	−27.0	35.2	50.3
Peru	10.7	3.1	1.2	11.0	−17.0	n.a.	n.a.
Philippines	19.9	3.9	n.a.	n.a.	n.a.	n.a.	n.a.
Venezuela	27.0	25.5	10.8	40.0	−23.0	42.4	49.0

n.a.—not available.

a. 1980–81 average to 1982–84 average.

Sources: Columns 1 and 2: Dooley, Helkie, Tryon, and Underwood (1986), reported in Khan and Haque (1985); columns 3 and 4: Cuddington (1986a), reported in Khan and Haque (1985); column 5: Economic Commission on Latin American Countries, reported in Sachs (forthcoming); columns 6 and 7: Keefe Nationwide Bankscan, February 19, 1985, reported in Sachs (forthcoming).

The implications of capital flight for public policy in both creditor and debtor countries remain largely uninvestigated. To a significant extent standard portfolio diversification motives can explain two-way flows. If this is the reason that flight has occurred, then these outflows do not constitute evidence of a market failure that warrants intervention. The current concern about it is consequently misplaced.

Some features of international capital markets may justify a less sanguine view, however. A particular problem is the enforceability of debt contracts. Creditors typically must rely on government intervention, or the threat of intervention, to enforce payment. In the event of default, domestic bankruptcy proceedings result in a transfer of the debtor's assets to the creditor. In an international context, however, the willingness or ability of the borrower's government to effect such a transfer is in doubt. Lenders may have little ability to assess the solvency of a particular private borrower in a developing country, at least relative to the ability of the government of that country. They may also be much more able to penalize the country as a whole for nonpayment than to impose sanctions on an individual private borrower in that country. For these reasons loans for private borrowers may be channeled through the government, or lenders may require that loans to private borrowers come with government guarantees.

A major part of lending to developing countries has taken the form of public or publicly guaranteed debt. Even where no guarantee was provided, lenders have held governments accountable for the debts of private borrowers in default. Díaz-Alejandro's (1985) account of the bankruptcy of some Chilean banks provides an example. Even though the Chilean government explicitly did not guarantee foreign loans to these banks, creditors demanded and received payment from the government when private banks became insolvent.

There is evidence that governments assumed a substantial amount of private debt during the period in which capital flight appears to have been most dramatic. Data taken from Sachs (forthcoming) on the percentage of U.S. bank exposure owed by the public sector of some of the major debtor countries are reported in table 1.

This article develops a model in which the expectation of increased tax obligations created by the potential nationalization of private debt generates capital flight. One possibility is that government guarantees have no implications for the allocation of resources. In this case investment patterns replicate those that would emerge if private lenders could enforce debt contracts directly. Subject to certain incentive-compatibility constraints on individual borrowers, an efficient allocation of resources emerges.

Through the budget constraint of the government, however, implicit or explicit public guarantees create an interdependence among private investment decisions that is otherwise absent. A move by one borrower that increases the likelihood of his own default increases the expected tax obligations of other borrowers. This increases the incentive for other borrowers to place their own funds abroad, and it increases the likelihood of default on their own loans as well. Capital flight arises as a form of contagion.

In the first version of the model, developed in section I, the mechanism that leads to capital flight is outright fraud. Private borrowers have the ability to invest their own and borrowed funds abroad, where they are not only less productive than in domestic investment projects, but where they earn less than the cost of funds from abroad. But by placing these funds overseas the borrower escapes the obligation to repay his loan or to pay taxes to his government.

The assumption that funds placed abroad escape the tax base of the borrower's government and the reach of foreign creditors seems largely consistent with the observed operation of international capital markets. Transfers of these funds are often not recorded and have apparently been effected through such devices as underinvoicing of exports and overinvoicing of imports (see Dooley's 1986 discussion). Without an official record, taxation is difficult. Borrowers can also make it difficult for lenders to match the identities of particular private depositors and private borrowers because the former tend to be individuals and the latter limited liability firms. Intrafamily transfers can also make funds difficult to trace. Hence, while lending institutions have knowingly accepted deposits of private individuals from large debtor countries in significant amounts, they apparently do not, to date, have the legal ability to use these deposits as collateral against outstanding loans. The analysis in this article is based on the extreme assumption that flight capital entirely escapes both taxation by the borrower's government and debt collection by foreign lenders. The basic points of the analysis would survive generalization (under more restricted conditions) to situations in which funds abroad were only partially susceptible to taxation and confiscation by lenders.

Given the tax obligations of domestic borrowers, lenders can restrict loan amounts to ensure that investing domestically and subsequently repaying is in each borrower's interest. Potential nationalization of private debt means that the flight of any one borrower's capital raises the tax obligations of other borrowers. Hence it raises the incentive for other borrowers to invest abroad as well. Consequently, equilibrium may involve all borrowers investing domestically, with foreign loans repaid, or all investing abroad, with government insolvency and default on foreign loans the possible consequence.

In the second version of the model, developed in section II, the reason for flight is somewhat more subtle. The borrower's effort in managing his project and generating returns on his investment will determine whether he is able to finance repayment. But the incentive to put in the necessary effort depends negatively on debt-service obligations and anticipated tax obligations. Again, lenders can design loan contracts that provide the required incentive, *given* tax obligations.[2] Here again, however, potential nationalization of private debt implies that a low level of effort by one borrower, leading to his default, increases the tax obligations of others. Their incentive to expend effort is consequently diminished as well. The interdependence of borrowers' effort decisions generates the same potential for

2. Stiglitz and Weiss (1981) model the potential for moral hazard in the design of debt contracts.

contagion as in the first version of the model. In one equilibrium borrowers expend sufficient effort to service debt. In another they do not. In this second equilibrium they place their own capital abroad, since here it earns a higher return.[3]

The analysis in this article builds on previous work on capital flight. Khan and Haque (1985) model the phenomenon as the response to an asymmetric risk of expropriation facing domestic and foreign investors. Domestic investors face a higher risk of expropriation, so they invest abroad. Domestic investment is consequently financed with foreign funds. The model here extends this approach by relating the risk of expropriation (through high taxation) of domestically owned capital to public and publicly guaranteed foreign debt. Eaton and Gersovitz (forthcoming) also provide a model in which public debt can lead to the flight of private capital. Their concern is with government borrowing to finance public goods rather than with publicly guaranteed private debt, but in both models anticipated tax obligations generate the potential for flight.

Dornbusch (1985) and Ize and Ortiz (1986) analyze capital flight in a macroeconomic context. To quote Dornbusch on the Argentine case: "The source of capital flight was the combination of currency overvaluation, the threat of devaluation, and ongoing and increasing domestic financial instability. The domestic instability derives from an inability to bring deficits under control and [to] stop the inflationary process in a decisive way (p. 229)." This view complements the analysis here. The government's inability to finance expenditure, including debt-service obligations, led to inflationary finance, a form of taxation of domestic capital. As a consequence, capital fled.[4]

I. Capital Flight and Potential Fraud

The contagion problem can be illustrated most succinctly in a simple deterministic model. A national economy that is small in world capital markets is endowed with n potential projects. Project i yields an output valued as:

$$q_i = f_i(k_i) \qquad f_i' > 0, f_i'' \leq 0 \tag{1}$$

where k_i is total capital invested in the project. Each project is owned by an entrepreneur with an endowment of capital $\bar{k}_i$. In addition, he is permitted to borrow up to an amount $\bar{k}_i^f$ from abroad at a gross interest cost, s_i, which will turn out to be a constant.

3. The interdependence of private borrower decisions created by public loan guarantees resembles that among depositors in Diamond and Dybvig's model of "bank runs" (1983). In both cases the interdependence of investment decisions leads to the possibility of contagion and an inferior equilibrium. They interpret their model as supporting government deposit guarantees. In contrast, in this model government guarantees are the source of the problem.

4. Diwan (1986) develops a model in which capital flight emerges as a response to the limitation that credit rationing by foreign lenders places on the risk-sharing opportunities available to domestic residents through borrowing.

If the owner invests the funds in the project then he must service any debt from borrowed funds and pay a tax, t_i. His after-tax return is consequently $q_i - s_i k_i^f - t_i$, where k_i^f denotes actual foreign borrowing.[5] Alternatively he may invest his own and borrowed funds abroad, default on his loan, and evade the tax. His return on this investment is ρ_i, assumed to be a constant. The decision to invest at home or abroad consequently depends upon whether the net after-tax return on domestic investment is greater than or less than that on foreign investment:

$$f_i(\bar{k}_i + k_i^f) - s_i k_i^f - t_i \gtrless \rho_i (\bar{k}_i + k_i^f). \tag{2}$$

Given s_i, the borrower's interest cost of foreign capital; $\bar{k}_i$, the entrepreneur's own capital; ρ_i, the interest rate on funds placed abroad; and t_i, the tax, expression 2 constrains the amount of foreign capital that the entrepreneur can borrow without having an incentive to invest abroad. In the region where the amount invested is so low that $f_i' > s_i + \rho_i$, an increase in foreign indebtedness *reduces* the incentive for flight. Assuming that the left-hand side of equation 2 exceeds the right-hand side, in this region foreign lenders will be willing to extend further credit, since doing so will not create an incentive to default, while domestic lenders will want to borrow more since the return to domestic investment exceeds the marginal cost of borrowing, s_i. Once the amount invested domestically reaches a level such that $f_i' < s_i + \rho_i$, however, as foreign indebtedness increases so does the incentive for flight. The point at which expression 2 holds with equality consequently defines a *maximum* amount that lenders will be willing to extend, $\bar{k}_i^f$. Note that it is a decreasing function of t_i, s_i, and ρ_i.

It would never be in the interest of someone intending to repay to borrow more than the level of capital at which the project's marginal product of capital equals the interest rate. This amount, k^{f^*}, is determined by the condition:

$$f_i' (\bar{k}_i + k_i^{f^*}) = r \tag{3}$$

where r is the risk-free gross rate of interest, $r \geq \rho_i$. Hence whether the credit ceiling is binding depends upon whether $k_i^{f^*} \gtrless k_i^f$. In any region in which $\bar{k}_i^f$ is binding, the marginal product of capital domestically will exceed the return on funds placed abroad (that is, $f_i' > \rho_i$). Thus, wherever it is binding, the ceiling is an increasing function of the entrepreneur's own capital, as can be demonstrated by differentiating condition 2 with respect to $\bar{k}_i$.

Consider, as an example, the case in which technology is linear, so that

$$f_i(k_i) = \alpha_i k_i.$$

For there to be an incentive to perpetrate fraud at *any* level of indebtedness requires that $\alpha_i < s_i + \rho_i$, while a borrower's willingness to borrow and invest *any* amount domestically requires that $\alpha_i > s_i$. Under these restrictions, condition 2 implies a debt ceiling,

5. Making the tax obligation a function of output or income does not affect the analysis substantially, although it introduces some inessential complications.

$$\bar{k}_i^f = \frac{(\alpha_i - \rho_i)\,\bar{k}_i - t_i}{s_i + \rho_i - \alpha_i}.$$

In general, more borrowed capital can safely be provided the more productive the project in question, the lower the interest cost of the loan, the lower the return on funds placed abroad, the lower the tax, and the more that the entrepreneur himself has to invest. The debt ceiling, $\bar{k}_i^f$, reflects the complementarity between the entrepreneur's own capital and borrowed funds when loans are rationed.

Foreign lenders are competitive, and supply loans at a risk-free gross rate, $r \geq \rho_i$, offered to this economy. The loan rate charged may be strictly greater than the rate of return on investments by domestic investors abroad due to (i) the cost of foreign banking services, (ii) foreign reserve requirements, and (iii) the cost to domestic borrowers of evading exchange controls. If foreign lenders can observe all the parameters of individual projects, including the borrower's total indebtedness, and repayment of loans in the absence of fraudulent investment is automatically guaranteed, then they will provide any amount up to $\bar{k}_i^f$ at the safe rate. Hence, $s_i = r$. Funds in excess of this amount will not be available at any rate, since default is then a certainty. If the credit ceiling is not binding, then borrowing proceeds to the point at which the domestic return equals the world cost of capital. Otherwise the incentive-compatibility constraint implies a marginal product of capital in excess of this cost.

In neither case does capital flight or default ever occur. This is because lenders know all the parameters of the borrower's decision and ensure that this option is not in the borrower's interest. With imperfect information, capital flight and consequent default on foreign loans could occur if lenders overestimate the productivity of a particular project or the amount that the borrower himself has at stake, or underestimate total indebtedness or the borrower's return on funds placed abroad.

Government Guarantees

Foreign lenders may make loans contingent on a guarantee from the borrower's government for either of two reasons. One is that lenders may not be able to observe the parameters of particular loan projects directly and therefore rely on the local government to determine whether or not these are at financially sound levels. Requiring a loan guarantee makes accurate reporting of the relevant data incentive-compatible for the government.

A second reason is that lenders may have no direct method to enforce repayment. Even if funds are invested domestically, lenders must rely on the local government to pursue bankruptcy proceedings against a borrower who does not repay. Lenders may have penalties to invoke against nations as a whole to enforce repayment, but these may have no deterrent effect if invoked at the level of an individual borrower.

An obvious example is a credit embargo. A threatened embargo against an individual borrower will have little effect in deterring default if the borrower foresees little need to borrow again. Conversely, the central government may

have a much stronger incentive to maintain access to foreign capital markets for other potential borrowers, including itself.

For current purposes I assume that the impact of the penalty for failing to repay a guaranteed loan contract is sufficient to ensure that the government will enforce repayment of any loans that are extended, *given* that borrowed funds were invested domestically. If P is the penalty that lenders impose on the country as a whole for failing to enforce a loan contract, and total debt service obligations are $S \equiv \sum_{i=1}^{n} s_i k_i^f$, then lenders will ensure that $P \geq S$ for any debt obligations that arise.[6]

The Government Budget Constraint

The government's net financing requirement from the n investment projects (its expenditure less taxes from other sources) is denoted R. If all foreign borrowed and domestic funds are invested locally, then the government need only enforce existing loan contracts to make good on its loan guarantees. A set of taxes, t_i, that generate revenue greater than or equal to the government's net financing requirement,

$$\sum_{i=1}^{n} t_i \geq R,$$

will provide sufficient revenue.

A useful simplification is that firms are identical in the sense that they face the same gross rates of return on project and overseas investment and the same tax and have equal initial capital endowments:

$$(4) \qquad \left.\begin{array}{l} f_i(k) = f(k) \\ \rho_i = \rho \\ t_i = t \\ \bar{k}_i = \bar{k} \end{array}\right| \qquad i = 1,\ldots,n.$$

These firms will have borrowed the same level of foreign capital, $k^f = \min(\bar{k}^f, k^{f*})$, at a uniform cost, s.

Let m denote the number of loans fraudulently obtained for domestic projects in which the funds were invested abroad. The consequent default on these loans generates an additional revenue requirement, equal to msk^f, if the government is to fulfill its loan guarantees. The minimum per firm tax on the remaining $n - m$ projects necessary to meet this requirement is

$$(5) \qquad t = (R + msk^f)/(n - m).$$

This tax implies a maximum after-tax income for a borrower who invests domestically of

$$(6) \qquad \psi(\bar{k}, k^f, s, R, m) \equiv f(\bar{k} + k^f) - sk^f - (R + msk^f)/(n - m).$$

6. Relaxing this assumption gives rise to the possibility of credit rationing at the aggregate level, many implications of which have been analyzed elsewhere. Introducing the potential for aggregate credit rationing here complicates the analysis substantially, without affecting most basic results.

Given k^f, this return falls as m, the number of firms engaging in fraud, rises (that is, $\psi_m < 0$).

At the time that loans are extended, the government cannot precommit itself both to a given tax structure and to guarantee loans unless it can also ensure that all borrowed funds are invested domestically and consequently will provide a base for repayment. Its budget constraint forces the government to modify taxes in response to actual investment patterns if it is to fulfill loan guarantees.

Multiple Equilibria

At the time that borrowers allocate funds between domestic and foreign investment, the values of k^f and s as well as $\bar{k}$ and R are predetermined. Given these values, a Nash equilibrium in investment allocation is an allocation in which no single borrower has an incentive to deviate from his investment decision given the investment decisions of the other $n - 1$ borrowers.

The basic result of this article is that under reasonable conditions there are at least two such equilibria. These equilibria have different welfare implications, and one Pareto dominates the other. It follows from observing that, since $\psi_m < 0$, for some parameter values

$$\psi(\bar{k},k^f,s,R,n-1) < \rho\,(\bar{k} + k^f) \leq \psi(\bar{k},k^f,s,R,0) \tag{7}$$

where $m = n-1$ and 0, respectively. The first term is what a single borrower would earn if he were the *only* borrower to invest domestically. The second is what can be earned abroad, which is independent of other borrowers' decisions. The third term is what a borrower earns by investing domestically if all other borrowers do the same. The second inequality in expression 7 is implied by equation 2 for $t = R/n$. Hence credit rationing should ensure that this inequality is satisfied, which implies that it pays to invest domestically if everyone else has. Hence in one equilibrium everyone does invest domestically ($m = 0$). I call this the *normal* equilibrium.

The first inequality is more likely to be satisfied, the larger R, k^f, and n. It implies that it does not pay to invest domestically if no one else does, so that in another equilibrium no one invests domestically ($m = n$). I call this *flight* equilibrium.[7]

In the normal equilibrium private borrowers repay loans, and foreign lenders necessarily receive payment. What happens in the flight equilibrium depends upon whether the government has sufficient revenue from other sources to repay. If $-R$, net revenue already available from other sources, exceeds debt-service obligations, nsk^f, then the government can repay without raising additional revenue. Assume that the possibility of raising additional revenue in an amount T incurs a cost (directly and in terms of excess burden, administrative cost, or negative political consequences) of $C(T)$. If the cost of raising the revenue needed

7. A third equilibrium is one in which $m = \tilde{m}$ where $\tilde{m}$ is defined by the condition $\psi(\bar{k},k^f,s,R,\tilde{m}) = \rho(\bar{k} + k^f)$. It is unstable, and hence I assign it a zero probability of occurring.

to repay loans exceeds the penalty of default (that is, if $C[nsk^f + R] > P$), then the government will choose to default on foreign loans and suffer the consequences. If this inequality is reversed, then it will repay loans with income generated by taxes on other sources of income. In this second case a precommitment by the government to using these alternative sources of revenue to repay guaranteed loans in default would eliminate the potential for flight. As long as income generated by investment projects that do yield income is a less costly revenue source, however, a promise not to use these projects as a tax base is not credible.

Whether or not the government raises additional revenue, the normal equilibrium Pareto dominates the flight equilibrium. The government avoids the default penalty or the cost of raising additional revenue, borrowers earn a higher return (as condition 2 directly implies), and lenders are necessarily repaid.

If in the flight equilibrium the government repays foreign loans, then the potential for flight will not affect the terms on which foreign loans are available. Loans from abroad will be available at the safe world lending rate, r. If capital flight leads to default, however, then lenders must assess the likelihood of a flight equilibrium in deciding upon the terms on which they will supply loans. The next section discusses how the potential for flight can affect the availability of credit.

Sunspots: Introducing Uncertainty

At the time loans are extended neither lenders nor borrowers know which equilibrium will emerge. Nothing intrinsic to the model determines the choice between them. One approach in such cases is to introduce uncertainty in the form of a lottery across equilibria, assuming that the generally observed resolution of a random process extrinsic to the model (for example, "sunspots") determines the outcome (see, in particular, Cass and Shell 1983).

Let ϕ denote the commonly observed outcome of a random process which can assume any value in the set Φ; this outcome will influence lenders' and investors' expectations about capital flight. The true value of ϕ is observed after loans are extended but before the investment allocation decision is made. All agents share the belief that certain realizations of ϕ imply flight and that the remaining possible ones imply the normal outcome. When the true value of ϕ is realized agents then act accordingly. The probability that lenders (correctly) assign to a normal equilibrium outcome is denoted π; the probability of flight is consequently $1 - \pi$.

Competition among risk-neutral lenders will ensure a level of investment that satisfies a zero expected return condition, that is,

$$E\,(snk^f) = rnk^f. \tag{8}$$

When flight leads to default, two types of situations could emerge.

In the no-flight case, lenders constrain the amount that they lend to a level so low that even a single borrower could repay the total debt and still earn a profit investing domestically. Formally, the level of k^f would satisfy:

$$\psi(\bar{k},k^f,r,R,n-1) \geq \rho\,(\bar{k}+k^f). \tag{9}$$

There is no-flight equilibrium, so that the safe rate is the rate actually charged ($s = r$). This would typically involve very little lending.

In the potential-flight case, lenders constrain k^f to a level at which repayment occurs only in the normal equilibrium, that is,

$$\psi(\bar{k},k^f,\tilde{s},R,0) \leq \rho(\bar{k}+k^f) \tag{10}$$

where

$$\tilde{s} \equiv r/\pi. \tag{11}$$

At one extreme the probability of a normal equilibrium outcome, π, is equal to one; the capital-flight equilibrium, while now a possibility, never actually occurs, and private loan obligations are always met. Even though the government has guaranteed loans, it need never use general revenues to repay them. The allocation of resources is the same as what would have emerged if lenders could enforce loan contracts directly with borrowers without requiring a guarantee.

At the other extreme $\pi = 0$. Again, capital flight never occurs but now borrowers are rationed to the no-flight level, such a small amount that any *one* borrower could service the national debt and still earn a net return in excess of that abroad.

For values of π near zero, this rationing will also be the equilibrium. For values of π closer to one, the equilibrium amount borrowed will be intermediate between the levels observed at the two extreme values of π. In some states flight will occur and the government will not meet debt-service obligations.

Policies that reduce the probability of flight (raising π) benefit the country in two ways. They have the direct effect of increasing the likelihood of the normal equilibrium, in which lenders, borrowers, and the government are better off. They have the additional effect of expanding the amount of foreign capital available. Since the economy is, by assumption, one in which the marginal product initially exceeds the world cost of capital, this is an added benefit.

II. Capital Flight and Moral Hazard

In the model developed in the previous section, capital flight occurred because both domestic and foreign funds were invested fraudulently overseas rather than in domestic projects. Even if borrowed funds are invested domestically, however, government debt guarantees can imply multiple equilibria, one of which is characterized by the flight of *nationally owned* capital and possible default on foreign loans.

Consider a situation in which the return on a project depends both on the outcome of an exogenous random process, x, and on the level of managerial effort, e. Only the owner of the project can observe x and e. Consequently, outside observers cannot tell how much of the return on a project is determined by managerial effort and how much by luck.

The simplest case to consider is one in which the production relationship takes the form

$$g_i(k_i,e_i,x_i) \tag{12}$$

where e_i and x_i can take on values 0 or 1, and

$$g_i(k_i,1,1) = f_i(k_i)$$
$$g_i(k_i,0,1) = g_i(k_i,1,0) = g_i(k_i,0,0) = 0.$$

That is, a positive return requires both a high level of effort and a positive realization of the random process. Let λ_i denote the probability that the random process is positive, $x_i = 1$. *Given* that the manager expends effort ($e_i = 1$), the expected gross output from the project is $\lambda_i f_i(k)$.

As before, let s_i denote a borrower i's cost of foreign capital, $\bar{k}_i$ his own endowment of capital, ρ_i his return on funds invested abroad, and t_i the tax on revenue from this project, which is only collectible if the project yields a positive revenue. In addition, let β_i denote the disutility in terms of income that the borrower suffers from exerting effort in managing his project.

First consider the case in which lenders can automatically recover loan obligations if the project has yielded the available resources, but not otherwise. Hence, as long as

$$f_i(k_i) - t_i \geq s_i k_i^f \tag{13}$$

and $x_i = e_i = 1$, then repayment is effected. If $x_i = 0$ or $e_i = 0$, however, then there are no resources available for repayment. The lender, by assumption, does not have access to income from the borrower's own capital placed abroad, so in the absence of a government guarantee, loans are not repaid.

The following events occur in sequence. First, owners of projects borrow a particular amount from foreign lenders (possibly with their own government acting as intermediary or guarantor). Second, the owners of these projects decide, simultaneously or sequentially, whether or not to exert effort in managing their investment project and where to invest their own funds. Finally, after all decisions have been made, the random component of the production process, x, is realized. In this version of the model, owners of projects are precluded from shifting borrowed funds abroad, possibly because the lender or the government can monitor these funds, and placement abroad would signal a decision not to exert effort in management. The potential for embezzlement of borrowed funds could be introduced here as well, introducing elements of the previous analysis. For simplicity it is not.

At the time a borrower decides where to invest his own wealth and how much effort to expend, his foreign indebtedness is already determined, while the outcome of the random element in the production process is still unknown. Following the standard technique of backward induction, I discuss the effort and portfolio decision first, taking foreign indebtedness as given, and then turn to the prior borrowing decision.

Given that he intends to exert effort, the optimal portfolio decision for a risk-neutral individual is to invest his own funds in his own project to the point at which the return at home equals that available abroad. Mathematically, he should invest an amount w_i abroad, where w_i satisfies:

$$\lambda_i f_i'(k_i^f + \bar{k}_i - w_i) = \rho_i \tag{14}$$

as long as the value of w_i that satisfies this expression lies between zero and $\bar{k}_i$. Here k_i^f denotes the predetermined level of foreign borrowing. If

$$\lambda_i f_i'(k_i^f) < \rho_i$$

then he should invest all his own funds abroad (set $w_i = \bar{k}_i$). Conversely, if

$$\lambda_i f_i'(k_i^f + \bar{k}_i) > \rho_i$$

then he should invest all his own funds domestically (set $w_i = 0$).

Any income that the project generates is available for payment of debt and taxes. The highest expected income that the borrower can achieve given a decision to exert effort and given k_i^f is defined as $h^i(k_i^f)$ where:

$$h^i(k_i^f) \equiv \lambda_i \max\,[f_i(k_i^f + \bar{k}_i - w_i^*) - s_i k_i^f - t_i, 0] + \rho_i w_i^* - \beta_i$$

and where w_i^* is the optimal level of w_i.

Given a decision *not* to exert effort, the borrower's optimal portfolio decision is, of course, to invest all his own funds abroad, ensuring himself a return $\rho_i k_i$. Given k_i^f, the decision to expend effort is thus *incentive compatible* if and only if

$$h^i(k_i^f) \geq \rho_i \bar{k}_i. \tag{15}$$

If this constraint is satisfied then the borrower will choose to exert effort in managing his project and set $w_i = w_i^*$. If not, then he will choose not to exert any management effort and invest all of his own funds abroad (set $w_i = \bar{k}_i$). Note that, in particular, an increase in tax obligations makes this constraint more difficult to satisfy.

Having characterized the optimal effort and portfolio decision given foreign indebtedness, I now turn to the prior borrowing decision. In the absence of a government guarantee, lenders will only lend an amount that satisfies condition 15. If this condition is not satisfied then the borrower will not exert any effort in managing this project. Hence default is certain. If this condition is satisfied then the borrower will exert effort, ensuring repayment in the state of nature in which $x_i = 1$.

Competitive, risk-neutral lenders will be willing to extend loans in any amount that satisfies condition 15 at an interest rate that is high enough to offset losses on loans to firms that fail to generate output because of bad luck. Hence, for firm i the interest rate will be given by:

$$s_i = r/\lambda_i \tag{16}$$

where r continues to represent the safe world gross interest rate and λ_i the probability that $x_i = 1$.

Given this interest rate and the incentive compatibility constraint 15, risk-neutral borrowers will wish to borrow an amount that maximizes expected income, which is given by the function $h^i(k_i^f)$. Since the expected cost of funds from abroad, r, is at least as great as the return on funds placed abroad, ρ, a risk-neutral borrower will never borrow abroad for domestic investment and then place his own funds abroad, given that he exerts effort.[8] Hence the amount of borrowing that maximizes expected income is given by the condition:

$$\lambda f_i'(k_i^f + \bar{k}_i) = r. \tag{17}$$

As in the previous version of the model, I denote the value of k_i^f that satisfies equation 17 as k_i^{f*}. For any borrowing to be possible requires that:

$$h(k_i^{f*}) \geq \rho \bar{k}_i. \tag{18}$$

In the subsequent discussion I assume that this condition *is* satisfied at $t_i = 0$. This condition ensures that some movement of capital to this country increases its income. In contrast with the situation in which flight is the consequence of outright fraud, the incentive to flee does not grow with the total amount borrowed. If equation 18 is satisfied then k_i^{f*} is the actual amount lent; if not, no amount is offered.

Government Guarantees

As before, foreign lenders may require the guarantee of the borrower's government to extend a loan to any particular private borrower. This may be so that the government will enforce repayment or because the government can observe project returns not observable by the foreign lender. A guarantee would then preclude a borrower's falsely claiming bad luck ($x_i = 0$), hence that output was zero, and that repayment could not be made.

Consider the case in which foreign borrowing is channeled through the government, which guarantees foreign lenders a return r, and charges each individual private borrower $s_i \geq r/\lambda_i$. If the number of firms is large and x_i is independent across firms then, as long as the incentive-compatibility constraint 15 remains satisfied, the statistical law of large numbers ensures that the government's receipts from loans it has extended can finance payment to foreigners.

The Government Budget Constraint

Assume, as before, that the government's net revenue requirement is R. Given that private borrowers expend effort managing their projects, this revenue is

8. Risk aversion would provide a motive to invest abroad even if the borrower intends to expend effort on his own project. As risk aversion introduces a number of complications that are largely irrelevant to the basic point, I continue to assume that borrowers are risk-neutral.

generated by a set of tax rates, t_i, that satisfy

$$\sum_{i=1}^{n} \lambda_i t_i \geq R.$$

Again, it is convenient to focus upon the case in which firms are identical in the sense that

$$(19) \qquad \left.\begin{array}{l} f_i(k) = f(k) \\ \bar{k}_i = \bar{k} \\ \lambda_i = \lambda \\ \rho_i = \rho \\ t_i = t \\ \beta_i = \beta \end{array}\right| \qquad i = 1,\ldots,n.$$

Consequently, each firm will have borrowed the same amount, k^f, at cost s.

Let m now denote the number of firms whose owners have decided not to expend effort on their projects and have consequently invested their funds abroad. These borrowers will, of course, default on their loans. They generate an additional revenue requirement, mrk^f. In order to finance the total revenue required, the government must impose a tax equal to the prior net financing requirement plus the loan default repayment, spread over those firms earning a positive return on domestic investment:

$$(20) \qquad t = (R + mrk^f)/\lambda(n - m).$$

The consequent expected income of a borrower who expends effort and invests domestically is

$$\psi(\bar{k},k^f,s,R,m) = \lambda[f(\bar{k} + k^f) - sk^f] - (R + mrk^f)/(n - m) - \beta.$$

Multiple Equilibria

The after-tax income of any borrower who invests domestically and expends effort on his own project falls as the number of borrowers who choose not to expend effort (and hence invest abroad) rises. Unless indebtedness is restricted to a level so low that even one borrower could repay the total debt and still earn a positive return—that is, the level at which $\psi(\bar{k},k^f,s,R,n - 1) \geq \rho\bar{k}$—there are again two equilibria.

In one equilibria all owners of firms invest their own funds domestically and expend effort in managing their firms. The risk premium that the government charges on guaranteed loans to domestic borrowers compensates for losses on loans to firms whose output is low for exogenous reasons.[9] Foreign loans are repaid without recourse to additional taxation.

In the second equilibrium, all domestic borrowers place their own capital abroad and exert no effort in managing their firms. All private borrowers default,

9. The next section demonstrates that it is optimal for the government to charge domestic borrowers a nominal interest rate just sufficient to cover foreign loan obligations in the normal equilibrium.

so that the government lacks revenue sufficient to repay foreign loans, and it must either raise additional revenue from other sources or default as well. In contrast with the specification in section I, the flight equilibrium is not the consequence of the outright perpetration of fraud.[10] Borrowers do not abscond with the foreign capital that they have borrowed but do, as promised, invest it domestically. They manage their investment in a way that reduces the likelihood of repayment, however. Since their effort is never observable, this failure does not constitute verifiable fraud in the same sense that the misuse of borrowed funds did in the previous analysis.

The Optimal Pricing of Domestic Loans

Again, an extrinsic source of uncertainty ("sunspots") may generate a lottery between the two equilibria. When flight leads to default on foreign loans, if π is the probability of a normal equilibrium and $1 - \pi$ the probability of a flight equilibrium, then foreign lenders will require an interest rate

$$\tilde{r} \equiv r/\pi. \tag{21}$$

Expected national income generated by the projects under consideration is

$$\begin{aligned} Y^e &= n\pi[\lambda f(\bar{k} + k^f) - \tilde{r}k^f - \beta] + (1 - \pi)\, n\rho\bar{k} \\ &= n\{\pi[\lambda f(\bar{k} + k^f) - \beta] - rk^f\} + (1 - \pi)\, n\rho\bar{k}. \end{aligned} \tag{22}$$

The level of foreign borrowing that maximizes Y^e satisfies

$$\lambda\pi f'(\bar{k} + k^f) = r. \tag{23}$$

To achieve this level of foreign indebtedness, the government should charge individual private borrowers a nominal interest rate which accounts for the probability of default: $s = r/\lambda\pi$. In the normal equilibrium the government collects rnk^f/π, which equals foreign debt-service obligations. Hence in this equilibrium the government can finance foreign debt fully out of interest received from domestic borrowers.

III. Conclusion

I have developed these two versions of the model to illustrate how a particular type of market failure, the inability to enforce contracts between private agents without public intervention, can generate capital flight. The interaction between government guarantees and private investment occurs in a very simple framework. As a consequence a number of issues remain outside the analysis.

For one thing, the government's tax base appears only very crudely. In principle the issues raised here relate to the government's overall fiscal and debt structure,

10. There remains, however, avoidance or evasion of tax obligations. This feature of flight equilibrium is essential to both versions of the model.

including tax, expenditure, and monetary policy. The role of seigniorage as a form of finance seems particularly relevant to the countries in question.

A second, and related, omission is an analysis of the government's default decision as the outcome of the weighing of the costs and benefits of repudiation. Here the cost of default is exogenous. Eaton, Gersovitz, and Stiglitz (1986) provide a recent discussion of the incentives to avoid default.

A third omission is an analysis of the dynamics of accumulation. The issues raised in the model clearly have implications for savings behavior, but I have treated national wealth as given.

Because of these limitations, the model does not provide an adequate framework for a general comparison of alternative policies. It does point to some considerations that could be important in weighing policy alternatives, however.

The most obvious one is that there is a benefit to extending the tax base of borrowing countries to include income from private assets abroad. The brain-drain literature has already made this point for a very different reason. Policies in both developing and developed countries could serve this end.

To the extent that taxing foreign income is infeasible, capital controls that succeed in preventing investment abroad could alleviate the problem simply by eliminating the possibility of flight. The benefits of such controls that are implied by this analysis need to be weighed against the administrative cost, the reduced possibility for diversifying exogenous risks, and the potential for rent-seeking activity that controls would pose. Another problem is that if such controls do not eliminate the possibility of flight, but only reduce the return on funds invested abroad, they will not, on their own, reduce the probability that flight will occur. Indeed, information that increases borrowers' expectation of future controls might lead to flight as borrowers attempt to remove funds before controls are put into effect. An increased fear of controls would then be acting as a particular realization of an extrinsic random process (or "sunspot") that leads to flight.

The analysis suggests two other implications about policy that probably deserve greater emphasis. First, there may be a benefit to replacing explicit or implicit government backing of private loans with bankruptcy procedures more similar to those used domestically that compensate lenders with equity in the assets of private borrowers in default. Such a step would reduce interdependence among private investment decisions created by guarantees that can lead to flight. Second, the expansion of the tax base to include income from factors in fixed supply domestically (land, in particular) can reduce the incentive for flight. To the extent that income of this type is perceived as a source of finance that is no more costly than taxation of income from mobile factors, there is less reason for capital to flee in the presence of large potential government finance requirements.

Appendix. *Symbols Used in the Model*

C = costs (collection, administrative, political) to the government of raising additional tax revenue
e_i = managerial effort as a determinant of project return; value 0 or 1
f_i = gross return on domestic project i
h_i = highest expected entrepreneurial income given $e_i = 1$
k_i = total capital invested in project i
$\bar{k}_i$ = entrepreneur capital endowment for each i
k_i^f = foreign capital borrowed for project i
$\bar{k}_i^f$ = foreign borrowing ceiling for each project
m = number of firms which invested fraudulently obtained foreign funds abroad (section II)
= number of firms which invested their own funds abroad (section III)
n = number of total potential investment projects
P = penalty imposed on country for uncompensated private loan default
q_i = value of output of i
R = government's net financing requirements from n investment projects
r = gross risk-free interest rate charged by foreign lenders
$\tilde{r}$ = interest rate charged by foreign lenders given an extrinsic source of uncertainty of repayment
S = borrower's total debt service obligation
s_i = borrower's cost of foreign borrowing; gross interest rate
T = additional tax revenue required
t = minimum tax on domestically funded projects given default on others
t_i = tax on project i
w_i = share of entrepreneur's capital to invest domestically, given uncertainty and managerial effort as determinants of project outcome
w_i^* = optimal domestic investment of entrepreneur's own capital, given his decision to expend managerial effort
x_i = exogenous random determinant of return on investment in project i; value 0 or 1
Y^e = expected national income generated by projects
α_i = coefficient of return on investment in i (linear technology function)
β_i = disutility of borrower managerial effort in project
λ_i = probability that $x = 1$
π = probability that lenders correctly assign outcomes implying a normal equilibrium (that is, domestic investment and loan repayment)
ρ_i = foreign interest rate: return on investment abroad
ϕ = commonly observed random process outcome in set Φ for value of loan before investment allocation decision
ψ = maximum after-tax income for domestic investor ($\psi_m < 0$)

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Effects of Restraining Steel Exports from the Republic of Korea and Other Countries to the United States and the European Economic Community

David G. Tarr

In this article a model is developed to evaluate the impact on an exporting country of a restraint imposed on its export by an importing economy in the context of a three-region model of world trade in a single product. The welfare changes in any of the three regions in the model and in the global economy can be evaluated.

The model is applied to the restraints imposed on steel exports from the Republic of Korea to the United States and the European Economic Community (EEC). The United States and the EEC are found to have incurred significant losses as a result of the restraints. The largest part of these losses are quota rents transferred to Korea and the rest of the world. Under reasonable parameter assumptions, Korea and the rest of the world obtain net gains from the quotas, because the resource misallocation costs are smaller than the quota rents.

The model is modified to analyze a tariff barrier rather than a quantitative restraint. It is found that an "equivalent" tariff on steel transforms Korea and the rest of the world from net gainers to net losers as a result of a restraint.

The steel producers of the United States and the European Economic Community have undergone significant dislocations as steel demand has declined since 1975, and the location of the lowest steelmaking costs has shifted first to Japan in the 1960s and early 1970s, and later to the Republic of Korea and Brazil.[1] The U.S. and EEC governments have responded with increasing protection. Since 1978, the EEC has maintained an extensive system of "voluntary restraint agreements" (VRAs), which limit steel imports. Although the United States had a period of

1. See Tarr (forthcoming) for the details of the decline in demand, output, and employment, as well as the shifts in relative costs.

David G. Tarr is a senior economist with the U.S. Federal Trade Commission. This article is based on a larger study by the author (Tarr 1986a) which was completed while the author was a long-term consultant in the Development Research Department of the World Bank. The author would like to acknowledge the helpful comments of J. Michael Finger, Vittorio Corbo, Brian Hindley, Gregory Ingram, Morris Morkre, Hans Mueller, Chong Nam, Theophilos Priovolos, and Billy Yoo.

roughly free trade in steel products from 1982–84 (with the exception of the restraints on imports from the EEC), it imposed quotas in late 1984 on virtually all significant suppliers of steel to the United States.

The costs to the United States of its newly adopted system of quotas have been examined elsewhere (Tarr and Morkre 1984); in this article the costs to Korea and other countries which export steel to the United States and EEC are examined.

Based on the methodology of Corden (1957), many authors have estimated the costs to an importing nation of a restraint it imposes on a particular product. Empirical efforts to determine the costs to an exporting nation of a restraint imposed on its exports of a particular, somewhat disaggregated, product by an importing nation are much less common. Development of a methodology to estimate such costs has also received relatively little attention.[2] In section I, a brief description of the model and the welfare methodology is provided. The model is specified in mathematical terms in the appendix; more detail is provided in Tarr (1986a). The structure of the VRAs is discussed in section II. In section III, results of the simulations of the model using the best parameter estimates are presented, and alternative elasticity and policy simulations are examined.

I. Summary of the Model

The country on which we focus specific attention is Korea, which has emerged as a low-cost supplier of steel. Although estimates of the welfare effects of a trade restriction are normally made for a single country in a partial equilibrium context, too many important interaction effects may be left out of a model that examined Korea alone. Most notably, the amount of the quota rents that the exporting nation obtains from a VRA is crucial to estimating the welfare effects. It is clearly necessary to include the restraining importing nation in the model to estimate the quota rents effectively. It is important also to include other suppliers of steel.

Thus, a three-region model of world steel trade has been developed with Korea *(K)* as one of the regions. Since both the United States and the EEC restrain steel imports, they are treated as one region, denoted *U*. The rest of the world constitutes the remaining region, *R:* exports from this region are also restrained by agreements with the United States and EEC.

The means by which export quotas are imposed facilitates the transfer of rents to exporting countries. Restraint of exports, together with competition by importers, allows rent capture by exporters. If there is monopolistic importing, the outcome is less clear. As there are many steel importers, however, the most reasonable assumption regarding the steel quotas is that importers do not capture the rent.

It is reasonable to treat steel from different regions as differentiated products (the "Armington [1969] assumption").[3] This means that each region has three

2. Magee (1972) provides a starting point for the analysis.

3. For a justification of this and other empirical assumptions, as well as a full derivation of the model, see Tarr (1986a).

demand functions for steel (one for each region's steel products) and each demand function depends on prices from each of the regions. This gives a total of twenty-seven own and cross-elasticities of demand in the model. There are also three supply elasticities, one for each region. A methodology has been developed (Tarr 1986b) for choosing between two competing sets of estimates of the elasticities of demand: the Armington elasticities and those available from Grossman (1982). Employing this methodology, a set of demand elasticity estimates has been obtained for the United States and EEC based on the Grossman estimates, while the Armington elasticities have been utilized for the other two regions of the model.

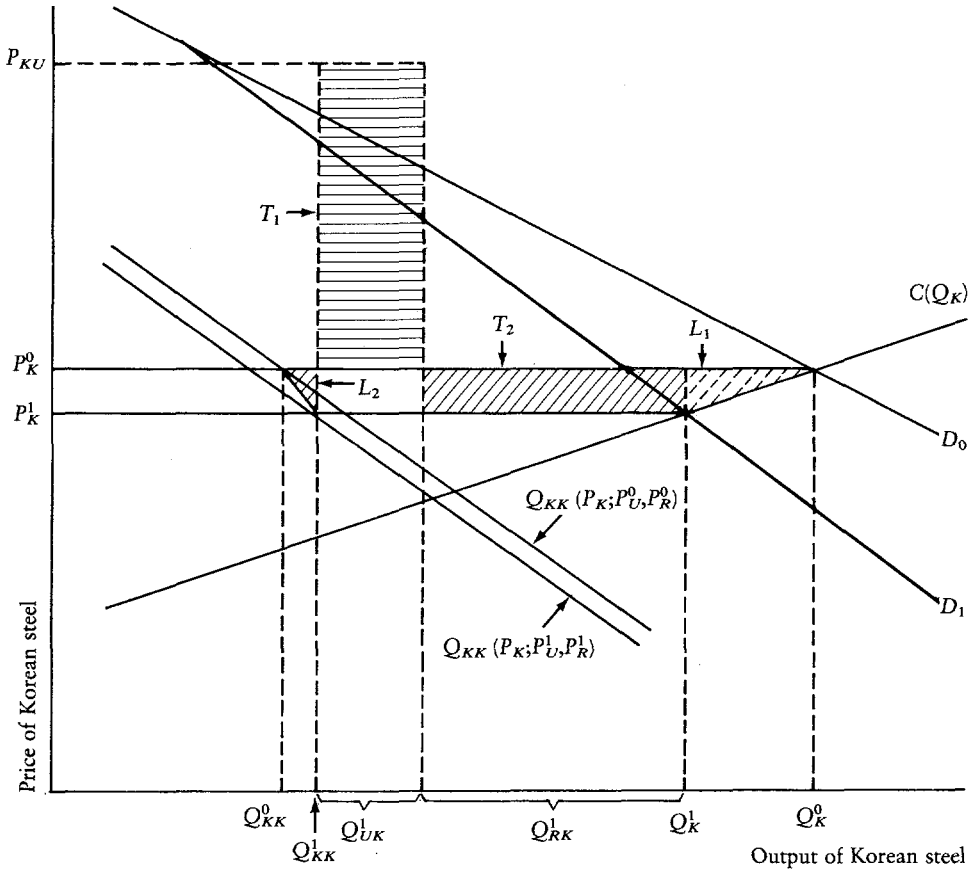
The estimating procedure involves first assuming that the prices and quantities observed in 1984 are equilibrium values determined by the specified system of supply and demand equations. This allows calibration of the constants of the equations. Next, the quotas are imposed and the model is modified accordingly. With the system of supply and demand functions modified by the quotas, new predicted prices and quantities are determined. Changes between predicted prices and quantities and the actual prices and quantities of 1984 are attributed to the effects of the quota.

A methodology has been developed for calculating the welfare effects of the quotas on all three regions and the world. The change in welfare for any region is defined to be the change in producers' plus consumers' surplus. The technique for performing the welfare calculation, which is an extension of the Burns (1973) methodology, is developed in Tarr (1986a).

Figure 1 depicts the relevant costs of restraints on Korean exports in its home market. D_0 is the prequota demand curve for Korean steel from all sources, and D_1 is the postquota demand. $C(Q_K)$ is the Korean supply curve for steel, taken to be the horizontal sum of the individual firms' marginal cost curves. This assumes that Korean and rest-of-world suppliers equate price to marginal costs and that the marginal costs of suppliers are increasing—there are no relevant unrealized economies of scale. Korean home market prequota equilibrium is at price P_K^0 and quantity Q_K^0, and the equilibrium shifts to P_K^1 and Q_K^1 after the imposition of the quota. In the figure, Q_{ij}^0 is the quantity of steel the region i purchases from the region j in the prequota equilibrium, for i and j elements of the set $W = \{K,U,R\}$; Q_{ij}^1 is defined analogously for the postquota equilibrium. For example, Q_{UK}^1 is the quantity of steel the region U purchases from Korea (K) after the imposition of the quota.

Since the quota on Korean exports results in a decline in demand for Korean steel, the postquota price and quantity of steel supplied in Korea declines. With less Korean steel production, Korean resources must be shifted into their next best alternative use. The loss to the Korean economy caused by this shift of resources to less productive alternatives is measured by the triangle of deadweight loss, L_1. The lower price of steel in Korea induces greater consumption of home steel in Korea; at prequota prices the opportunity value of the steel to Korean consumers at the margin was P_K^0. The triangle L_2 measures the deadweight consumption loss,

Figure 1. *Welfare Costs of Restraints on Korean Steel Exports: Home Market Costs*



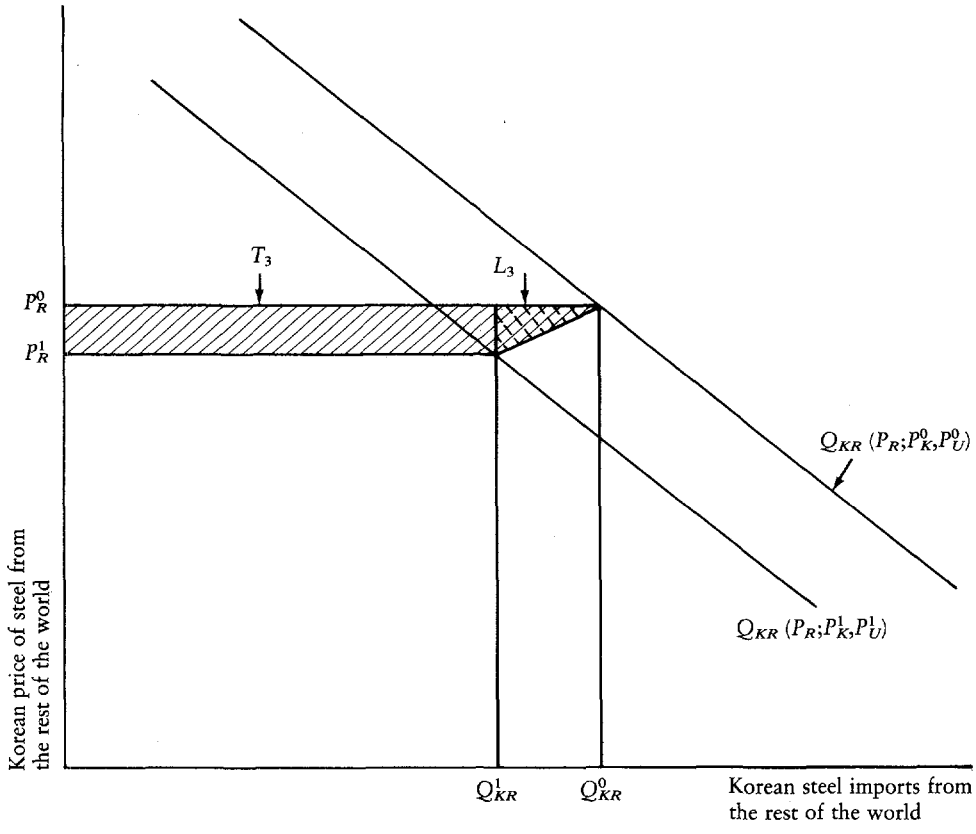
Key: Regions—K = Korea; R = rest of the world; U = United States and EEC. Welfare—L = deadweight loss; T = rent transfer.

this area being the excess of export earnings above the value to consumers of the increased consumption.

Figure 1 also displays two areas of rent transfers. As a result of the quotas, Korea obtains a higher price (P_{KU}) on its sales in the region U. These rents are depicted by the rectangle T_1. Since Korean steel sells at a lower price to R (rest of the world) after the quotas (P_K^1 instead of P_K^0), Korea loses inframarginal rents on these sales. This loss of rents is depicted by the rectangle T_2.

In figure 2, the Korean demand curves for steel from the region R are depicted: because of the differentiation of the product, two-way trade occurs between Korea and the rest of the world. Since the price of steel from R declines after the quotas are imposed in U—the rest of the world is also restrained by quotas—Korean consumers gain surplus on the purchases of steel from R. A direct application of the Burns methodology implies that the Korean gain in consumers'

Figure 2. *Changes in Korean Consumer Surplus on Purchases of Steel from the Rest of the World*



Key: Regions—K = Korea; R = rest of the world; U = United States and EEC. Welfare—L = deadweight loss; T = rent transfer.

surplus on its purchases of steel from R is the rectangle T_3 plus the triangle L_3. A third figure analogous to figure 2 could also be drawn, depicting the changes in welfare attributable to the changes in Korean purchases of steel from the region U. The welfare effects are also analogous.

Thus for Korea, the change in welfare can be reduced to the sum of eight terms. There is an area (L_1) of production inefficiency and an area (L_2) representing consumption inefficiency for Korea of its domestically produced steel. Korea gains rents on its sales to the region U (T_1); these are the "quota rents." Korea also experiences rent losses on its sales to the rest of the world (T_2). Since the price of steel from U increases, Korea loses consumers' surplus on its purchases from U (these terms are not depicted); Korea gains surplus on its purchases from R ($T_3 + L_3$). For R, there are eight terms with a fully analogous interpretation to those for Korea that must be calculated to assess the welfare effects. The region

U loses quota rents on its purchases from Korea and from *R* and suffers deadweight consumption losses on these purchases. It gains rents, however, on sales to *R* and *K*.

The sum of the change in the three regions' welfare is the change in world welfare. Since one region's rent gain is another's loss, rent transfers do not change world welfare unless different countries are accorded different welfare weights or real resources are expended in securing these rent transfers. The analysis has not incorporated the effects of such rent seeking. As discussed below, the change in world welfare can be decomposed into the sum of the deadweight loss triangles.

II. Allocation of Quota Rights

As rents are an essential aspect of the analysis, it is desirable to consider the allocation of the quota rights before discussing the results of the model. The voluntary restraint agreements that the United States and the EEC maintain are bilateral agreements with the major exporters to their home markets. The U.S. agreements with Japan and Korea are typical of the U.S. agreements with non-EEC countries.

In the case of Korea, the VRA is an "arrangement" between the governments of the United States and Korea. It stipulates that Korea will issue export licenses and certificates for the relevant products and that the United States will require presentation of such certificates as a condition of import into the United States. Korea is given specific quantity allowances, on roughly an annual basis, of particular products with quarterly adjustments based on demand forecasts for the U.S. market.

The arrangement stipulates that the Korean Ministry of Trade and Industry (MTI) is responsible for administering the export certificate scheme. The U.S. Department of Commerce provides quarterly reports to MTI regarding the ceiling amount of the specified exports. MTI determines the share of the total allowed exports that goes to each of the Korean steel companies reportedly based on 1983–84 benchmark export performance. MTI has delegated the administrative responsibility for issuing certificates and monitoring adherence to the arrangement to steel industry associations in Korea.[4]

The arrangement between the governments of the United States and Japan is very similar to that between the United States and Korea. While the responsible agency is not specified in the VRA, the Japanese Ministry of International Trade and Industry (MITI) determines company shares calculated from the U.S. Department of Commerce quarterly ceiling data, based on the export performance of the companies during the 1981–84 period. The administrative functions are also handled by an industry organization, the Japan Iron and Steel Exporters Association-U.S.A., explicitly formed for this purpose.

4. The Korean Pipe and Tube Association issues certificates for pipe and tube products, and the Korean Iron and Steel Association issues the certificates for other steel products.

Table 1. *Change in Steel Prices*
(1984 U.S. dollars per metric ton)

Korea	−2.38
United States and EEC	0.38
Rest of the world	−0.20
Korean steel in United States and EEC	24.34
Steel from rest of the world in United States and EEC	19.37

Note: Calculated as postquota equilibrium price minus price in prequota equilibrium.
Source: Author's calculations based on data sources detailed in Tarr (1986a).

III. Summary of Results for the Best-Parameter Estimates

Empirical results of the model, based on the best estimates of the parameters, are discussed below. The discussion starts with the initial price impact, goes on to outline the effects on trade flows, and culminates with an explanation of the overall welfare costs resulting from changes in rents, and production and consumption inefficiency.

The Effect on Prices

Table 1 shows that, as a result of the imposition of the quotas, the price of Korean steel in the United States and EEC rises by $24.34 per metric ton. Similarly, the price of steel from the rest of the world in *U* rises by $19.37 per metric ton. These amounts measure the quota rents per ton earned by Korea and the rest of the world on their remaining sales to the United States and EEC. Conversely, the prices of steel from Korea and the rest of the world decline outside the United States and EEC by $2.38 and $0.20, respectively.[5]

The Pattern of Production

The prices of steel from Korea and the rest of the world decline outside the United States and EEC because imposition of the quotas decreases the demand for steel from these regions. Sales of Korean steel are estimated to decline by 107 thousand metric tons and those of the rest of the world by 3,079 thousand metric tons (table 2). The total decline in sales from Korea and the rest of the world is less than the reduction in their sales to the United States and EEC because both regions increase their sales in their home markets. Exports from Korea to the United States and EEC decline because of the quota, but increase to the rest of the world. The increase in Korean exports to the rest of the world and decrease in exports from the rest of the world to Korea are explained by the decline in price of Korean steel relative to steel from the rest of the world.

The second column of table 2 indicates that the United States and EEC sell more steel after the quota. The increase in total sales of United States and EEC steel, however, is less than the increase in its home market sales because the United States and EEC export less steel: sales are diverted from exports to home markets.

5. The greater decline in the price of Korean steel relative to the drop in price of steel from the rest of the world is attributable to the greater supply elasticity of steel from the rest of the world.

Table 2. *Change in Steel Trade Using Best Estimates of Parameters*
(thousands of metric tons)

	Sales			
Sales	*From Korea*	*From United States and EEC*	*From rest of the world*	*Total*
To Korea	113	−2	−19	92
To United States and EEC	−312	1,218	−3,261	−2,355
To rest of the world	92	−51	201	242
Total	−107	1,165	−3,079	−2,021

Note: Calculated as postquota minus prequota equilibrium.
Source: Author's calculations based on data sources detailed in Tarr (1986a).

The percentage change in output is estimated to be relatively small for all regions: −0.79% for Korea; −0.98% for the rest of the world; and 0.72% for the United States and EEC.

The Pattern of Consumption

The United States and EEC consume less steel due to the increase in the price of steel from all regions in the United States and EEC, but consume more home-produced steel (table 2). Korea and the rest of the world consume more steel after the imposition of the quota because the drop in their demand for steel from the United States and EEC is more than offset by their increased consumption of steel from *K* and *R* due to the decrease in their prices. The world consumes about 2 million tons less steel after the quota.

Welfare Effects—Korea

The welfare effects for all three regions are presented in table 3. Korea is estimated to gain about $32.4 million as a result of the quota. The table shows that the effect of the rent transfers dominates the production and consumption inefficiency losses. The quota-induced higher prices that Korea receives on its sales in the United States and EEC result in an increase of $41.9 million in quota rents. The combined effect of the production and consumption deadweight losses is about one-quarter of a million dollars. Korea lowers its domestic price and its price in the rest of the world, however, which results in a loss of $9.8 million in inframarginal rents on its sales to the rest of the world. Korea gains $0.4 million in total changes in consumers' surplus. The gain in consumers' surplus on its purchases from the rest of the world (where the price has fallen) exceeds the decline in consumers' surplus on its purchases from the United States and EEC (where the price has risen). Since Korea purchases much more steel from the rest of the world than it does from the United States and EEC, this result is not surprising. Moreover, since Korean consumers gain surplus on their purchases of domestic steel (due to its price decrease), we can conclude that overall, Korean consumers' surplus increases.

These results may not be surprising to some, though a model which incorporates unrealized economies of scale might be expected to change the results significantly.

Table 3. *Welfare Costs of U.S. and EEC Steel Import Quotas: Best Estimates of Parameters*
(thousands of 1984 U.S. dollars per year)

	Korea	*United States and EEC*	*Rest of the world*	*World*
Total	32,388	−471,216	402,757	−36,071
Sources of total				
Change in rents from sales to				
Korea	—	69	−548	
United States and EEC	41,937	—	400,614	
Rest of the world	−9,767	6,638	—	
Inefficiency costs				
Production	−128	—	−309	
Consumption	−135	−35,372	−20	
Change in consumers' surplus on imports	481	−442,551[a]	3,020	

— Not applicable.

Note: Calculated as welfare in postquota equilibrium minus welfare in prequota equilibrium. Negative numbers indicate a decline in welfare.

a. The consumption inefficiency costs of U.S. and EEC consumers on purchases of non-home-produced steel are recorded in the line immediately above and are excluded here to avoid double counting.

Source: Author's calculations based on data sources detailed in Tarr (1986a).

The observed high capacity utilization in the Korean steel industry, however, argues for modeling the industry with a lack of unrealized economies of scale.

Welfare Effects—Rest of the World

The rest of the world is estimated (table 3) to gain $402.8 million as a result of the imposition of the quotas. Again the quota rents it earns on sales to the United States and EEC ($400.6 million) dominate the results. The production and consumption inefficiency or deadweight losses are relatively insignificant ($0.329 million). Compared with the inframarginal rent losses of Korea, the rest of the world loses relatively little in inframarginal rents on sales to Korea because its price outside of the United States and EEC falls by less. For the same reason, the rest of the world gains relatively more on consumers' surplus changes outside its home market than does Korea.

Welfare Effects—United States and EEC

The biggest losses as a result of the imposition of the quotas are borne by the United States and EEC, with an estimated $471 million in net welfare costs. While the United States and EEC gain about $6.7 million in inframarginal rents on sales to Korea and the rest of the world, this is offset by the loss of consumers' surplus of $478 million on its purchases of steel from Korea and the rest of the world. In the case of the United States and EEC, these consumers' surplus losses are decomposed in table 3 into consumption inefficiencies of $35.4 million and rent transfers to *K* and *R* of $442.6 million. Over 90 percent of the loss of consumers in the United States and EEC is captured by producers in Korea and the rest of the world, as reflected in the gains in rents for *K* and *R* in table 3.

The $35.4 million difference between the losses of consumers in the United States and EEC and the gains in rents of Korea and the rest of the world is the substantial deadweight losses of consumers in the United States and EEC. That is, consumers in the United States and EEC who were at the margin, but were purchasing steel from Korea or the rest of the world, are squeezed out of the market for steel from these regions and purchase products that were less desirable to them at the prequota prices. Consumers in the United States and EEC lose $31.6 million and $3.8 million resulting from reduced imports from the rest of the world and Korea, respectively (figures are not shown in table 3).

There is also a significant transfer of income from consumers to producers in the United States and EEC. In addition to rents obtained from exports to Korea and the rest of the world (the $6.7 million total from table 3), producers also capture $62 million in the loss of consumers' surplus on domestic purchases of United States and EEC steel. Thus, the total loss to consumers in the United States and EEC is $533 million per year, not just the $471 million shown in table 3; but producers there gain the difference.

What do the United States and EEC obtain and give up as a result of the VRAs? On the one hand, they obtain a small increase in production in the home region and an increase in profits for home producers. On the other hand, the VRAs also result in a large transfer of income toward the exporting regions. As a result of these large transfers, the United States and EEC lose significantly more than they do under the "equivalent tariff," where their losses are confined to the inefficiency costs of protection. These transfers, however, clearly reduce the opposition of the exporting regions, which thereby receive some compensation. Indeed, the estimates suggest they are overcompensated for the inefficiency losses imposed on them through the protection.

Welfare Effects—the World

It is estimated that the world loses $36.1 million per year as a result of the imposition of the system of United States–EEC quotas. This is simply equal to the sum of the change in welfare for the three regions. Further insight can be obtained, however, by decomposing the change in world welfare into appropriate deadweight loss triangles. The great bulk of these losses ($35.4 million) derives from deadweight losses of consumers in the United States and EEC on their purchases of steel from Korea ($3.8 million) and the rest of the world ($31.6 million). Table 3 refers to production and consumption inefficiencies in K and R, which (for K) correspond to the areas L_1 and L_2 in figure 1. It can be shown, however (Tarr 1986a), that the sum of Korean aggregate production inefficiency plus its consumption inefficiency is equal to its production inefficiency on its sales to R and U. Moreover, it is shown that Korea's production inefficiency on its sales to R is captured by consumers in R as additional surplus. Thus, from the perspective of the world, the only inefficiency costs borne by Korea are the production inefficiencies attributable to its lost sales in U. An analogous result holds for R. Production inefficiencies borne by producers in K and R on lost sales

in *U* are $0.372 million and $0.327 million, respectively. Thus, the losses to the world can be reduced to production and consumption inefficiencies related to imports into *U*. This is consistent with the Harberger (1971) principle that since price equals marginal costs in all other markets, there are no resource misallocation costs related to reallocations in those markets. The deadweight losses estimates are unchanged if the equivalent tariff method of protection is adopted.

Summary of Best Estimates

Welfare gains for Korea and the rest of the world result from the large quota rents earned on sales to the United States and EEC. The resource misallocation costs incurred by Korea and the rest of the world are small in relation to the rent transfers, so that the net effect of the VRAs on the exporting nations is beneficial. Since one region's positive rent transfer is another region's negative rent transfer, the rent transfers do not affect world welfare unless they induce economically wasteful behavior. Thus, there is a decline in world welfare equal to the sum of the resource misallocation costs for all the regions.

The protecting economies, however, suffer a significant decline in welfare. They lose the resource misallocation costs plus the rent transfers to the nations from which they import. Their producers gain from the restraints, but most of these gains are offset by additional losses to their consumers, above the losses to the economy shown in table 3.

The experience of the Organization of Petroleum-Exporting Countries cartel should help to make these results intuitive. In the mid-1970s, by effectively organizing most of the world's oil exporters to the non–centrally planned economies, the cartel dramatically increased its welfare through rent transfers. It does not make any difference in the global welfare analysis whether the restraint on the exports is imposed by the exporting region or the importing region. What matters is the level of the restraint and how significant are the suppliers who are not restrained. (In the next section simulations are performed that demonstrate the importance of restraining alternative suppliers in this model.) In the case of steel exports, the United States and the EEC have restrained exports from virtually all significant suppliers. This allows exporters to capture monopoly rents arising from the restriction of supply since other suppliers cannot compete and drive down those rents.

Limitations of the Model

The model can be extended in a number of ways:

Rent seeking. There are many ways that rent seeking (broadly defined) might dissipate the rents of the exporting nations. For example, lobbying activities, allocation of quota rights to other than the most efficient suppliers, and transshipment activities would serve to reduce the rents. To the extent that rent seeking is important empirically, these estimates (which ignore the rent-seeking effects) overstate the benefits to the exporting nations from the quotas.

Economies of scale. If there are unrealized economies of scale in Korea or the rest of the world, these would be expected to increase the inefficiency costs associated with the output reduction caused by the quotas.

Cartelization. Where import competition would otherwise prohibit cartelization, producers in the restraining region may be able to collude behind the protection of VRAs. Any such cartelization, which would raise prices above marginal costs in the restraining region, would add further to the costs of protection in the restraining region.

New entry. The effects of the restraints on entry have not been analyzed. Potential steel producers may be discouraged from entering because of fear of restraint in the major export markets. Conversely, the existence of quota rents for and restraints on the most efficient suppliers may encourage new entry. By diverting demand, new entry would lower the rents of the incumbent suppliers in the restrained region.

Second-best considerations. The model has assumed that private and social costs and benefits are identical in the alternate use of resources.

Elasticity assumptions. The impact of alternate elasticities and policies on the estimates has not yet been considered. This is addressed in the next section.

III. Alternate Elasticity and Policy Simulations of the Model

Different Quota Levels

The alternate policies of a more restrictive quota on Korea and a less restrictive quota on the rest of the world have also been simulated in the model. The results of these simulations are combined in tables 4, 5, and 6. The results of the simulation of a less restrictive quota on *R* (just one ton less than its prequota equilibrium) are shown without parentheses. The results of a tighter export quota on Korea (reducing exports by 413,000 tons rather than the prior 312,000) are shown in parentheses. It was found that Korean welfare decreased with a loosening of the restraint on *R*, and the welfare of *R* increased with a tightening of the restraint on Korea. That is, the welfare of one of the restrained regions increases or decreases, as the restraint on the other region is tightened or loosened, respectively. In addition, there was a very small decrease in the welfare

Table 4. *Simulated Change in Steel Prices: Higher Quotas for Rest of World and Lower Quotas for Korea (in Parentheses)*
(1984 U.S. dollars per metric ton per year)

Korea	−2.35	(−3.14)
United States and EEC	0.03	(0.39)
Rest of the world	0.00	(−0.20)
Korean steel in United States and EEC	11.12	(27.94)
Steel from rest of the world in United States and EEC	1.27	(19.77)

Note: Calculated as price in postquota equilibrium minus price in prequota equilibrium.
Source: As in table 1.

Table 5. *Simulated Change in Steel Trade: Higher Quotas for Rest of the World and Lower Quotas for Korea (in Parentheses)*
(thousands of metric tons per year)

	Sales			
Sales	*From Korea*	*From United States and EEC*	*From rest of the world*	*Total*
To Korea	113 (150)	−2 (−2)	−22 (−27)	89 (121)
To United States and EEC	−312 (−413)	83 (1,245)	−1 (−3,261)	−230 (−2,429)
To rest of the world	93 (122)	−5 (−52)	−29 (192)	60 (262)
Total	−106 (−141)	77 (1,190)	−52 (−3,096)	−81 (−2,047)

Note: Calculated as postquota minus prequota equilibrium.
Source: As in table 1.

of Korea with the tighter restraint on it, implying that the tighter restraint exceeded the optimal level of monopoly restriction of export. In the case of a significantly less binding restraint on *R*, the costs to the United States and EEC are reduced dramatically (by over 90 percent), and the gains to Korea and *R* decrease.

Table 6. *Simulated Welfare Costs of U.S. and EEC Steel Import Quotas: Higher Quotas for Rest of the World and Lower Quotas for Korea (in Parentheses)*
(thousands of 1984 U.S. dollars per year)

	Korea	*United States and EEC*	*Rest of the world*	*World*
Total	9,270	−50,877	39,504	−2,103
	(32,359)	(−485,563)	(414,214)	(−38,990)
Sources of total				
Change in rents from sales to				
Korea	—	5	−9	
		(71)	(−550)	
United States and EEC	19,163	—	30,420	
	(45,316)		(409,084)	
Rest of the world	−9,640	437	—	
	(−12,982)	(6,779)		
Inefficiency costs				
Production	−124	—	0[a]	
	(−222)		(−312)	
Consumption	−133	−1,736	0[a]	
	(−235)	(−38,012)	(−19)	
Change in consumers' surplus on imports	5	−49,583[b]	9,093	
	(482)	(−454,400)	(6,011)	

— Not applicable.
Note: Calculated as welfare in postquota equilibrium minus welfare in prequota equilibrium. Negative numbers indicate a decline in welfare.
a. The small amount of production and consumption inefficiency for the rest of the world is rounded off to zero.
b. The consumption inefficiency costs of U.S. and EEC consumers on purchases of non-home-produced steel is recorded in the line immediately above and is excluded here to avoid double counting.
Source: As in table 1.

Table 7. *Simulated Change in Steel Prices: Alternative Demand Elasticities*
(1984 U.S. dollars per metric ton)

Korea	−2.38
United States and EEC	0.34
Rest of the world	−0.20
Korean steel in United States and EEC	5.23
Steel from rest of the world in United States and EEC	17.19

Note: Calculated as price in postquota equilibrium minus price in prequota equilibrium. The U.S. own elasticity for Korean steel is taken to be −10, and the U.S. cross-elasticity of demand for Korean steel with respect to the price of steel from the rest of the world is taken to be 0.5.

Source: As in table 1.

Table 8. *Simulated Change in Steel Trade: Alternative Demand Elasticities*
(thousands of metric tons)

	Sales			
Sales	*From Korea*	*From United States and EEC*	*From rest of the world*	*Total*
To Korea	113	−2	−19	92
To United States and EEC	−312	1,077	−3261	−2496
To rest of the world	92	−46	198	244
Total	−107	1,029	−3082	−2,160

Note: Calculated as postquota equilibrium minus prequota equilibrium. The U.S. own elasticity for Korean steel is taken to be −10, and the U.S. cross-elasticity of demand for Korean steel with respect to the price of steel from the rest of the world is taken to be 0.5.

Source: As in table 1.

Alternate Elasticity Assumptions

Some alternative elasticity assumptions have also been simulated in the model. Most notably, we attempted to determine if there were elasticity values that would result in a loss in Korean welfare as a result of the existing system of quotas; the results of that simulation are presented in tables 7, 8, and 9. The selected elasticities in this simulation are: −10 for the United States and EEC elasticity of demand for Korean steel with respect to a change in the price of Korean steel in the United States and EEC (instead of the prior −4.512); and 0.5 for the United States and EEC elasticity of demand for Korean steel with respect to a change in the price of steel from *R* in the United States and EEC (instead of the prior 4.503). While the selected elasticities are theoretically plausible, they are not values for which we have empirical support. In these cases, however, the net decline in Korean welfare is due to lost inframarginal rents on its sales to *R*, rather than because the resource misallocation costs come to dominate.

In addition, simulations have been performed that estimated the effects of increased substitutability of steel products in the demand functions of the regions. It was found that the less differentiated the products among regions, the less the costs to the world, the United States, and the EEC, and the smaller the gains to Korea and *R* of the existing quota system.[6] This is essentially

6. See Tarr (1986a) for the detailed estimates of this simulation.

Table 9. *Simulated Welfare Costs of U.S. and EEC Steel Import Quotas: Alternative Demand Elasticities*
(thousands of 1984 U.S. dollars per year)

	Korea	*United States and EEC*	*Rest of the world*	*World*
Total	−531	−387,565	358,552	−29,545
Sources of total				
Change in rents from sales to				
Korea	—	62	−549	
United States and EEC	9,011	—	355,630	
Rest of the world	−9,769	5,860	—	
Inefficiency costs				
Production	−128	—	−309	
Consumption	−135	−28,846	−20	
Change in consumers' surplus on imports	489	−364,641[a]	3,800	

— Not applicable.

Note: The U.S. own elasticity for Korean steel is taken to be −10, and the U.S. cross-elasticity of demand for Korean steel with respect to the price of steel from the rest of the world is taken to be 0.5. Welfare in postquota equilibrium minus welfare in prequota equilibrium. Negative numbers indicate a decline in welfare.

a. The consumption inefficiency costs of U.S. and EEC consumers on purchases of non-home-produced steel are recorded in the line immediately above and are excluded here to avoid double counting.

Source: As in table 1.

because consumers are not having to divert demand to less preferred types of steel.

The Equivalent Tariff

The impact of altering the restraint from a quota to an "equivalent tariff" (in the sense defined by Bhagwati 1965) was also estimated retaining the elasticity assumptions underlying tables 1, 2, and 3. The welfare results are presented in table 10. It follows from the adopted definition of equivalent tariff that the price and trade flow effects are the same as under the quota; thus tables 1 and 2 show these effects. It was found that if the United States and the EEC employed tariff barriers to raise the tariff-inclusive import price in their home market by the same amount as the estimated price increase of the quota, then all three regions in the model lose, while resource misallocation costs for the world are unchanged. Thus, the tariff transforms Korean and rest of the world's welfare gains into net losses.

IV. Conclusion

This article has developed a model through which we may evaluate the effect on a nation of a restraint imposed on its exports by an importing nation. The model was formulated for a three-region model of world trade in a particular product, so that the effects (in terms of price changes and trade flows) on any of the regions may be determined. A methodology was developed for evaluating the resulting welfare changes on any of the regions in the model and on the world.

Table 10. *"Equivalent Tariff" Welfare Costs*
(thousands of 1984 U.S. dollars per year)

	Korea	*United States and EEC*	*Rest of the world*	*World*
Total	−13,655	−20,409	−2,006	−36,071
Sources of total				
Change in rents from sales to				
Korea	—	69	−548	
United States and EEC	−4,107	—	−4,149	
Rest of the world	−9,767	6,638	—	
Inefficiency costs				
Production	−128	—	−309	
Consumption	−135	−35,372	−20	
Change in consumers' surplus on imports	481	8,256[a]	3,020	

— Not applicable.

Note: Welfare in posttariff equilibrium minus welfare in pretariff equilibrium. Negative numbers indicate a decline in welfare.

a. The consumption inefficiency costs of U.S. and EEC consumers on purchases of non-home-produced steel are recorded in the line immediately above and are excluded here to avoid double counting.

Source: As in table 1.

The model has been used to analyze the effects on the Republic of Korea of the restraints (primarily quantitative) imposed on their exports to the United States and the EEC. As expected, it was found that the United States and the EEC suffered significant losses as a result of imposing the restraints. The largest part of these losses was quota rents transferred to Korea and the rest of the world. The resource misallocation costs incurred by the latter two regions were smaller than the quota rents they earned; under most of the reasonable assumptions about the parameters in the model, Korea and the rest of the world gain after the imposition of the quotas. Simulations with a more restrictive quota on Korea combined with a less restrictive quota on the rest of the world showed that the welfare of one restrained region increases (decreases) as the quota on the other exporting region is tightened (loosened). In the case of the steel restraints, an "equivalent" tariff would transform Korea and the rest of the world from net beneficiaries to net losers as a result of a restraint.

Although we were concerned in this article with applying the model to the steel restraints imposed on Korea, other countries or products could be substituted in the model provided the appropriate economic analysis of the values of the parameters was performed. Although definitive qualitative results are often difficult to obtain, the model appears to provide results that are consistent with economic theory, and thus should be useful for obtaining quantitative results on the effects of trade barriers in a variety of contexts.

Appendix: The Mathematical Structure of the Model

After the United States imposed its quota system, due to the prior existence of the EEC restraint system, essentially no steel beyond the quota level could be

exported to the United States or the EEC. Thus, it is reasonable to group the United States and the EEC together as one restraining region. Since we are interested in the impact of the quotas on Korea in particular, we separate Korea from the rest of the world in defining the regions of the model. Thus we divide the world into three regions: Korea *(K)*; the United States and the EEC *(U)*; and the rest of the world *(R)*.

It is assumed in the following that each region has demand functions that are differentiated by place of production. This is the Armington (1969) assumption, but the Armington elasticities are not assumed throughout.

Demand Functions

Each region has a demand function for steel from its own region, as well as for each of the other two regions. If Q_{ij} is defined to be the ith country's demand for the jth country's product, then we take:

$$Q_{ij} = a_{ij} + \sum_k b^i_{jk} P_k \qquad i,j,k \in W = \{K,U,R\} \tag{1}$$

where P_k is the price of the kth region's product, W is the set of the three regions, the a_{ij}s are constants, and the b^i_{jk}s are constants reflecting the slope of the ith region's demand for the jth region's product with respect to a change in the kth region's price. Since there are three regions, we have nine demand functions, where each of the demand functions depends on all of the steel prices.[7] Clearly there are variables other than price that affect the quantity of steel demanded in a region. We can think of the a_{ij}, in equation 1, as being a function of a vector of parameters that affect the demand for steel, $[a_{ij} = f^{ij}(\theta)]$. A comparative statics exercise will be conducted, where the vector θ is held constant at its value in the initial equilibrium. This implies that the a_{ij}s are constants in the comparative statics exercise.[8]

7. If the relevant demand functions or production functions are weakly separable between steel products and other products, then the demand for steel products may be written as a function of the prices of steel products alone and income allocated to steel. Nonsteel prices will affect steel demand only through their impact on the income allocated to steel. By writing the demand functions in the manner of equation 1, we are making the weak separability assumption. See Tarr (1986b) for a discussion of the implications of weak separability on the elasticities of demand. With this assumption the model is in the spirit of "quasi" general equilibrium models; see Corado and de Melo (1985).

8. More generally we could think of the Q_{ij} as being a function, possibly nonlinear, of the vector of prices and the vector of parameters. That is, $Q_{ij} = F^{ij}(P,\theta)$, where P is the vector of prices of the three regions. The constants b^i_{jk} in equation 1 could be thought of as the partial derivatives of the F^{ij} evaluated at equilibrium. That is,

$$b^i_{jk} = \frac{\delta F^{ij}(P,\theta)}{\delta P_K},$$

where the partial derivatives are evaluated at the values of P and θ in the initial equilibrium. The set of demand equations 1 would then represent a linear approximation to the demand equations F^{ij} in the neighborhood of the initial equilibrium. For changes in prices or quantities in the neighborhood of equilibrium, we could use equations 1 to approximate the changes in F^{ij}.

The demand elasticities that we employ are based on the work of Grossman (1982) and Armington (1969). Since both of those authors employed specifications that resulted in constant own and cross-elasticities of demand, the slopes employed in equations 1 are linear approximations to the constant elasticities and are accurate in a neighborhood of equilibrium.

Supply Functions

A supply function is specified for each region:

$$S_i = \alpha_i + \beta_i P_i \qquad i \in W \tag{2}$$

where S_i is the quantity supplied in the ith country, and the α_i and β_i are constants with interpretations analogous to the a_{ij} and b^i_{jk} of the demand functions.[9]

Equilibrium Conditions

For equilibrium to prevail it is necessary that:

$$S_j(p) = Q_j(p) = \sum_i Q_{ij}(p) \qquad i,j \in W \tag{3}$$

where $Q_j(p)$ is the aggregate demand across regions for the jth region's product, and p is the vector of prices. If we define the ith region's excess supply as:

$$X_i(p) = S_i(p) - Q_{ii}(p) \qquad i \in W \tag{4}$$

then equation 3 is equivalent to:

$$X_j(p) = \sum_{i \neq j} Q_{ij}(p) \qquad i,j \in W. \tag{5}$$

Suppose we work with the system of equations defined by equation 3. Then equilibrium exists at:

$$\alpha_j + \beta_j P_j = a_j + \sum_k \hat{b}_{jk} P_k \qquad j,k \in W \tag{6}$$

where we define the variables $a_j = \sum_i a_{ij}$ and $\hat{b}_{jk} = \sum_i b^i_{jk}$ for $i,j,k \in W$. Converting to matrix notation, equilibrium is at:

$$p = [B - \beta]^{-1} [\alpha - a] \tag{7}$$

where α and a are vectors of the α_i and a_i, B is a three-by-three matrix of the $\hat{b}_{jk}$, that is, $B = [\hat{b}_{jk}]$, and β is a diagonal matrix with the β_i on the diagonal. With the equilibrium price vector, the quantities going to each region are determined from equation 1.

Equations 1 characterize the demand functions of the regions when there are no restraints. If quantitative restraints are imposed, however, the equations would have to be altered. That is, the quantity of steel entering the region U from K and R is fixed by the quotas, yielding $Q_{UK} = Q^*_{UK}$ and $Q_{UR} = Q^*_{UR}$, where the asterisk denotes the fixed quantity set by virtue of the quota. This reduces the

9. Each supplier is assumed to be indifferent as to the place of sale and sells to the highest bidder. Thus only one price is specified in the supply functions.

In our model we aggregate over all steel products. In fact, there are many steel products, and producers have a certain amount of ability to substitute production of one for another. The supply function would more accurately be characterized in disaggregated form as a function of the prices of all the separate products the producers are able to produce. When a quota is imposed, producers may substitute production of one product for another as profit conditions and constraints indicate. Such diversion and upgrading possibilities should imply that constrained producers lose less than will be implied by the aggregate approach taken here (see, for example, Falvey 1979).

number of unknown quantity variables that have to be determined from nine to seven.

Conversely, the existence of the quota in the region U implies, for binding levels of the quota, that there is a wedge between the price of Korean steel in U and the price of Korean steel in K and R. Similarly, there is a wedge between the price of steel from R in U and the price of steel from R in K and R. This implies that while there were only three prices in the prequota system, there are five prices to determine after the quota is imposed: P_K, the price of Korean steel in Korea and R; P_U, the price of steel from U; P_R, the price of steel from the rest of the world in R and K; P_{KU}, the price of Korean steel in U; and P_{RU}, the price of steel from R in U. In what follows, define the price vector $P^t = (P_K, P_U, P_R, P_{KU}, P_{RU})$, where the superscript t denotes transpose so that P is a column vector.

Assume that in the postquota equilibrium the quotas are binding and let $\hat{Q}_K(P)$ equal the demand for Korean steel from R and K after the quota. Then, since there is no price wedge in K or R we have:

$$\hat{Q}_K(P) = Q_{KK}(P) + Q_{RK}(P) \tag{8}$$

where the demand functions on the right-hand side of equation 8 come from equation 1. Similarly, for the region R we have:

$$\hat{Q}_R(P) = Q_{KR}(P) + Q_{RR}(P) \tag{9}$$

where again the right-hand-side functions come from equation 1.

With binding quotas, the Korean price in U exceeds the Korean price elsewhere, that is, $P_{KU} > P_K$, where P_K is taken to be the price of Korean steel outside of U. Similarly, $P_{RU} > P_R$. Korean suppliers will therefore fill their quota allotment in U before selling any steel elsewhere. This implies that the steel supply function of K to regions outside of U is equal to the original supply function less the quota allotment to U. Thus, for equilibrium to prevail in the market for Korean steel outside of U, we must have the quantity of Korean steel demanded outside of U equal to the quantity of Korean steel supplied outside of U:

$$\hat{Q}_K(P) = Q_{KK}(P) + Q_{RK}(P) = \alpha_K - Q^*_{UK} + \beta_K P_K. \tag{10}$$

An alternative way of arriving at equation 10 is to consider the demand for Korean steel from all sources. This would be: $\hat{Q}_K(P) + Q^*_{UK}$. This total demand would have to be equal to the total supply for equilibrium to prevail. Since, at the margin, Korean suppliers will receive the price P_K that prevails outside of U, for equilibrium we have:

$$\hat{Q}_K(P) + Q^*_{UK} = \alpha_K + \beta_K P_K. \tag{11}$$

Equations 10 and 11 are obviously equivalent.

An entirely analogous argument for the region R yields a second equilibrium condition:

$$\hat{Q}_R(P) = Q_{KR}(P) + Q_{RR}(P) = \alpha_R - Q^*_{UR} + \beta_R P_R. \tag{12}$$

Define $b_{jk} = \sum_{i \neq U} b^i_{jk}$. Then substituting the relevant demand functions from equation 1 into equation 10, and utilizing the definition of b_{jk} yields the version of the equilibrium condition with which we will work:

$$(13) \quad (b_{KK} - \beta_K) P_K + b_{KU} P_U + b_{KR} P_R = \alpha_K - Q^*_{UK} - a_{KK} - a_{RK}.$$

Arguing analogously again for the region R yields the equilibrium condition:

$$(14) \quad b_{RK} P_K + b_{RU} P_U + (b_{RR} - \beta_R) = \alpha_R - Q^*_{UR} - a_{KR} - a_{RR}.$$

Now consider the supply and demand for steel from producers in the region U. If there is to be equilibrium, it is necessary that quantity demanded equals quantity supplied in this market:

$$(15) \quad Q_U(P) = Q_{KU}(P) + Q_{UU}(P) + Q_{RU}(P) = \alpha_U + \beta_U P_U.$$

Since the regions K and R are not restraining imports and have no wedges between their home prices and world prices, we may substitute for $Q_{KU}(P)$ and $Q_{RU}(P)$ from equation 1 into equation 15. With respect to the region U, however, we must substitute the prices actually faced by consumers in U into their demand function. Since they face higher prices than exist elsewhere in the world, we have:

$$(16) \quad Q_{UU}(P) = a_{UU} + \sum_{j \in W} b^U_{U_j} P_{jU},$$

where P_{jU} is the price of the jth region's product in U and $P_{UU} = P_U$. Also substituting equation 16 into equation 15 yields the equilibrium condition:

$$(17) \quad b_{UK} P_K + (\hat{b}_{UU} - \beta_U) P_U + b_{UR} P_R + b^U_{UK} P_{KU} + b^U_{UR} P_{RU} = \alpha_U - a_U$$

where, as in equation 6, we define $\hat{b}_{UU} = \sum_{j \in W} b^i_{UU}$.

We now have three equations, from the three equilibrium conditions, but five unknowns in the price vector. The additional two equations required are the equations that clear the market for steel from K and R in U. When the region U imposes a quota on steel from K or R, the prices must adjust to clear the market at the fixed quantity. Thus, we focus on the region U's demand functions for steel from K and R, respectively. We have:

$$(18) \quad \sum_{j \in W} b^U_{Kj} P_{jU} = Q^*_{UK} - a_{UK} \qquad \text{and}$$

$$(19) \quad \sum_{j \in W} b^U_{Rj} P_{jU} = Q^*_{UR} - a_{UR}.$$

Combining the five equilibrium conditions, we have:

$$(20) \quad (b_{KK} - \beta_K) P_K + b_{KU} P_U + b_{KR} P_R = \alpha_K - Q^*_{UK} - a_{KK} - a_{RK}$$

$$(21) \quad b_{UK} P_K + (\hat{b}_{UU} - \beta_U) P_U + b_{UR} P_R + b^U_{UK} P_{KU} + b^U_{UR} P_{RU} = \alpha_U - a_U$$

$$(22) \quad b_{RK} P_K + b_{RU} P_U + (b_{RR} - \beta_R) = \alpha_R - Q^*_{UR} - a_{KR} - a_{RR}$$

$$(23) \quad b^U_{KK} P_{KU} + b^U_{KU} P_U + b^U_{KR} P_{RU} = Q^*_{UK} - a_{UK}$$

$$(24) \quad b^U_{RK} P_{KU} + b^U_{RU} P_U + b^U_{RR} P_{RU} = Q^*_{UR} - a_{UR}.$$

Define the matrix A as the matrix of coefficients of the price vector in equations 20–24, that is:

$$A = \begin{bmatrix} (b_{KK} - \beta_K), & b_{KU}, & b_{KR}, & 0, & 0 \\ b_{UK}, & (\hat{b}_{UU} - \beta_U), & b_{UR}, & b^U_{UK}, & b^U_{UR} \\ b_{RK}, & b_{RU}, & (b_{RR} - \beta_R), & 0, & 0 \\ 0, & b^U_{KU}, & 0, & b^U_{KK}, & b^U_{KR} \\ 0, & b^U_{RU}, & 0, & b^U_{RK}, & b^U_{RR} \end{bmatrix}$$

Define the vector c as the vector of constants on the right-hand side of equations 20–24. We may rewrite 20–24 in matrix notation as:

$$A\,P = c. \tag{25}$$

The equilibrium price vector can be determined from 25 by inverting:

$$P = A^{-1}c. \tag{26}$$

Once we have the predicted postquota equilibrium prices and quantities, we can calculate welfare effects of the quotas on all three regions. The methodology for performing the welfare calculation, which is an extension of the Burns (1973) methodology, is developed in Tarr (1986a).

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Nigeria During and After the Oil Boom: A Policy Comparison with Indonesia

Brian Pinto

Nigeria and Indonesia provide an interesting contrast with regard to performance and policy during and after the oil boom. Roughly a decade after the first oil shock, Nigeria is faced with several economic problems including a serious decline in its agricultural sector and a deteriorating external debt situation. While some decline in the nonoil traded goods sector reflects efficient adjustment to the oil boom, policy with regard to public expenditure, exchange rates, pricing, and the trade regime could exacerbate such decline and impede readjustment as the boom subsides. The links between oil prices, deficits, inflation, and real exchange rate appreciation are analyzed and Nigerian and Indonesian fiscal and exchange rate and agricultural and foreign borrowing strategies are compared. It is concluded that with the exception of cuts in the deficit since 1984, Nigerian policy following the boom has not been conducive to adjustment to the current period of low oil prices and high real interest rates. Corrective measure and policy options are discussed. A postscript gives post–September 1986 policy changes.

Nigeria, a member of the Organization of Petroleum-Exporting Countries (OPEC), is an exporter of coveted high- (bonny light) and medium-grade crude oil. The oil price shocks of 1973–74 and 1979 resulted in a large transfer of wealth to Nigeria. Public expenditure increased greatly, as did the country's access to international capital markets. Evidence of "Dutch disease" emerged during this period: agriculture, the main nonoil tradables sector, declined. Following the collapse of oil prices in 1982 and the rise in real interest rates, Nigeria experienced rising inflation, strict rationing of foreign exchange, and the possibility of debt rescheduling. This coincided with the rise of parallel markets, so that an illegal, floating-rate parallel market coexisted with an official, fixed-rate market.

This article analyzes the Nigerian experience during and after the oil boom; Indonesia is used as a contrast for policy comparison. The two countries are similar in being heavily populated oil exporters, dependent on agriculture and primary sectors as the chief source of nonoil exports and having similar trade policies, including protection of capital-intensive industry and manufacturing.

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The main differences, it will be argued, are in their fiscal and exchange rate, agricultural, and external debt policies.

Section I describes the process of adjustment to an oil boom. The implications of the exchange rate regime and fiscal policy are discussed. Section II presents data on Nigeria and Indonesia and compares their policies. Section III discusses post–oil boom adjustment issues for Nigeria.

I. Response to the Oil Boom: Public Expenditure, Real Exchange Rates, and Macroeconomic Policy

Faced with higher immediate and anticipated income after 1973, the Nigerian government had a range of choices: it could consume the increase currently, in the future, or spread the increased consumption over time. If part of the wealth were to be saved for future consumption, this could be achieved via increased investment in foreign assets or domestic physical capital. Finally, it could spend *more* than the current addition to income, that is, it could borrow. The decisions on these issues are based on interactions between the social rate of time preference (consumption now versus later), the relative rates of return between physical and financial assets (a question of portfolio choice), and expectations regarding oil prices and, hence, future revenues.[1]

The dominance of oil in the Nigerian economy is evident from the data in table 1. The share of oil in gross domestic product (GDP) and exports rose sharply after 1970–73. This rendered the Nigerian terms of trade virtually synonymous with the price of oil deflated by the import price index. In all the years except those immediately following the two oil shocks, domestic absorption exceeded GDP and national disposable income. This was reflected in current account deficits, which arose in 1976–78 and 1981–83.

Comparative data on Indonesia in table 1 suggest that the main difference between the two appears to be the more moderate rise in the share of oil in total exports in Indonesia.

The Oil Boom and the Real Exchange Rate

Commodity booms are traditionally analyzed in terms of "spending" and "resource movement" effects.[2] We abstract from the "resource movement" effect because the oil sector can be considered to be a separate enclave with its own capital, labor, and technology: it does not compete with the nonoil economy for resources.

The "spending" effect operates as follows: in the nonoil economy, both tradables and nontradables are produced (henceforth, we shall use "tradables"

1. Gelb (1986) presents estimates of the size of the oil windfall and its disposition for several middle-income oil exporters, including Nigeria and Indonesia.

2. Much of the discussion here is based on Neary and van Wijnbergen (1986, chap. 1). See also the references therein. For other policy-based discussions on the adjustment, see Gelb (1986), Nankani (1979), and Glassburner (n.d.). A commodity boom study of interest is in Edwards (1984).

Table 1. *Oil Production, Oil Exports, and the Current Account Balance: Nigeria and Indonesia*

	Oil production as percentage of GDP		*Oil exports as percentage of total exports*		*Current account balance as percentage of GDP*	
Year	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*
1970	8.1	5.2	57.5	40.3	−3.8	−3.4
1971	11.1	8.0	74.5	45.8	−3.3	−4.0
1972	13.4	10.8	81.9	51.4	−2.4	−3.0
1973	16.6	12.3	85.0	50.1	−0.1	−2.9
1974	31.9	22.2	92.9	70.2	16.9	2.3
1975	20.4	19.7	93.2	74.8	0.1	−3.6
1976	22.9	18.9	93.3	70.2	−0.8	−2.4
1977	22.6	18.9	93.4	67.2	−2.1	−0.1
1978	22.6	19.2	90.5	63.9	−7.2	−2.7
1979	26.3	21.8	93.4	56.9	2.5	1.9
1980	19.4	25.7	96.1	58.7	5.8	4.0
1981	22.2	24.0	96.9	64.6	−6.7	−0.7
1982	19.1	19.6	98.6	66.7	−8.6	−5.9
1983	15.2	18.5	96.3	63.7	−5.0	−7.8
1984	12.9[a]	17.7	96.3[a]	55.2	0.5[a]	−2.5
1985	—	—	—	41.3	—	−2.0

— Not available.

a. Estimates.

Sources: Oil output and Nigerian GDP: World Bank data and estimates. Indonesian GDP, oil exports, total exports, and the current account balance: International Monetary Fund, *International Financial Statistics,* various years.

to refer to tradables other than oil). Let r denote the relative price of tradables to nontradables, which we define as the real exchange rate. Assuming tradables and nontradables are normal goods, the demand for both increases following the rise in real income associated with the oil boom.

Equilibrium in this model can be described solely in terms of market clearing for the nontraded good, for which by definition, domestic demand must equal domestic supply. The excess demand for nontraded goods that arises following the boom can be eliminated by a rise in their relative price, that is, a fall in r. This draws resources out of the tradables sector into the nontradables sector, so that nontradables output rises and tradables output falls. The consequent decline in the tradables sector is called "Dutch disease." It is accompanied by real appreciation, that is, a fall in r. Strictly, there is no "disease" since the boom enables the economy to attain a higher level of consumption and welfare. Real appreciation is necessary for efficient adjustment to the boom, since traded goods can be imported.

Real appreciation by itself, therefore, does not constitute grounds for intervention. There might be some basis for providing assistance to the declining sector, however, on allocative and distributional grounds. The relevant nonoil tradables sector in Nigeria and Indonesia is agriculture. Owing to the reduced competitiveness of agriculture during the oil boom, the farmer may be dissuaded from using better inputs and more advanced techniques, or even from buying

fertilizer. This may create setbacks to long-run agricultural development, and thus provide an argument for subsidies and special assistance programs to agriculture during the oil boom. Of course, we already live in a second-best world, and intervention may be desirable in the case of market failure irrespective of an oil boom; but the boom would raise the optimal level of subsidy if capital market imperfections exist, which is the presumption in Nigeria and Indonesia (see Neary and van Wijnbergen 1986).

Government Spending and Real Exchange Rates

Oil revenues accrue to the government in the first round, whether through direct sales, royalties, or taxes. Therefore, the composition and timing of government spending are important (see, for example, Harberger 1983).

Government spending is biased toward construction, services, and capital-intensive investments in protected sectors, which are essentially nontradable. Wages and salaries are also important components of government spending. In addition to these direct effects on the nontradables market, the rise in private disposable income also creates excess demand for nontradable goods as a result of the "spending effect," causing real appreciation. This leads to a reallocation of resources in the nonoil economy.

The major domestic productive resource in the nonoil economy in Nigeria and Indonesia is labor. With government spending concentrated in urban centers and on nontradables, mobile labor moves from agriculture to services and construction in cities. This can occur due to a rise in the real wage in terms of tradables and a fall in terms of nontradables, which is exactly what a short-run model with sector-specific capital and mobile labor would predict.

Government Spending and the Money Supply

Following the analysis of the oil boom as a real phenomenon above, monetary aspects of it are now reviewed. The analysis assumes fixed exchange rates and capital controls, which would be descriptive of Nigeria. Later, these assumptions are relaxed.

The increase in foreign exchange as a result of the oil boom accrues to the government and is deposited in the central bank. If it accrued to private citizens and were deposited in commercial banks, an increase in the money supply would occur in the usual way through the money multiplier. Since the increase is deposited in the central bank, however, there will be no increase in the domestic money supply unless the government spends at home out of the increased oil earnings, or domestic credit to the private sector is increased. This is because in the absence of spending, the increase in net foreign assets of the central bank is exactly offset by the reduction in net domestic credit to the government, leading to an unchanged monetary base.

This can be shown by manipulating the balance sheet identity for the combined central and commercial banking system (see Dornbusch 1980, chap. 2, eq. 11):[3]

3. The first term in parentheses on the right-hand side of equation 1 is the change in domestic credit to the government. The fixed exchange rate is normalized to unity.

$$\Delta M_2 = (G - T + \Delta NFA^g) + \Delta DC^{nb} + \Delta NFA^b, \tag{1}$$

where

M_2 ≡ the liabilities of the banking system (broad money)
$G - T$ ≡ government spending less taxes
NFA^g ≡ net foreign assets of the government
DC^{nb} ≡ domestic credit to the nonbank private sector
NFA^b ≡ net foreign assets of the banking system

Taxes, T, sum together oil and nonoil revenues. Suppose now that oil revenues increase by one dollar, which is deposited in the central bank. G remains fixed. On the right-hand side of equation 1, T and ΔNFA^b increase by +1 each, so that the net change is zero: money supply does not change. If, however, government domestic spending monetizes the oil dollar, G increases by +1 as well, so that $\Delta M_2 = +1$. Since government debt held by the nonbank public is negligible for countries such as Nigeria, an open market operation to sterilize the impact of this spending on the domestic money supply is precluded.

To emphasize that the oil boom is a real phenomenon, however, assume for a moment that open market operations were feasible and carried out. This would merely alter the shares of money and bonds in private wealth: the "spending" effect would still operate as a result of the rise in real income.[4]

The money supply will increase as government domestic spending monetizes the oil revenues. The demand for real money balances rises as well, owing to the rise in real income. Inflation will therefore result only if the increase in the supply of money exceeds that of the demand for money. This is the presumption immediately after a commodity boom. Since the price of tradables is fixed by the exchange rate (foreign prices are normalized to unity), the relative price of nontradables rises, that is, there is a real appreciation.

Exchange Rate Regime and Capital Controls

We now relax the assumptions of fixed exchange rates and capital controls, which are applicable to Nigeria: its currency, the naira, has an adjustable peg to a basket of currencies and has behaved like a fixed (adjustable) exchange rate. The naira is nonconvertible, and there are capital controls.

The Indonesian rupiah is convertible and has been crawling since 1978. It was subject to maxidevaluations in 1971 (preoil boom), 1978, and 1983. There are no capital controls, and there is a high degree of asset-market integration with Singapore. Other things being equal, Indonesia's open capital account permits its citizens a greater diversity of financial assets.

These differences in the capital account do not alter the basic conclusion of the earlier sections: that the oil boom is a real phenomenon, and what counts is the

4. Suppose, ignoring its political feasibility for the moment, that G in equation 1 were held constant after the boom. Would this stifle the spending effect and thereby prevent real appreciation? This depends on what happens to net transfers to the private sector, including expectations of tax rebates. Conceivably, the "wealth effect" of the oil boom could operate through the private sector. For an interesting comment, see Neary and van Wijnbergen (1984).

spending effect associated with real income.[5] Real appreciation is required to facilitate adjustment to the oil boom. During a downturn in the oil markets, convertibility and an open capital account may impose fiscal discipline—unless convertibility is suspended and capital controls introduced—and thereby hasten adjustment to a postboom phase.

Fiscal Policy

Indonesia has a balanced budget law, which stipulates that government spending should not exceed revenues *plus* official foreign borrowing. This departs from convention, since the portion of spending financed by foreign borrowing would be treated as a deficit. Nevertheless, we see in the next section that there were important differences in fiscal policy between Nigeria and Indonesia.

Since the government is generally the biggest borrower and investor in such countries, fiscal policy is closely linked to the borrowing strategy. This too will be explored in the next section.

II. Empirical Evidence and Policy Comparison

A basic conclusion of section I is that real exchange rate appreciation is inevitable during an oil boom. Such an appreciation is necessary to spur adjustment to the oil boom and restore equilibrium in the goods market.

What magnitude of real appreciation is appropriate? There are two factors relevant here. The first is expectations regarding the oil market. If the oil boom were seen as permanent, rather than transitory, sustained real appreciation would be acceptable, with some stabilization of the real exchange rate (RER) expected as supply in the nontraded goods sector responded. If, however, the boom is temporary, then the costs of readjusting to a "normal" oil situation might outweigh the potential benefits from responding to the oil boom and reallocating resources as though the boom were permanent. The difficulty lies in making this judgment ex ante. Not only have expectations for the oil market been volatile, but a credible hypothesis is that the transient nature of the oil boom was not foreseen in the mid-1970s. The following forecasts by the Economic Analysis and Projections Department of the World Bank for the 1985 price of a barrel of oil made at three different points in time illustrates this: the 1976 forecast was $21.9; in 1979, following the second oil shock, this number was revised upward to $47.3; and then downward to $29.0 in 1983, which in retrospect was an overestimate. These forecasts have a mean of $32.73 and a standard deviation of $10.70 per barrel, indicating the volatility of expectations for the oil market.

The second factor relates to fiscal, monetary, and exchange rate policies. Suppose, for example, that government spending were cut, and the currency devalued, once it was discovered that the oil market was going to collapse and

5. Monetary effects and exchange rate adjustments could, however, affect the speed of adjustment following the boom. See Neary and van Wijnbergen (1986) for fixed versus floating regimes; also see Harberger (1983).

remain sluggish for awhile. Two things would happen: the rates of money supply increase and inflation would decline, and the real exchange rate would tend to depreciate. The signals to investors and wage earners would tend to reverse themselves, leading to an increased resource flow into the traded goods sector.

With the above considerations in mind, we turn to empirical evidence on real exchange rates, deficits, inflation, and the terms of trade in Nigeria and Indonesia from 1970 to 1984.

Alternative Measures of the Real Exchange Rate

The RER is used here as an indicator of the relative price of (nonoil) tradables to nontradables faced by producers. In practice, one works with consumer and wholesale price indices (CPIs and WPIs). Table 2 presents five measures of the RER for Nigeria: the first is a bilateral RER vis-à-vis the United States, with the exchange rate times the U.S. WPI serving as a proxy for the price of tradables, and the Nigerian CPI as a proxy for nontradables. The second and third measures are trade-weighted real exchange rates as conventionally defined: TRER1 is with varying trade (exports + imports) weights, while TRER2 is with 1980 trade

Table 2. *Five Measures of the Real Exchange Rate for Nigeria*

		Trade-weighted exchange rates			
Year	*Bilateral real exchange rate (1)*	*Varying trade-weighted (TRER1) (2)*	*1980 trade-weighted (TRER2) (3)*	*Varying import-weighted (TRER3) (4)*	*1980 import-weighted (TRER4) (5)*
1970	221.9	160.7	178.3	162.8	156.0
1971	196.9	150.9	164.2	152.8	146.1
1972	184.6	151.3	163.1	152.2	148.5
1973	197.8	163.6	177.3	163.4	164.6
1974	200.3	153.6	166.5	153.3	154.5
1975	159.7	136.0	139.4	130.8	131.0
1976	137.0	112.8	117.7	107.9	108.7
1977	125.2	115.3	119.7	111.6	112.8
1978	112.0	108.4	111.4	107.3	109.0
1979	107.9	105.6	107.4	105.1	106.1
1980	100.0	100.0	100.0	100.0	100.0
1981	101.9	90.7	90.7	87.8	87.8
1982	105.6	91.6	91.6	85.4	85.4
1983	95.9	79.3	79.3	72.4	72.4
1984	76.7	58.5	58.5	52.2	52.2

Note: Correlation coefficient between TRER1 and 2 is 0.9978; between TRER3 and TRER4 is 0.9973. Each RER measures the relative price of tradables to nontradables.

Explanation of columns: (1)—nominal exchange rate index times the U.S. wholesale price index (WPI) divided by the Nigerian consumer price index (CPI). (2)—as in (1), with import and export weights: 1970 weight for 1970–74; 1975 weight for 1975–79; and 1980 weight for 1980–84. (3)—as in (1), with 1980 trade weight. (4)—as in (2), with import weights only. (5)—as in (1), with 1980 import weight.

Sources: Exchange rates, Nigerian CPIs and U.S. WPIs: *International Financial Statistics,* International Monetary Fund, various years. Trade and import weights: *Direction of Trade,* International Monetary Fund, various years.

weights.[6] Both rely on CPIs. The fourth and fifth measures are also trade-weighted real exchange rates, but they use import weights instead of trade weights. TRER3 uses varying import weights, while TRER4 is based on 1980 import weights.

Although the use of import instead of trade weights may appear minor, it is significant in the Nigerian and Indonesian context. Since oil is the main export, using import weights essentially excludes oil from the computation. This is desirable from three points of view: (a) it focuses on the nonoil sector, which is a major objective of this paper; (b) it abstracts from the impact on trade weights of the large increases in the price of oil; and (c) it makes economic sense because there is no resource movement effect between oil, whose factors may be regarded as sector specific, and the rest of the economy.

Consequently, it was decided to work with an import-weighted real exchange rate for the rest of this study. The high positive correlation (0.997) between TRER3 and TRER4 made it a matter of indifference with which to work. TRER4 was chosen for simplicity and also because it rules out any anomalies related to the appreciation of the U.S. dollar which started in the fourth quarter of 1980, and which would be reflected in the bilateral RER. Interestingly, appreciation for Nigeria between 1973 and 1984 was 61 percent according to the bilateral RER, and 64 percent and 67 percent respectively using TRER1 and TRER2. When measured by TRER3 and TRER4, it was 68 percent.

Oil Prices, Deficits, Inflation, and the Real Exchange Rate

Table 3 presents data for Nigeria on the price of oil, terms of trade, inflation, money supply, and (trade-weighted) nominal and real exchange rates. The terms of trade were measured as the relative price of oil to imports. The RER is measured by TRER4, discussed in the previous section. The nominal exchange rate appeared to generally reflect the price of oil, appreciating (depreciating) as it rose (fell). The rate of growth of high-powered money (M1) was phenomenal between 1973 and 1977, and then again immediately following the second oil price increase in 1979. The fact that this led to high rates of inflation (despite nominal appreciation of the naira in some of these years) suggests that the flow supply of money grew much faster than the flow demand.

Comparative data on Indonesia in table 3 show that the increases in M1 and inflation rates are similar to those in Nigeria. Major differences exist with regard to the terms of trade (which were slightly less variable for Indonesia) and the

6. The trade-weighted RER, TRER, is defined as:

$$\text{TRER}_t \equiv \prod_{i=1}^{n} (E_{it}\ \text{CPI}_{it})^{\alpha_i} / \text{CPI}_t$$

where α_i is the relevant trade weight, $\sum_{i=1}^{n} \alpha_i = 1.00$. E_i is the exchange rate vis-à-vis the ith trading partner, and CPI_i, its CPI. In the denominator, CPI refers to the Nigerian CPI. The subscript t refers to time. TRER_t is defined such that a fall (rise) implies that Nigerian inflation is rising faster (slower) than the mean inflation rate of its trading partners, connoting thereby a decrease (increase) in competitiveness or equivalently, a real appreciation (depreciation). See Edwards (1984) for a treatment of analytical and measurement issues.

Table 3. *Oil Price, Terms of Trade, and the Real Exchange Rate: Nigeria and Indonesia*

Year	*Oil price (current U.S. dollars)*		*Terms of trade (1980 = 100)*		*Nominal exchange rate (NER) (1980 import weights)*		*NER rate of change (− = appreciation)*		*Rate of growth in M1 (percent)*		*Inflation rate (percent)*		*Real exchange rate (1980 import weight)*	
	Nigeria	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*	*Nigeria*	*Indonesia*
1970	2.4	1.7	17.7	21.6	99.8	43.4	—	12.5	43.8	34.9	13.6	12.4	156.0	91.8
1971	3.2	2.2	21.8	25.6	102.0	47.2	2.2	8.7	4.2	28.7	16.1	4.4	146.1	100.5
1972	3.4	3.0	22.8	27.9	100.6	54.1	−1.4	14.7	11.5	50.6	2.8	6.4	148.5	113.2
1973	4.0	4.8	22.4	32.8	108.6	59.5	8.0	10.0	24.0	42.7	5.5	31.0	164.6	105.8
1974	11.3	11.7	52.2	52.4	100.5	58.1	−7.5	−2.4	89.7	40.4	12.5	40.6	154.5	87.6
1975	11.3	12.8	43.1	47.1	100.0	57.8	−0.5	−0.6	48.3	35.2	33.8	19.1	131.0	82.6
1976	13.9	12.8	45.6	46.9	92.8	56.7	−7.2	−1.8	48.3	25.6	24.2	19.8	108.7	74.2
1977	14.5	13.6	54.5	50.8	97.6	59.1	5.2	4.2	43.8	25.3	19.5	11.0	112.8	75.1
1978	13.9	13.6	54.9	50.9	107.9	70.1	10.6	18.6	−8.2	24.0	18.6	8.1	109.0	86.2
1979	21.3	19.2	65.8	75.8	108.0	101.0	0.1	44.0	20.5	33.3	11.1	20.6	106.1	109.1
1980	35.4	29.5	100.0	100.0	100.0	100.0	−7.4	−1.0	50.1	51.1	11.4	18.5	100.0	100.0
1981	38.9	35.0	105.5	102.2	96.8	98.7	−3.2	−1.3	5.6	29.2	20.9	12.2	87.8	94.3
1982	35.8	34.8	80.9	101.1	94.2	96.0	−2.7	−2.7	3.1	10.0	7.7	9.5	85.4	87.5
1983	30.0	29.5	61.8	98.5	93.7	128.9	−0.5	34.2	12.4	6.4	18.9	11.8	72.4	107.9
1984	28.5	28.4	—	98.2	90.1	145.2	−3.8	12.6	8.2	13.2	39.6	10.5	52.2	112.8

Note: 1984 Nigerian data are provisional estimates. Petroleum = Nigerian bonny light, Indonesian sumatra light. Terms of trade = index of export price divided by import price index. M1 = currency plus demand deposits. Inflation = rate of growth of CPI.

Sources: Petroleum prices: *Twentieth Century Petroleum Statistics* and World Bank estimates. Terms of trade: World Bank data. Import weights: International Monetary Fund, *Direction of Trade*. Exchange rates, M1, CPIs: International Monetary Fund, *International Financial Statistics*.

Table 4. *Nigeria: Government and Current Account Balances*

Year	Government surplus/deficit (million naira)	Government surplus/deficit as percentage of GDP	Oil receipts as percentage of GDP	Current account balance as percentage of GDP	Change in public external debt as percentage of GDP
1970–71	−118.8	−1.6	2.24	−3.54	0.25
1971–72	36.2	0.4	5.64	−3.20	0.75
1972–73	−82.7	−0.9	8.32	−2.45	0.40
1973–74	188.9	1.7	9.14	−0.05	2.82
1974–75	1,247.6	6.7	20.01	16.58	0.04
1975–76	−1,435.8	−6.8	20.23	0.12	−0.43
1976–77	−1,870.1	−6.9	19.80	−0.82	−0.53
1977–78	−2,134.2	−6.7	19.09	−2.06	0.16
1978–79	−1,185.0	−3.5	13.75	−7.10	2.70
1979–80	−757.0	−1.9	22.29	2.52	1.18
1980	−143.0	−0.3	23.06	5.85	0.88
1981	−4,734.0	−8.9	18.47	−6.76	2.64
1982	−4,524.0	−8.0	16.69	−8.58	4.02
1983	−6,650.0	−11.0	11.95	−5.01	4.75
1984	−3,984.0	−5.2	12.25	0.53	0.16

Note: Data for 1984 are provisional estimates. Current account balance and public external debt data are for calendar years.

Sources: Government oil receipts: Sayre P. Schatz (nondated). Current account balance, government deficits: International Monetary Fund, *International Financial Statistics*. Public external debt, GDP: World Bank staff estimates.

nominal exchange rate (reflecting Indonesia's maxidevaluations in 1978 and 1983). The net result is a more depreciated RER for Indonesia and an appreciating RER for Nigeria.

In table 4, government and current account deficits for Nigeria are presented. In Nigeria, as in many developing countries, the government is by far the biggest investor and borrower. A remarkable feature of table 4 is the wide swings in the current account balance: large surpluses in the boom years followed by large deficits as the oil boom subsided. Table 5 contains figures on Nigerian government deficits and their source of financing for the years 1980–84. The first column gives the deficit defined *exclusive* of oil receipts, that is, it treats the difference between expenditure and nonoil revenue sources as being financed by oil receipts and changes in domestic and foreign borrowing. The deficit thus defined actually increases despite the fact that oil receipts leveled off and then fell in nominal terms, before rising in 1984. This implies that large doses of new domestic and external debt were needed to close the gap. It will be noticed that the numbers in table 5 do not "add up." No attempt has been made to reconcile them because published figures on the deficit and its financing are not available beyond 1978 in *International Financial Statistics*. The main purpose of the table is to show the increasing reliance of the government on the inflation tax as indicated by the changes in net domestic credit.

If the Indonesian government were to strictly adhere to its balanced budget law, net domestic credit to the government would be constant. In fact it became negative in 1976 and has exhibited a decreasing trend ever since, implying a

Table 5. *Nigeria: Government Deficits and Financing*
(millions of naira)

Year	*Government deficit excluding oil receipts*	*Government oil receipts*	*Change in net domestic credit to government*	*Change in public external debt*
1980	−11,133.2	11,763.1	226.3	421.5
1981	−14,559.2	10,596.0	2,759.4	1,404.6
1982	−13,964.8	9,440.8	4,029.5	2,275.4
1983	−13,875.5	7,225.5	5,147.2	2,869.1
1984	−13,369.0	9,385.0	2,348.0	118.9

Note: Data for 1984 are provisional estimates. Public external debt data are for calendar years. Government oil receipts include petroleum tax revenues earmarked for capital funding of joint ventures by the Nigerian Petroleum Corporation.

Sources: Government oil receipts: World Bank estimates. Government deficits: International Monetary Fund, *International Financial Statistics*. Public external debt: World Bank staff estimates.

buildup of government net assets within the domestic banking system. As mentioned in section I under "Fiscal Policy," the balanced budget law and the classification of spending and accounting practices in Indonesia depart from convention.[7] In some boom years there were surpluses; in others, deficits (as commonly defined) were financed by foreign borrowing. But the deficit/GDP ratio between 1974 and 1984 was extremely small, always less than 5 percent, and it registered surpluses in two years. The balanced budget law, therefore, has induced a measure of fiscal discipline that is in sharp contrast to the fiscal response in Nigeria. The Nigerian ratio exceeded 5 percent in 7 years, with a peak of 11 percent in 1983, and did not indicate a surplus after 1974–75.

Real Exchange Rates in Nigeria and Indonesia

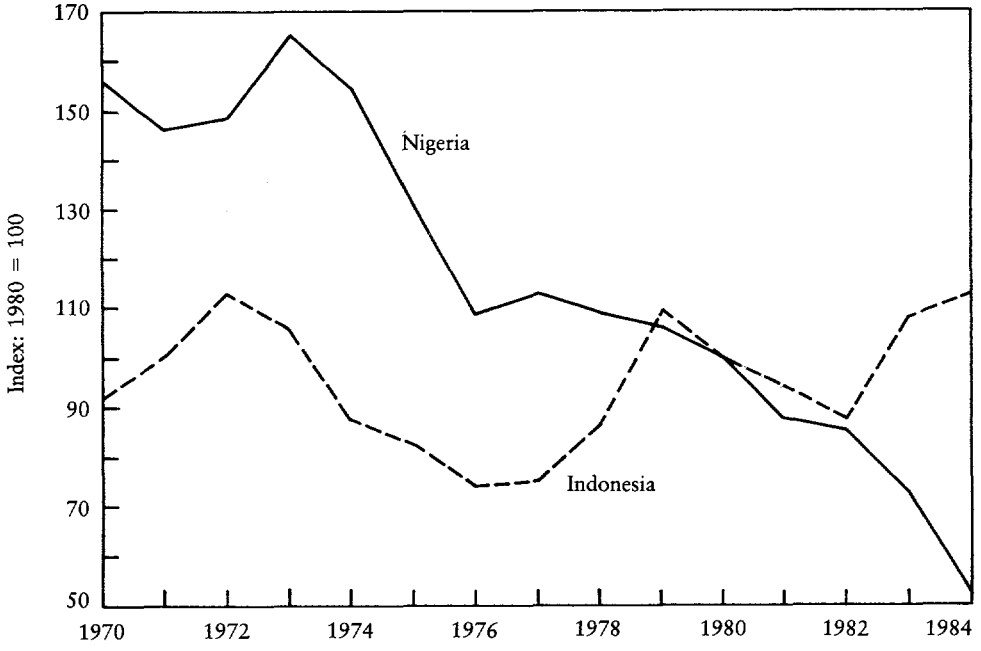
The rationale for computing trade-weighted real exchange rates based on import weights is discussed above in this section under "Alternative Measures of the Real Exchange Rate." The 1980 import weights were chosen in both cases, since varying them did not make much difference. The results are presented in figure 1.

While the Nigerian TRER appreciated (fell) more or less monotonically after 1973, the Indonesian TRER was cyclical, fluctuating around an almost constant mean. Interestingly, inflation rates (see figure 2) were comparable in the two countries right up to 1982.[8] Thereafter, inflation rates in Nigeria were far higher.

7. May (1985) addresses these issues and presents a reconstructed set of accounts.

8. This may appear surprising owing to the different fiscal responses of Nigeria and Indonesia. Net domestic credit to the private sector increased in both countries at about 28 percent annually between 1973 and 1982, but the size of the windfall over 1974–78 was 22.8 percent of nonoil GDP for Nigeria as compared with 15.9 percent for Indonesia (Gelb 1986). Net domestic credit to the government in Nigeria was negative in 1974 and 1975, but has grown rapidly since; that for Indonesia became negative in 1976 and has fallen rapidly since, except for 1982 and 1983 when it rose slightly but remained negative. The Pertamina crisis of 1975 could well mark a watershed in the Indonesian response to the oil boom. Pertamina, the Indonesian national oil company, borrowed heavily to diversify into a number of major capital-intensive and service projects, many of which were (and are) considered of doubtful economic value. In 1975, this created a major debt rescheduling problem. Thereafter, borrowing powers were restricted to the Ministry of Finance, and the scope of Pertamina's activities was curtailed.

Figure 1. *Trade-Weighted Real Exchange Rates, Nigeria and Indonesia*



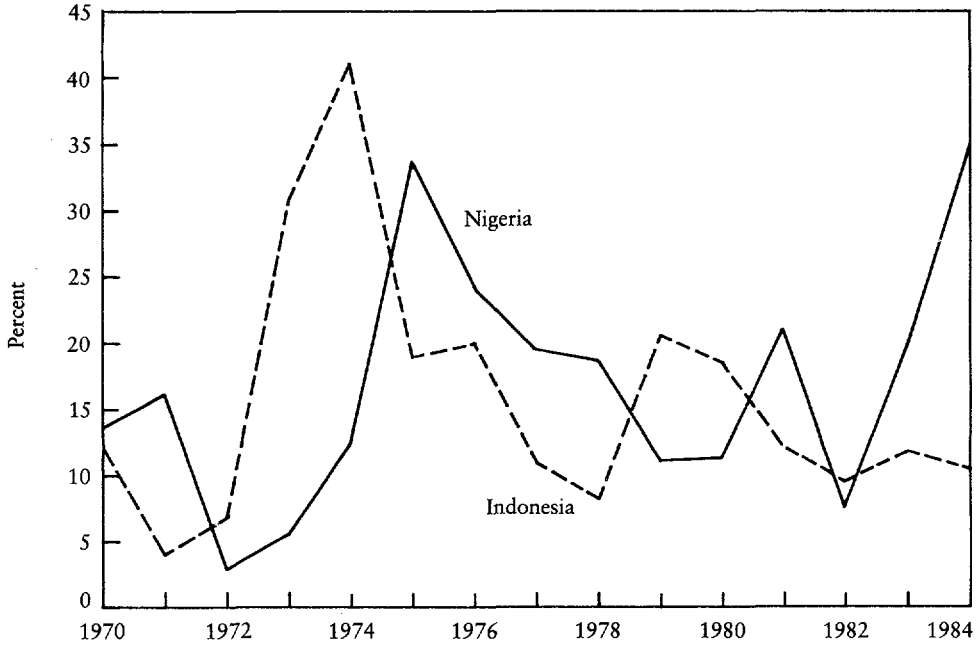
Sources: International Monetary Fund, *Direction of Trade Statistics* and *International Financial Statistics*, various years.

The effects of the two maxidevaluations in Indonesia are reflected in figure 1. The rupiah was devalued in November 1978 from Rp415/U.S dollar, at which value it had been pegged since 1971, to Rp625/U.S. dollar. This rate was allowed to crawl downward until March 1983, when it was devalued from Rp700/U.S. dollar to Rp970/U.S. dollar. One might conclude by looking at the graphs that the RER fluctuated a great deal in Indonesia and was therefore less informative than in Nigeria, where it consistently appreciated.

Two comments are relevant here: first, whether or not the RER is informative depends upon what type of expectations mechanism is posited. If the variability in the RER is predictable, and if it is expected that the RER will fluctuate around some trend, then the signal could still be informative. Further, and this point is stressed by Arndt and Sundrum (1984), even a temporary improvement in the TRER can be valuable if, for two or three years, it gives relief to producers in the tradables sector and encourages resources either to remain or increase there. There is evidence that the beneficial effects of the 1978 devaluation had been lost by late 1982, which is supported by the graph; but this implies that the beneficial relative price effects persisted for over three years.

Warr (1984) speculates on the reasons underlying the devaluations of 1978 and 1983. He argues that while the 1978 devaluation may have been adopted

Figure 2. *Inflation Rates, Nigeria and Indonesia*



Source: International Monetary Fund, *International Financial Statistics,* various years.

to protect the tradables sector from the consequences of the oil boom, the 1983 devaluation may also have been partly due to balance of payments pressures.[9]

Second, although in Nigeria the RER was appreciating when computed using official exchange rates, the black market premium has been rising since 1982, coinciding more or less with strict official exchange rationing and the collapse of oil prices. We discuss this further in the section on post–oil boom adjustment issues.

Agricultural Performance and Policy in Indonesia and Nigeria

The presumption following an oil boom is that agriculture will decline owing to a reallocation of resources in favor of nontradables in the nonoil economy. This presumption needs to be qualified by at least two factors. First, as mentioned

9. Warr (1984) points out that in 1978 the view was widely held that the nonoil traded-goods sector needed to be protected, reflecting a presumption that Indonesia's oil exports would inevitably decline in volume, possibly vanishing within twenty years. Although Arndt and Sundrum (1984) point out that capital had moved abroad in anticipation of the 1978 devaluation, both they and Warr (1984) ignore the asset market integration with Singapore as impinging on the magnitude or timing of the devaluation.

earlier, oil revenues typically accrue to the government so that the real and monetary effects of an oil boom are critically dependent on the timing and composition of government spending. Second, the desirable magnitude of RER appreciation depends, among other things, on expectations regarding future oil prices, including the perceived persistence of the terms of trade improvement, the size of oil reserves, and adjustment costs.

In Nigeria, the oil boom led to a severe disruption of the agricultural economy and a large exodus of labor to the cities. Between 1970 and 1982, annual production of Nigeria's major cash crops—cocoa, rubber, cotton, and groundnuts—fell by 43, 29, 65, and 64 percent, respectively. The share of agricultural imports in total imports increased from about 3 percent in the late 1960s to about 7 percent in the early 1980s.

Indonesia succeeded in avoiding serious economic disruption in the agricultural sector. Agricultural growth slowed in the mid-1970s, but recovered to previous levels by the late 1970s. Rice production grew by 4.2 percent per year from 1968 to 1978 and by 6.7 percent from 1978 to 1984, largely because of rapid increases in rice yields. The share of agricultural imports in total imports remained unchanged at about 1 percent. The share of Indonesia's agricultural exports as a proportion of both developing-country agricultural exports and world agricultural exports rose at a rate of 2 percent and 0.5 percent per year, respectively, from 1965 to 1983. Nigeria's corresponding export market shares over the same period declined at the rate of 5.7 percent and 7.1 percent per year, respectively.

There were important differences in macro- and microeconomic policy between Nigeria and Indonesia. At the macro level, the two maxidevaluations in Indonesia helped significantly to reverse earlier trends of appreciation in the import-weighted real exchange rate. Fiscal policy and the composition of government spending also differed. The bulk of Nigeria's increased public expenditure went into transport, primary education, a major steel complex, construction, and auto assembly. Agricultural investments (federal and state) have accounted for an estimated mere 3 percent of disbursement in the 1970s. In contrast, Indonesia pursued an expenditure strategy relatively balanced between physical infrastructure, education, agricultural development, and capital-intensive industry.

At the microeconomic level, Nigerian agricultural policy has been criticized for its deficiencies in three areas: failure to encourage private price setting and marketing channels; failure to create a satisfactory credit system to finance farming, support services, and processing units; and in its failure to create infrastructure and an economic environment to support private services in machinery maintenance, repair, spares, and training. Most serious, perhaps, is the criticism of commodity boards for imposition of heavy taxes and retention of producer payments and for setting producer prices that bear little relationship to international prices, eroding producer incentives.[10]

10. Unless otherwise noted, the data in this section are derived from World Bank sources.

Table 6. *Nigeria: Movements in Rural Terms of Trade: Index of Real Producer Prices*
(1975 = 100)

Year	*Cocoa*	*Rubber (latex)*[a]	*Seed cotton*	*Groundnuts*	*Soyabeans*	*Palm oil*
1975	100.00	—	100.00	100.00	100.00	100.0
1976	77.30	—	80.80	87.80	80.80	80.8
1977	104.20	100.00	74.80	83.50	91.70	77.7
1978–79	90.30	86.60	64.80	76.20	82.40	81.0
1979–80	94.00	89.10	57.90	82.30	73.70	91.8
1980–81	92.80	93.70	64.00	90.00	74.60	92.0
1981–82	76.80	96.00	61.60	79.80	63.90	76.2
1982–83	71.30	104.00	62.70	74.10	66.90	70.7
1983–84	62.10	84.00	51.70	59.90	71.10	57.2
1984–85	47.70	64.60	49.90	62.10	66.50	49.7

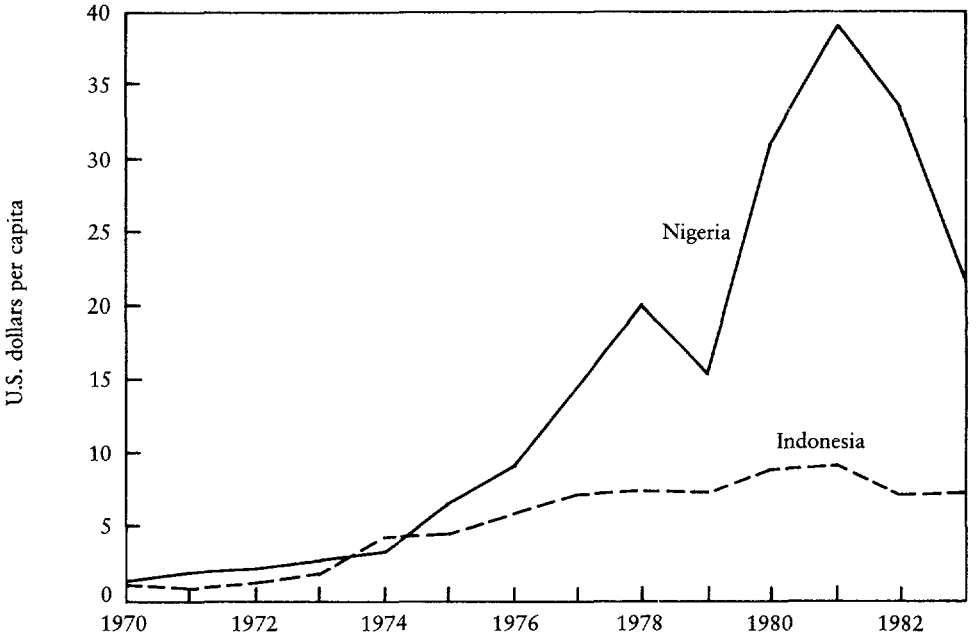
— Not available.
a. 1977 = 100.
Note: Real producer prices = Commodity Board producer prices (naira per ton) / rural CPI.
Sources: Prices: Central Bank of Nigeria, various years. CPI: Federal Office of Statistics, Lagos.

Table 6 attests to the rapid decline in producer price incentives in Nigeria. It presents an index of the real producer price faced by the farmer, defined as the nominal commodity board price divided by the rural CPI. Although data on the rural CPI are available only from 1975 onward, it appears that the decline had begun by 1975. The rural terms of trade (as measured by this real producer price) deteriorated significantly for all six commodities shown. For cocoa, cotton, and palm oil, the real producer price was less than 50 percent of its level in 1975 by the end of the period shown, and in all cases, it was less than 70 percent. Since commodity board prices are set with reference to the official exchange rate, in recent years the overvalued naira has contributed to this decline. But the marketing and pricing policies of the monopsonistic commodity boards also deserve scrutiny.

Indonesian policy has been more market oriented. The closest Indonesia comes to having a commodity board is BULOG ("Logistics Board"), the major objective of which is to ensure that prices closely follow international price trends. There has been heavy emphasis on rice production with considerable input of research and extension (the BIMAS ["Public Guidance"] extension and credit program), investments in irrigation, and subsidization of fertilizer. As a result, Indonesia is almost self-sufficient in food, with domestic production of rice and root crops adequate for its needs.

These differences are evident in per capita food imports between 1970 and 1983 (see figure 3). Both series behaved smoothly until about 1974. Thereafter, imports in Nigeria diverged significantly, consistent with Nigeria's policy of favoring the urban consumer, reaching a peak of U.S.$39 per capita in 1981, compared with U.S.$9 per capita in Indonesia. Nigerian imports fell sharply in 1983 owing to the introduction of stringent import licensing. Overall, import policy has been marked by erratic tariff policies and the

Figure 3. *Food Imports Per Capita, Nigeria and Indonesia*



Sources: Nigerian food imports: Central Bank of Nigeria. Indonesian food imports: U.N. Trade System. Population: World Bank data.

imposition or relaxation of quantitative restrictions depending on the fluctuating oil revenues.[11] Indonesia has performed well in production of both food and exports: exports of rubber, coffee, tea, and spices were maintained throughout the oil boom.

For Nigeria, cocoa is virtually all that is left of agricultural exports. Low profitability is reflected in a roughly 50 percent decline in the volume of exports since the early 1970s, and a drop in Nigeria's position in world production from about 16 percent in the preboom years to 8 percent today.

Once a net agricultural exporter, Nigeria now spends more on import of agricultural products than it earns from its agricultural exports. Both exportables (cash crops such as cocoa and rubber) and importables (food) have been affected by the real appreciation of the exchange rate and the exodus of labor to urban centers. Some deterioration in agriculture following the oil boom may be regarded as unavoidable, but the decline of Nigerian agriculture was certainly exacerbated by erratic import and agricultural pricing and marketing policies. Since 1982 foreign exchange rationing and strict import licensing have increased the premium on illegal sale of foreign exchange and improved the outlook for

11. See Ohene-Yankyera (1984) for a study of the impact of Nigeria's food import policy on domestic agriculture.

food, as an import-competing product. But this is more due to questionable macroeconomic policy than a corrective policy for agriculture.

Foreign Borrowing: Nigeria and Indonesia

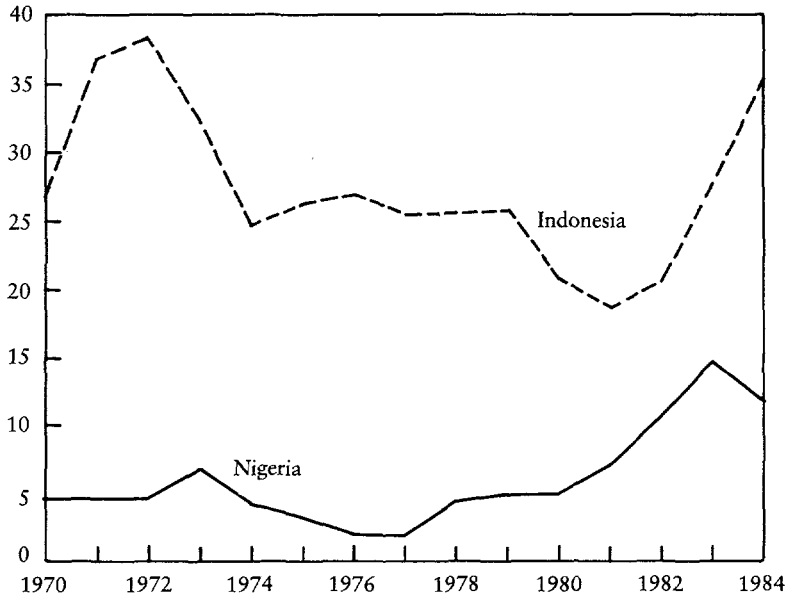
While Nigeria's proven oil reserves are estimated at about 16.6 billion barrels, this is considered an underestimate because of the current promising explorations in the Niger delta (see the *Petroleum Economist,* March 1985; *Oil and Gas Journal,* December 31, 1984; OPEC *Annual Statistical Report,* 1983). The utilization of natural gas, of which about 80 percent is currently being flared, is likely to increase because of the Escravos pipeline project. If one accepted 16.6 billion barrels of oil as a conservative estimate of Nigeria's reserves, deducted an extravagant marginal extraction cost of $5 per barrel and assumed that 50 percent of the proceeds accrue to the government, the total value at a price of about $14 per barrel for bonny light/medium would be $75 billion. This compares favorably with Nigeria's total foreign debt outstanding and disbursed of $12.3 billion in 1983. Yet Nigeria faces a potential rescheduling problem of insured trade credits of about $2 billion, as its creditors insist on a prior IMF agreement.

Since oil is an asset, it can facilitate intertemporal trade, allowing Nigeria to run current account deficits now and repay them through surpluses in the future. In countries such as Nigeria and Indonesia, the government is invariably the biggest borrower and investor. Since fiscal deficits feed into current account deficits, which are financed either by running down reserves or borrowing, there is a close link between fiscal policy and the borrowing strategy. Nigeria financed current account deficits with short-term trade credits. In the boom years it accumulated surpluses, and ran deficits in the slack years, especially from 1981 onwards. This strategy is quite reasonable provided one expected slack years and boom years to alternate and be roughly of the same frequency; but in a period of sustained sluggishness in the oil market, it could lead to serious dislocations.

Indonesian fiscal policy has been conservative, as seen earlier. While Nigeria's debt outstanding and disbursed (DOD) increased by a factor of more than 10 between 1973 and 1983, that of Indonesia increased by a little more than fourfold. More remarkably, Nigeria's DOD increased by a factor of less than 4 between 1973 and 1980, and then more than doubled between 1980 and 1983. Assuming a population of 90 million for Nigeria and 150 million for Indonesia, Nigeria's DOD per capita was about $137 in 1983 while Indonesia's was about $145. The extent of concessional aid as measured by the average grace period and grant element is much higher for Indonesia, in which per capita income is lower. The maturity structure and interest rates favor Indonesia.

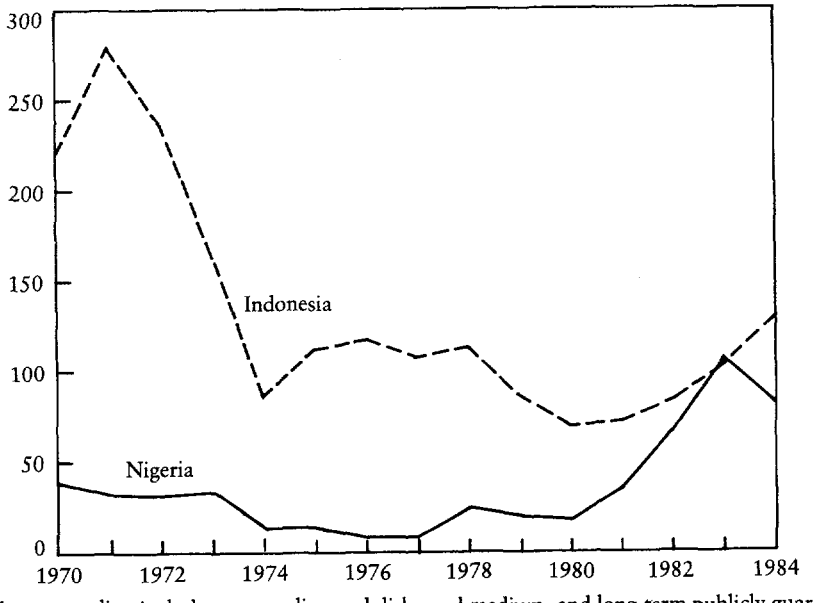
Two conventional measures of debt burden, the debt/GDP and debt/exports ratios for public and publicly guaranteed medium- and long-term debt are plotted in figures 4 and 5 for Nigeria and Indonesia over 1970–84. The debt/GDP ratio has been consistently and significantly higher for Indonesia: after 1982, if the

Figure 4. *Debt Outstanding as Percentage of Gross Domestic Product*



Note: Debt outstanding includes outstanding and disbursed medium- and long-term publicly guaranteed debt. Gross domestic product is at current prices. Data for 1984 are provisional estimates.
Source: World Bank data.

Figure 5. *Debt Outstanding as Percentage of Exports*



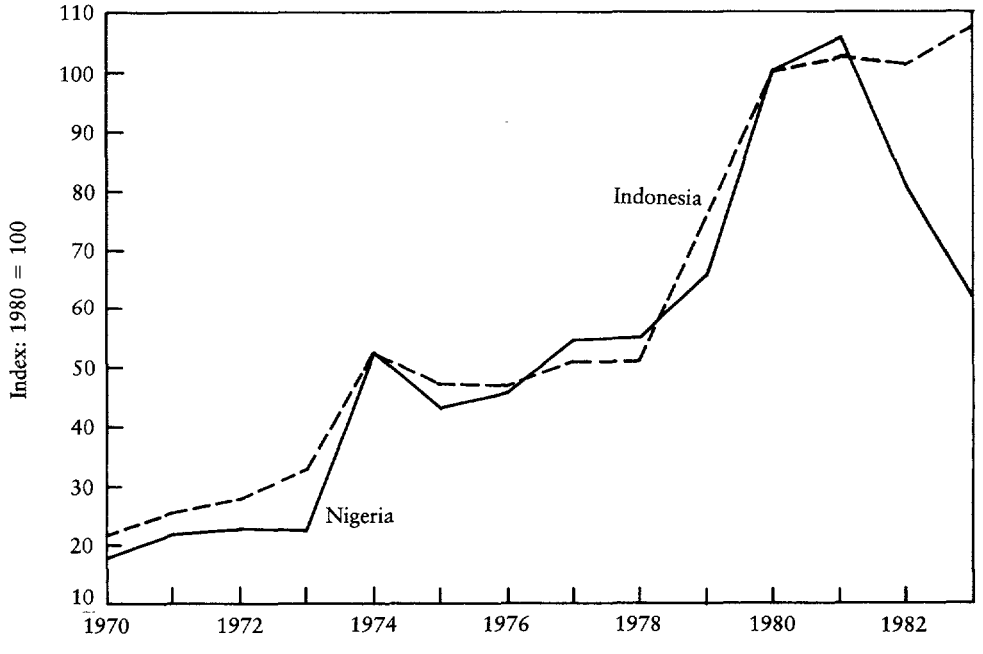
Note: Debt outstanding includes outstanding and disbursed medium- and long-term publicly guaranteed debt. Exports are totals at current prices. Data for 1984 are provisional estimates.
Sources: Debt: World Bank data. Exports: International Monetary Fund, *International Financial Statistics,* various years.

parallel exchange rate is used for computing this ratio for Nigeria (see section III) this conclusion may be reversed. The debt/exports ratio in Nigeria was considerably lower until about 1980, but has rapidly increased since then to a level roughly equal to the Indonesian ratio.

Given the debt burden measures, DOD per capita, and the vast oil and gas reserves of Nigeria, one might ask why debt rescheduling is not a straightforward issue. A crucial factor yet to be considered is the terms of trade (TOT) presented in figure 6: they have deteriorated sharply for Nigeria since 1981, following the oil glut. Indonesia's TOT, conversely, have remained fairly steady, even improving somewhat since 1981. This difference has its basis in the degree of export diversification in the two economies. Figure 7 plots the share of oil in total exports between 1970 and 1983. Since about 1974, oil has consistently accounted for more than 90 percent of Nigeria's exports, making its terms of trade virtually synonymous with the real price of oil.

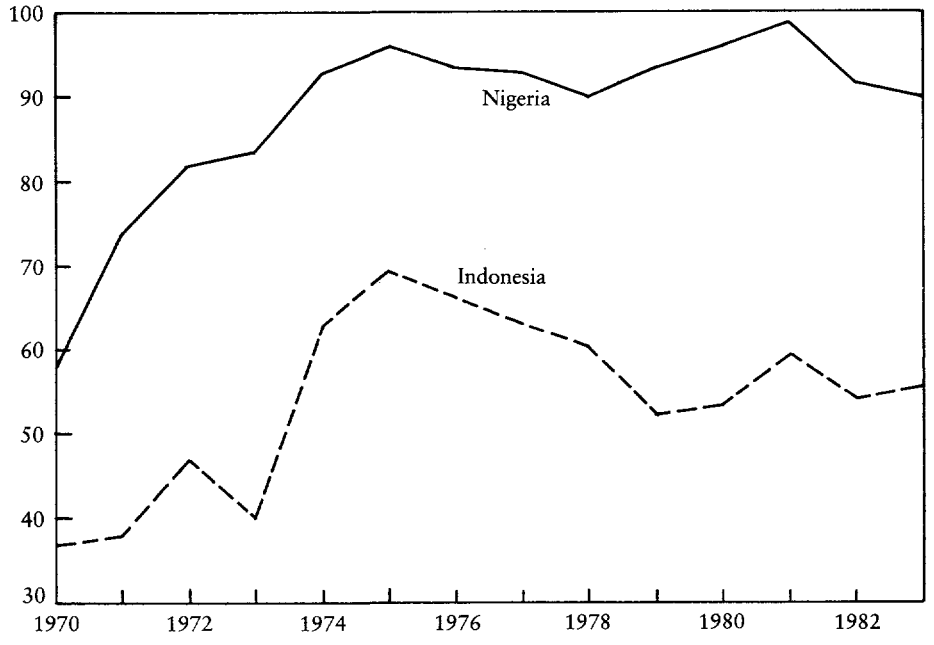
A final conclusive consideration is the perceived economic risks borne by prospective lenders. In today's environment, these risks would be closely related to the (perceived) abilities of Nigeria and Indonesia to adjust to the high real interest rate–low oil price squeeze. This might explain the reluctance of Nigeria's creditors to reschedule without a prior IMF agreement. The market may have

Figure 6. *Terms of Trade, Nigeria and Indonesia*



Sources: International Monetary Fund, *International Financial Statistics,* various years.

Figure 7. *Oil Exports as a Percentage of Total Exports, Nigeria and Indonesia*



Sources: International Monetary Fund, *International Financial Statistics,* various years. Oil exports: crude petroleum exports at current prices (in millions of U.S. dollars). Total exports: merchandise exports at current prices (in millions of U.S. dollars).

determined that without policy reform of the sort discussed in section III, Nigeria is at the limit of its debt-carrying capacity.

III. Nigeria: Domestic Adjustments and Exchange Rate Policy

By 1981, oil had become the key determinant of Nigeria's real income, external terms of trade, creditworthiness, government revenues, and foreign exchange earnings. Following the oil glut of 1982, the major and almost exclusive policy response till the fourth quarter of 1984 was to intensify rationing of foreign exchange. Rather than let the naira depreciate in an attempt to restore equilibrium, it was decided to amend the import licensing system. In 1982, a foreign exchange budget constraint and a priority allocation formula were imposed on the issuance of licenses. In February 1984 the licensing system was completely revised with the scrapping of the open general license (OGL) system. Prior to 1981, OGL had allowed for the unrestricted importation of nonprohibited items and goods not subject to individual licensing. Further, advance import deposits, which had been imposed on nonessential goods in 1979 (lifted in 1980) were reintroduced in 1982 for all goods. For the first time, in 1982 and 1983, Nigeria accumulated trade arrears, evidence of the excess demand for foreign exchange at the official rate.

With private capital transactions and a large fraction of private commercial transactions rationed out of the official foreign exchange market (capital controls existed even during the boom), the premium on foreign exchange in the parallel (illegal) market started growing.[12] The parallel exchange market has long been a channel for private capital transactions. It has also served as a channel for illegal imports. Even during the oil boom years when foreign exchange was plentiful and import licenses easy to get, goods on the banned list were smuggled into Nigeria. There is, for example, much evidence that imported textiles have always accounted for a significant percentage of domestic supply although they were and are on the banned list. With an increasing fraction of legal commercial transactions rationed out of the official market, the foreign exchange market in Nigeria began increasingly to assume the appearance of a dual exchange system: an official market where the exchange rate is fixed and depreciates at an exogenous rate; and an illegal parallel market where the naira floats freely.

In the parallel market, there is demand for foreign currency for imports and to hold as an asset. With the rationing of the official market, the marginal cost of foreign exchange is determined either explicitly or implicitly on the parallel market. Officially, the naira is nonconvertible and there are strict capital controls. By definition, it is "freely" convertible in the parallel market for trade and capital transactions.

The parallel market premium was fairly steady until the oil glut in 1982, when the price of oil fell far below expectations while government spending remained roughly the same (see table 5) so that the reliance on the inflation tax for financing the fiscal deficit increased considerably. In the fourth quarter of 1984, fiscal austerity measures were adopted, which greatly reduced the deficit and hence, slowed the growth rate of the nominal money supply. These measures complemented the rationing of the foreign exchange market introduced earlier. In addition, the official exchange rate was depreciated at a faster rate. The parallel market premium—defined as the ratio of the parallel to the official exchange rate—continued growing until the third quarter of 1984 (see table 7), implying that the naira was depreciating faster on the parallel market. Thereafter, it stabilized. These developments coincided with the declining real price of oil, as can be seen from table 7.

Fiscal, Monetary, and Exchange Rate Policy

To maintain external balance over an extended period requires that the present discounted value of future expected trade surpluses equal the value of foreign debt. With no improvement in oil prospects expected in the near future, there seems to be little option but to reduce government spending, in particular to lower the fiscal deficit/GDP ratio, since the deficit together with the private sector saving-investment balance determine the trade surplus. The Nigerians have been

12. Whether capital controls should be relaxed is an important issue in intertemporal trade but it is beyond the scope of this paper.

Table 7. *Nigeria—Deficit Finance, Inflation, the Official Exchange Rate, and the Parallel Market Premium*

Period	*Real price of oil*	*Change in net claims on government / beginning monetary base (percent)*	*Inflation*	*Official exchange rate depreciation (percent)*	*Parallel market rate depreciation (percent)*	*Official exchange rate (naira/dollars)*	*Parallel market premium*
1980.1	100.00	4.29	1.40	−3.80	−3.00	0.55	1.77
1980.2	117.54	−17.30	1.00	0.90	−14.30	0.56	1.50
1980.3	119.80	−10.16	11.30	−3.20	4.80	0.54	1.63
1980.4	117.09	26.32	1.40	−1.20	4.60	0.53	1.72
1981.1	122.91	−20.50	6.00	3.10	−1.10	0.55	1.65
1981.2	120.18	3.57	5.70	9.90	1.10	0.61	1.52
1981.3	114.87	31.16	4.60	10.80	5.40	0.67	1.45
1981.4	106.95	26.10	0.30	−4.10	−6.20	0.64	1.41
1982.1	107.53	7.05	0.90	1.80	11.00	0.66	1.54
1982.2	105.05	11.11	1.80	2.80	6.90	0.67	1.60
1982.3	104.58	19.76	1.80	1.20	14.80	0.68	1.82
1982.4	104.47	12.33	2.00	0.30	4.00	0.68	1.89
1983.1	88.23	10.64	4.90	0.70	19.40	0.69	2.24
1983.2	87.93	12.91	8.70	3.70	−2.60	0.71	2.10
1983.3	87.09	17.43	10.10	4.70	42.00	0.75	2.85
1983.4	86.67	7.56	7.30	0.20	32.40	0.75	3.77
1984.1	85.71	2.44	7.40	0.00	−0.40	0.75	3.75
1984.2	85.14	4.48	16.40	0.30	18.90	0.75	4.45
1984.3	85.34	7.31	7.70	2.30	3.90	0.77	4.52
1984.4	79.86	2.88	−3.90	4.20	−2.60	0.80	4.23
1985.1	80.04	−4.12	0.90	6.00	7.10	0.85	4.27
1985.2	79.96	−1.49	2.00	5.00	3.90	0.89	4.23
1985.3	80.49	12.19	−1.80	1.50	4.00	0.90	4.33
1985.4	80.02	−3.53	−1.40	3.60	−1.50	0.94	4.12

Note: Real oil price = Nigerian bonny light petroleum prices deflated by U.S. WPI (1980.1 = 100). Net claims on government = as in line 32an, *International Financial Statistics,* IMF. Monetary base = reserve money + net claims on government by commercial banks as in lines 14+22a–26d, *International Financial Statistics,* IMF. Parallel market premium = parallel rate / official rate.

Sources: Oil prices: World Bank data. Net claims on government, monetary base, inflation, official exchange rate: International Monetary Fund, *International Financial Statistics,* various years. Parallel market rates: International Currency Analysis, Incorporated, *World Currency Yearbook,* various years.

doing precisely this since end-1984. The reduction in deficits should slow down the rate of increase in the money supply and inflation. If deficits had not been reduced, given the current deterioration of Nigeria's external debt situation, a predictable implication would have been increasing reliance on seigniorage to finance the deficit.

Before 1981, Nigeria's adjustable peg exchange rate policy could be supported through reserve intervention. Private excess demand at the going official rate could be satisfied by reserve depletion. With this no longer feasible, and with the government indicating its reluctance to adopt flexible arrangements, the official exchange market is strictly rationed via an import licensing system. The resultant premium on foreign exchange has provided an incentive for the emergence of parallel markets, and thereby for exports and imports to go through parallel channels as well.

The rising parallel market premium (see table 7) may be taken as an indicator of inconsistency between fiscal and exchange rate policy, resulting in foreign exchange rationing. The situation would be exacerbated by a fall in the price of oil, and hence revenues, which in the absence of further reductions in government spending, would lead to a higher inflation tax.

Given this inconsistency between fiscal and exchange rate policy, investors are unable to use the real exchange rate as a signal for decisions about resource allocation. This is partly because of a measurement problem: the official nominal exchange rate is likely to become increasingly irrelevant as the black market premium grows. The prices of traded goods are more likely to reflect the parallel exchange rate.

More importantly, even if the parallel real exchange rate signals a depreciation, investors may be unwilling to commit themselves through irreversible investments in the tradables sector.[13] This is because a high premium could damage the credibility of macroeconomic policy and thereby impinge on business risk. Further, a high premium would be a serious disincentive for foreign investors, who may be reluctant to use parallel channels. Going through official channels would imply a significant tax on such investment when the premium is high. Likewise, private inward remittances are not likely to pass through official channels.

Reductions in real government spending and official imports are likely to be efficacious in reducing the premium. In substantial measure, fiscal austerity since the end of 1984 has exploited this possibility: the government's response to declining oil revenues in the face of rising debt service has been a drastic cut in federal and state expenditures, including a priority ranking of the investment program, reduction in public sector employment, and moves toward reduced subsidies and an increase in cost recovery in the parastatals and other areas such

13. Van Wijnbergen (1985) argues that in the absence of credible reform, liquid assets acquire an option value by enabling deferral of commitment. A similar motive might lead to capital flight and thus a higher black market premium in the current Nigerian context.

as education and health. The deficit/GDP ratio has fallen sharply as a result. A concerted effort has been made to meet medium- and long-term external debt service obligations, and uninsured trade credits have been rescheduled. The exchange rate regime, however, remains the same with the exception of a faster rate of depreciation.

Implications of the Exchange Rate Regime

The overvaluation of the naira is explicit in the high and growing parallel market foreign exchange premium, and implicit in the strict official rationing of foreign exchange. Since the government has reduced the real deficit, a devaluation should be effective in depreciating the official real exchange rate. The efficacy of a devaluation is enhanced because it is likely to be noninflationary. The reason is that a considerably more depreciated exchange rate than the official rate is already implicit in the domestic price of tradables, reflecting the scarcity premium in the illegal foreign exchange market. The devaluation would largely amount to a tax on rents received by those who get import licenses. Second, if the cut in the deficit/GDP ratio is seen as credible and sustainable, a devaluation will accelerate adjustment to a lower parallel exchange premium, reducing the desirability of using parallel channels.[14]

The present system is both inequitable and inefficient. It is inequitable because it results in a large transfer of unearned income, "rents," to those who obtain licenses. Importers are subsidized at the expense of exporters who surrender their foreign exchange earnings at the official rate but do not get the entire amount back for subsequent imports and of the central bank to the extent that it runs down reserves to finance the import program. The size of the unearned income can be estimated as the difference between the exchange rate implicit in the ultimate naira price of items officially imported, and their cost, insurance, and freight (c.i.f.) naira price at the official exchange rate. A crude measure of the unearned income can be obtained by multiplying the total value of the import program by the parallel market exchange premium, since this scarcity premium is reflected in the domestic price of traded goods. It suggests, given an illustrative import program of $3 billion (billion means one thousand million) and a parallel market naira/dollar premium anywhere between 2 and 3 naira per dollar that the rents are of the order of 6–9 billion naira, a significant fraction of annual GDP at roughly 70 billion naira.

The import licensing system is inefficient on three counts: first, it creates allocative inefficiency by encouraging economic activity that might be unviable with a more realistic exchange rate; second, it is wasteful, encouraging businessmen to invest resources in attempting to influence the composition of licenses, the well-known phenomenon of "rent seeking"; and finally, it imposes a serious administrative burden on civil servants.

14. For the dynamics of corrective fiscal and exchange rate policy in the presence of parallel foreign exchange markets, see Pinto 1986.

Recent Policy Developments

The emphasis of the Nigerian government has been shifting from large, capital-intensive projects to agriculturally based ones. Domestic and multinational companies are being encouraged to integrate backward by investing in agriculture as a source of raw materials. The government appears to be reducing its own involvement and encouraging private sector investment and credit flows. In keeping with what is perceived to be the economy's comparative advantage, the government intends to channel resources to agriculturally related industries that have high-employment potential, produce basic consumer necessities, and have extensive links with the rest of the economy. Priority industries include textiles, paper, drugs and chemicals, and food processing. Nonpriority industries, which include those with high import content and those which make consumer durables such as cars and electronic equipment, will be left to survive on their own.

While, on the one hand, the government is encouraging private enterprise and initiative, on the other hand, it is strengthening administrative control over crucial areas such as import licensing, and indirectly increasing its influence through its fiscal and exchange rate policies. These policies and signals are likely to become increasingly confusing as inflation and the parallel market exchange premium rise. Reliance on the private sector is likely to succeed only if backed by credible and consistent policy and clear market signals. The shift in emphasis away from a capital-intensive sector calls for major trade reforms. It is unlikely to be achieved through administrative allocation procedures.

IV. Concluding Remarks

This article provides a perspective on the Nigerian experience during and after the oil boom. It stresses that what mattered during the boom was the spending effect and its impact on resource allocation in the nonoil economy. With oil revenues accruing to the government, the composition and timing of public spending were crucial in the adjustment to the boom.

The policy comparison with Indonesia reveals that there were important differences between the countries with regard to fiscal and exchange rate policies. Principal differences also existed in their foreign borrowing strategies (which were more conservative in Indonesia) and agricultural policy (which was market-oriented and included provision of transitional assistance in Indonesia).

Lastly, post–oil boom adjustment issues for Nigeria have been discussed. While fiscal austerity has decreased government spending, the question of exchange rate unification (minimization of the parallel market premium) remains. One frequently encountered the following argument in Nigeria: "Oil is dollar-denominated and virtually our only export. What purpose then would be served by an exchange rate adjustment?" This article shows that this argument is incomplete. Such a perspective ignores too many issues: the credibility of macroeconomic policy; the rents and the administrative burden imposed on civil servants by

administrative allocation; the misallocation likely to be induced by the subsidy implicit in the overvalued exchange rate; and the constraints placed on pricing by the agricultural commodity boards.

Postscript

On September 26, 1986, Nigeria adopted a floating exchange rate regime with an interbank market, simultaneously getting rid of the strict rationing in the official foreign exchange market. It has also undertaken, or proposes to undertake, wide-ranging reforms in agricultural marketing (commodity boards were abolished at the end of 1986), domestic credit allocation, and pricing policies, in addition to other economic measures as part of a comprehensive medium-term adjustment program. The analysis contained in this article was completed prior to these developments.

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Adjustment with a Fixed Exchange Rate: Cameroon, Côte d'Ivoire, and Senegal

Shantayanan Devarajan and Jaime de Melo

As members of the Communauté Financière Africaine, Cameroon, Côte d'Ivoire, and Senegal cannot use the nominal exchange rate as a tool of macroeconomic adjustment. This article considers these countries' responses to the commodity and oil price shocks of the 1970s in light of this and other institutional constraints. Using a two-sector model, it shows that there exist instruments that, in principle, permit the real exchange rate depreciation necessary for adjusting to macroeconomic imbalances. The authors interpret the very different adjustment experiences of the three countries (despite their common economic structure and institutional setting) in terms of different uses of these instruments. Alternative assumptions about the labor market leave the qualitative nature of the results unaltered. Statistical analysis of data from the three countries confirms the model's linking of the current account and real exchange rate with the instruments of adjustment.

Like most developing countries, Cameroon, Côte d'Ivoire, and Senegal were subjected to the external shocks of commodity booms and oil price hikes in the 1970s. As members of the Communauté Financière Africaine (CFA) (a monetary union with France), however, these countries could not devalue their nominal exchange rate to adjust to the macroeconomic imbalances that followed. The purpose of this article is to interpret the adjustment experiences of these three countries in light of this and other institutional constraints.

The cases of Cameroon, Côte d'Ivoire, and Senegal are particularly interesting for another reason. In addition to sharing a common institutional framework for external adjustment, they have a similar economic structure: all three are largely primary product producers, with a small industrial base and service sector fueled by public expenditures. Yet the outcomes of their adjustment experiences were quite different. By the early 1980s, Cameroon was enjoying low foreign debt and steady, 4 percent growth in gross domestic product (GDP), while Côte

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d'Ivoire and Senegal were experiencing high debt-service payments and declining GDP.

Our major conclusion is that membership in the CFA zone does not, in principle, impede adjustment to macroeconomic imbalances. There exist enough instruments to achieve, for example, the real exchange rate depreciation that is necessary to redress a current account deficit. However, in practice, these instruments are not always used, or are used in the wrong direction, and this is why the outcomes were different in the three countries.

To make these points, we first describe in the remainder of this introduction the rules of CFA zone membership. Next, we look closely at the adjustment to shocks by Cameroon, Côte d'Ivoire, and Senegal, using a set of common "adjustment indicators" for 1973–84 (section I). These serve as the backdrop to a model of adjustment with a fixed exchange rate, presented in section II. The model captures the distinctive features of CFA zone economies as well as the instruments of adjustment to which they have access. While these countries cannot effect a nominal devaluation, the model shows how a real devaluation can be achieved by a reduction in government expenditure or a change in commercial policy. The roles of wage rigidity and unemployment are highlighted in the analysis. In section III, the model is tested using data from Cameroon, Côte d'Ivoire, and Senegal. Conclusions follow in section IV.

The CFA zone consists of a West and a Central African monetary union, the Union Monetaire Ouest-Africaine (UMOA) and the members of the Banque des Etats de l'Afrique Centrale (BEAC). Participation in the zone sets its members apart from most other developing countries in at least three ways: they have monetary integration, currency convertibility, and a fixed exchange rate.[1]

Monetary integration. Member countries pool 65 percent of their foreign exchange reserves with the French treasury. Each union's central bank sets monetary policy based on its overall asset position, and all bank members face the same interest rate.[2] The central bank influences an individual country's monetary position by imposing country-specific credit constraints and limiting each country's central government's borrowing to 20 percent of its previous year's fiscal receipts.[3] By pooling reserves, the countries avoid some of the seigniorage costs of holding reserves.

Currency convertibility. The CFA franc is convertible since it is guaranteed by the French franc (FF), itself a convertible currency. Each country has an operations account with the French treasury which it can overdraw at a graduated interest rate that rises to the Bank of France's rediscount rate. There

1. The institutional characteristics of the CFA zone and their implications for macroeconomic adjustment are described in Bhatia (1985) and Guillaumont and Guillaumont (1984). The implications of real exchange rate volatility are analyzed in Macedo (1984). Mundell (1972) provides a historical analysis of monetary integration in Africa. Devarajan and de Melo (forthcoming) evaluate and analyze the growth implications of participation in the CFA zone.

2. This is not strictly true for BEAC members.

3. This does not include borrowing by public enterprises, an important qualification for certain countries.

are no foreign exchange implications for transactions among zone members. Convertibility does, however, have implications for asset choice by residents and, in the longer run, for foreign direct investment.

Fixed exchange rate. The CFA franc (CFAF) is pegged to the French franc at an exchange rate (50 CFAF = 1 FF) that has remained unchanged since 1948. Parity adjustment requires unanimous agreement among zone members. Effectively, CFA countries cannot use nominal devaluation of the exchange rate as an instrument of macroeconomic adjustment.

Although a type of CFA franc had been in use during the colonial era, the two central banks were created when the majority of the members received their independence from France. In its early stages, the CFA zone was designed as a means of providing balance of payments credit to these emerging nations. In addition, it was felt that a common and stable exchange rate would attract foreign investment into these countries. Over the long run, membership in the zone has induced a sense of monetary and fiscal discipline, damping the "stop-go" cycles observed in many developing countries. Nevertheless, despite the general consensus that the monetary union has been working fairly well and that its members have probably fared better than they would have in its absence, concern has recently been raised that adjustments to macroeconomic imbalances have not been as prompt and complete as desirable, as sustained periods of real exchange rate appreciation have been observed among many zone members.

As a result of the turbulent 1970s, many CFA countries were experiencing macroeconomic "crises" in the early 1980s. Senegal and Côte d'Ivoire—the two largest UMOA members—had huge current account and public sector deficits that could in turn lead to debilitating debt-service payments in the future. Cameroon had become an oil exporter and was running sizable current account surpluses. Some observers began questioning whether the particular nature of the CFA zone prevented its members from adjusting their economies to these dramatic changes. To assess this question, we turn now to a detailed analysis of the adjustment process in Cameroon, Côte d'Ivoire, and Senegal.

I. Case Studies of Adjustment: Cameroon, Côte d'Ivoire, and Senegal[4]

All three countries experienced windfall gains from the commodity price increases of the mid-1970s.[5] Cameroon and especially Côte d'Ivoire benefited from the coffee and cocoa boom of 1975–77;[6] Senegal enjoyed a phosphates

4. For a more detailed description of these case studies, see Castillo and others (1986).

5. Davies (1983) provides a comparative study of how major commodities exporters reacted to the 1975–77 commodity boom. He shows that Cameroon and Côte d'Ivoire made extensive use of their commodity stabilization funds to tax the windfall gains to producers.

6. Following Brazil's frost in July 1975, which reduced world production by one-third, coffee prices doubled in 1976 and rose another 60 percent in 1977. The price of cocoa futures showed increases of 64 and 85 percent in 1976 and 1977.

boom in 1973.[7] In addition, Cameroon became a net oil exporter in 1980. Nevertheless, the adjustment experience of the three countries differed substantially. External borrowing patterns varied, as did the relative contributions of the private and public sectors to the trade deficits or surpluses. As suggested by the model to be presented in section II, the compositional differences in expenditures differentially affected the external sector's competitiveness in each country.

To study the adjustment experience, we use a matched set of adjustment indicators suggestive of the model to be presented below. These indicators measure the magnitude of the external shocks and help show how adjustment took place.

A first set of indicators is constructed from price indexes. The commodity terms-of-trade index is supplemented by an index measuring the ratio of the domestic producer price to the world price for the two most important export commodities (coffee and cocoa for Cameroon and Côte d'Ivoire; phosphates and groundnuts for Senegal). The impact of the shock on the structure of production is measured by two real exchange rate indexes. An index corresponding to the concept of the real exchange rate developed in the model of section II (the ratio of prices of tradables to prices of nontradables) is constructed from national accounts data (tradables include agriculture and industry, and nontradables account for the rest). A rise in the index signals an increase in the relative price of tradables. Second, a purchasing power parity index (PPPRER) is used to measure the external competitiveness of manufacturing. This index is the ratio of an import-trade-weighted manufacturing wholesale price index (WPI) of trading partners to the domestic manufacturing WPI, so that a fall in the value of the index indicates a loss of manufacturing competitiveness.[8]

The second set of adjustment indicators measures the sources of current account deficits and the composition of government expenditure. Observing that the current account (CA) is equal to net domestic savings, we decompose it into its private and public sector components:

$$CA = S_p - I_p + S_g - I_g, \tag{1}$$

where S_p and S_g are private and public savings, and I_p and I_g are private and public investment.[9] The usefulness of this decomposition derives not only from the fact

7. In 1974 phosphate prices increased by almost 400 percent.

8. In presenting the real exchange rates, we are not distinguishing between changes in the price ratio caused by external circumstances and those attributed to domestic price changes (that is, policy influenced). This is because our analysis will be based on relative prices. Regardless of what determines it, the real exchange rate remains the most important signal for domestic agents making decisions about engaging in tradable activity. Institutional monetary reforms in 1973 gave greater autonomy from France to the two central banks (BEAC, BCEAO) in setting money supply targets. As a result, money supply growth, which had averaged 10 percent annually since independence, rose to 45 percent in 1974. Obviously this change accounted for the observed drop in the PPPRER index in the three countries in 1974. For further discussion, see Castillo and others (1986).

9. The equality between the change in net foreign financial assets and CA is strictly valid only if there are no changes in the French franc–U.S. dollar exchange rate vis-à-vis the currencies in which debts are denominated.

that public sector deficits are, at least in principle, instruments of adjustment, but also from the observation that public sector spending is usually more intensive in nontradables than private sector spending, an observation that will play a crucial role in the model of section II. Finally public sector expenditure and investment patterns are tracked to see whether foreign borrowing is guided towards investment which, if it has a higher rate of return than the borrowing costs, would justify the increase in external debt.

Cameroon

Cameroon was subject to two major positive shocks in the late 1970s. First, the coffee and cocoa boom of 1975–77 led to windfall gains for the commodity stabilization fund (ONCPB), as producer prices were repressed during the boom. Second, the discovery of offshore oil, which went into production in 1978, created a one-time opportunity for the government to accelerate its development program.

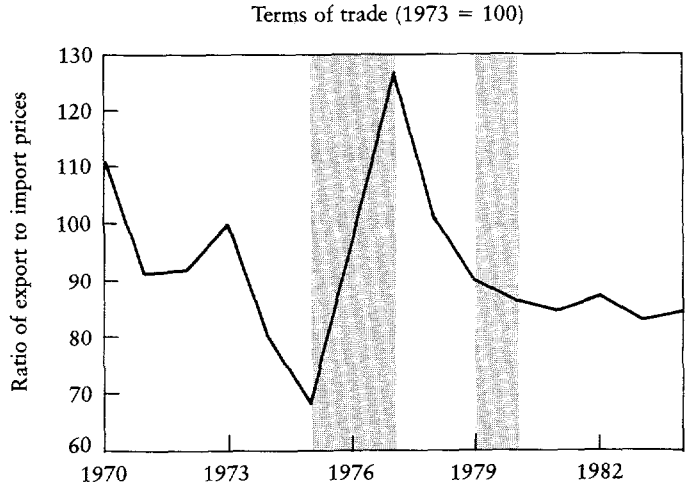
How did Cameroonian policymakers respond to these favorable shocks? Figure 1 summarizes the story. At the time of the 1976–77 coffee boom, production was at its lowest point since the 1960s. The "spending effect" of the boom was therefore not substantial. The real exchange rate did not appreciate (although its rate of depreciation slowed). Nevertheless, manufacturing competitiveness continued its downward slide, reflecting the country's inward-looking industrial policy, rather than the effects of the shock. After the boom, the government raised producer prices of both cash crops while simultaneously restraining government spending (between 1976 and 1980, both government expenditure and investment declined).

The post-1978 oil boom was of much greater significance but elicited a similar response. While estimates vary, there is reason to believe that up to three-fourths of the oil revenues were saved abroad.[10] This is confirmed by the sizable current account surpluses recorded since 1978. In fact, the government has used the oil revenues to retire a small part of its foreign debt. Consequently, and in contrast to other oil exporters' experiences, Cameroon's real exchange rate continued to depreciate (even when mining is excluded from tradables) in the first few years of the oil era (see figure 1). To the extent that this windfall was spent domestically, it was channeled into investment rather than consumption; while the share of public expenditure in GDP fell slightly between 1978 and 1982, that of public investment almost doubled.

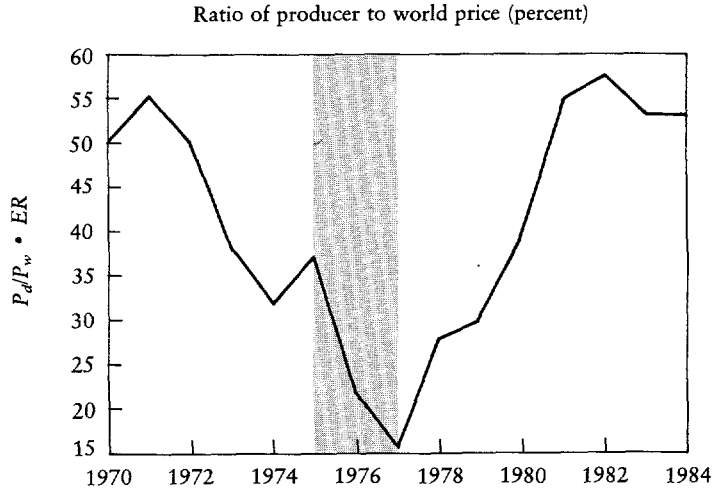
It is often observed that a period of real exchange rate appreciation is followed by a consumption boom because the private sector perceives a permanent increase in wealth. This was avoided in Cameroon. That it was private rather than public net savings which rose simply reflects the system of budget accounting in Cameroon. The bulk of oil revenues and expenditures financed by them are

10. Data about oil exports are systematically underreported in the official statistics, but oil revenue estimates are included as government receipts in our data.

Figure 1. *Adjustment Indicators for Cameroon*

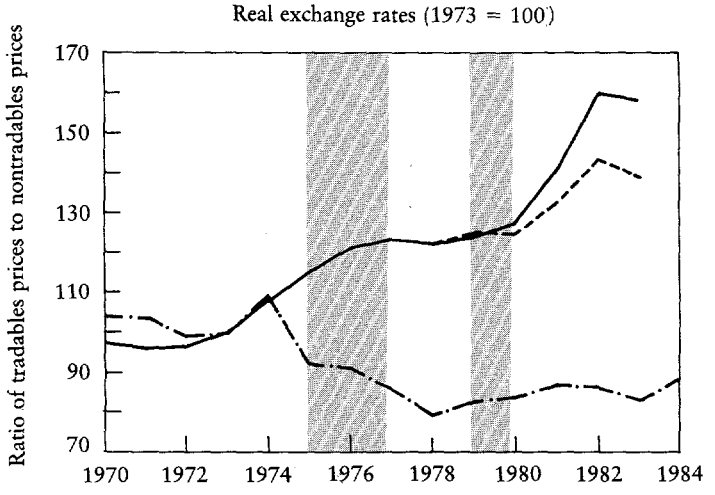


Note: Weighted index of prices of exported commodities to imported commodities.

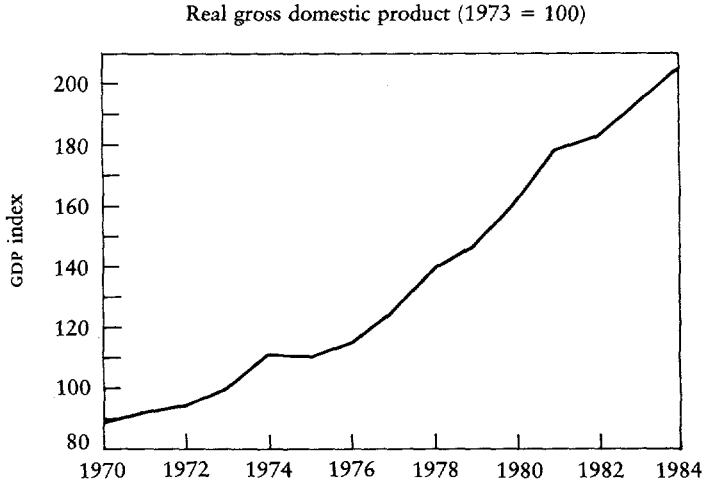


Note: For coffee and cocoa. P_d = domestic producer price; P_w = world price; ER = nominal exchange rate.

Figure 1 *(continued)*



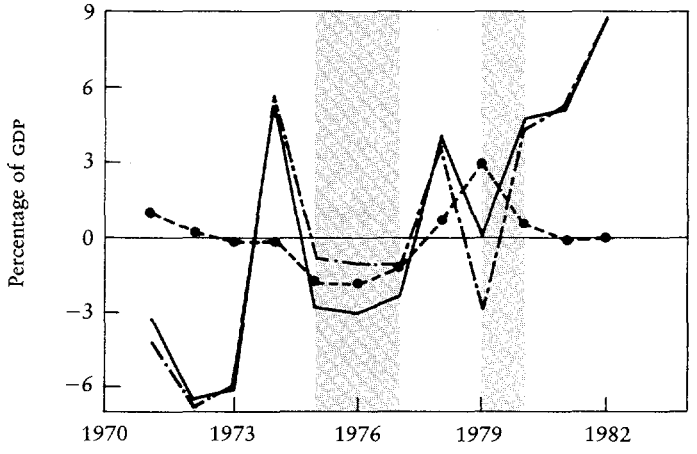
——— Price of tradables / price of nontradables
- - - - Price of tradables (excluding mining) / price of nontradables
—·— Manufacturing competitiveness index: import-weighted manufacturing wholesale price index of trading partners / domestic manufacturing WPI (a decline indicates a loss of competitiveness)



Note: Change in GDP from 1973 base value.

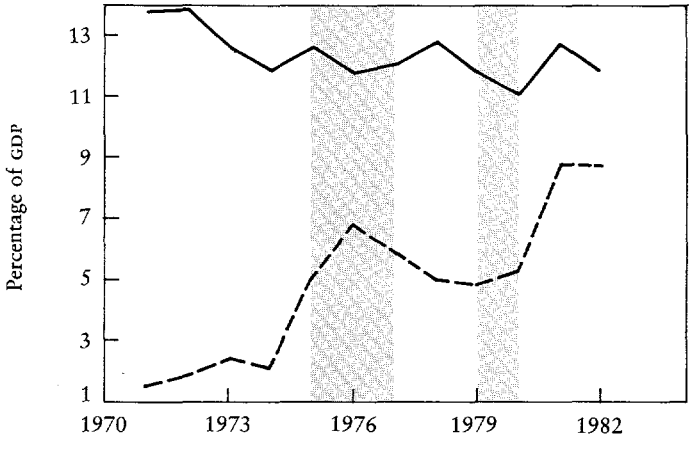
Figure 1 *(continued)*

Decomposition of net domestic savings (by public and private sources)



Note: All are measured as percentage of GDP.
- - - - - Federal government budget surplus
-·-·- Private sector surplus of savings over investment
——— Trade account balance

Public expenditure and investment (shares in GDP)



——— Public expenditure / GDP
- - - - Public investment / GDP

entered in the *compte hors budget,* which is outside the official public financial accounts. The government has used its liquid position to raise the producer prices of cash crops, keeping the real exchange rate from appreciating and preventing the traditional export sector from contracting Dutch disease. The bias of the public expenditure mix toward investment rather than consumption has also been beneficial for future growth. Because money and real wages have risen, however (the inevitable consequence of incomplete sterilization), manufacturing's international competitiveness has fallen, as shown by the PPPRER index.

Côte d'Ivoire

Given that coffee and cocoa account for 50 percent of Côte d'Ivoire's export earnings, the 1975–77 boom in these commodities led to a sharp but short-lived improvement in the overall terms of trade, which then deteriorated by a cumulative 37 percent between 1977 and 1980 (partly reflecting the 1979 oil price shock). As in Cameroon, the stabilization fund was the main recipient of the windfall gains between 1976 and 1978. The fund's income reached 16 percent of GDP at the peak of the coffee and cocoa boom in 1977.

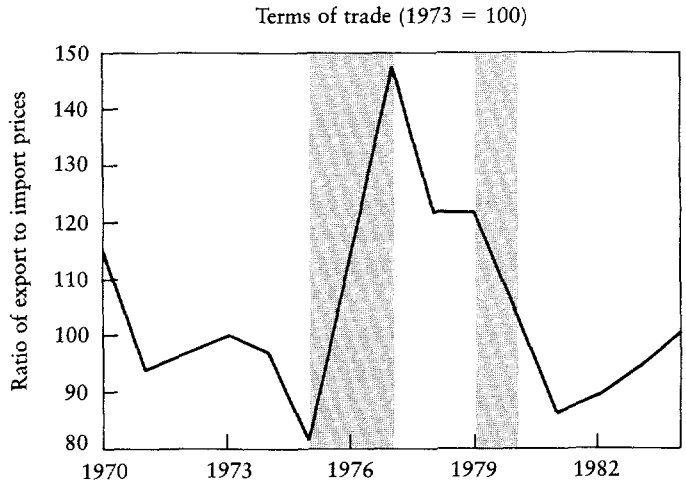
Faced with these rapid changes in its external environment, Côte d'Ivoire chose a different adjustment path from Cameroon. The government accelerated the investment program it had started around 1974 (see figure 2). The increase in public investment was mainly allocated to large projects with high unit costs, long gestation lags, and low foreign exchange earning potential. Furthermore, and unlike the other two countries, the government increased the share of public expenditure in GDP immediately following the coffee boom. As suggested by the model in section II, this expenditure pattern is consistent with the observed loss of manufacturing sector competitiveness.

When the commodity boom came to an end, the government continued its investment program, initially increasing the share of public investment in GDP. Public expenditure also continued to rise rapidly; its share in GDP rose from 15 percent in 1977 to a peak of 26 percent in 1982.[11] By contrast, the private sector adjusted rapidly on both sides of the boom, as shown in the decomposition of the net domestic savings. Private expenditure surged immediately following the boom, but it fell just as quickly when the terms of trade deteriorated.

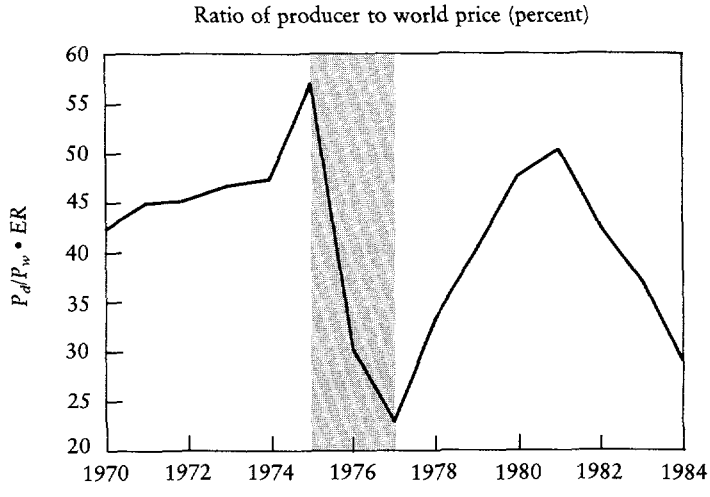
Part of the increase in public sector borrowing was financed internally (the money supply grew by 33 percent a year between 1975 and 1980), but much of it was external; the debt-service ratio (debt-service payments as a percentage of merchandise exports), which had averaged 8 percent during the 1965–75 period, quadrupled during 1980–85. When the time came to adjust in 1980, it was the private sector that generated the large surplus to service the increased external debt. Expenditure switching could have been achieved by reductions in the relative size of nontradable-intensive public expenditure; but little of this

11. The increased shares of government investment and expenditure in GDP are largely due to adjustment by the private sector.

Figure 2. *Adjustment Indicators for Côte d'Ivoire*

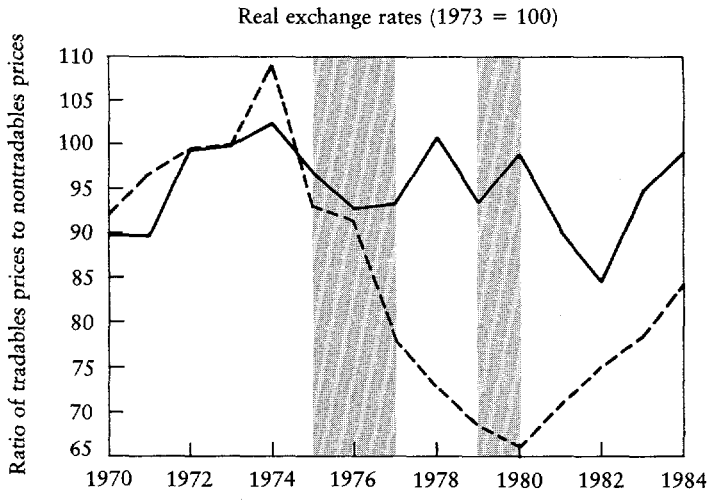


Note: Weighted index of prices of exported commodities to imported commodities.

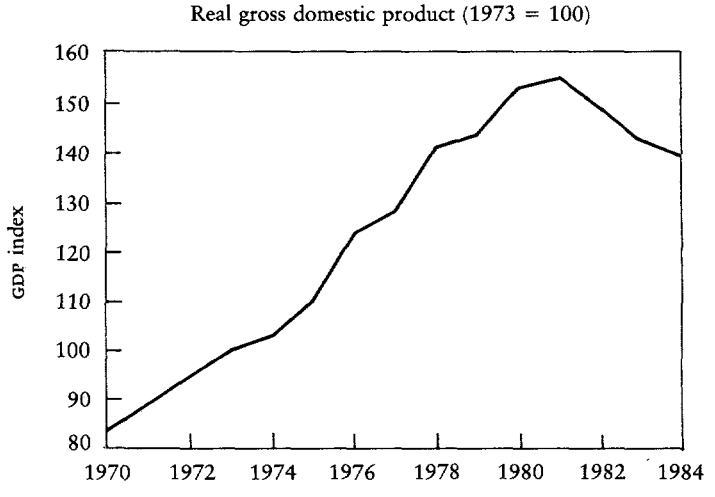


Note: For coffee and cocoa. P_d = domestic producer price; P_w = world price; ER = nominal exchange rate.

Figure 2 *(continued)*



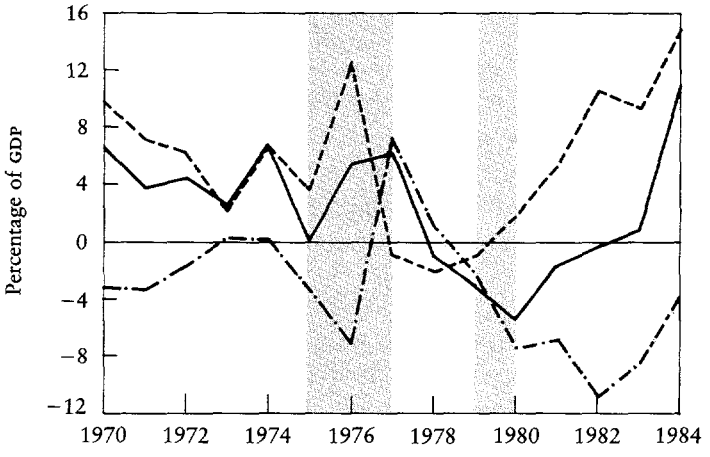
——— Price of tradables / price of nontradables
- - - - Manufacturing competitiveness index: import-weighted manufacturing wholesale price index of trading partners / domestic manufacturing WPI (a decline indicates a loss of competitiveness)



Note: Change in GDP from 1973 base value.

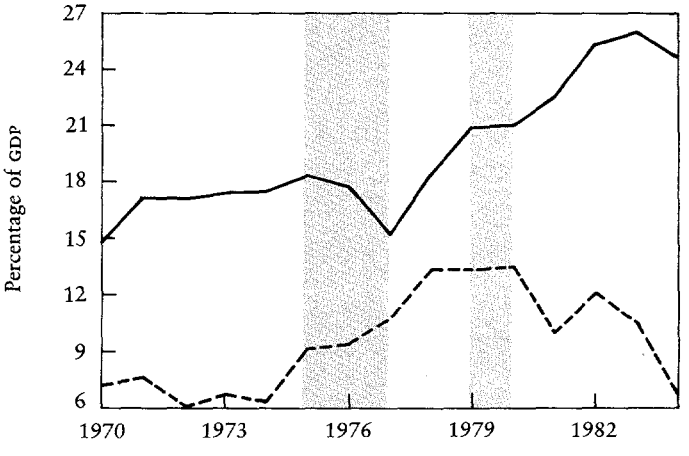
Figure 2 *(continued)*

Decomposition of net domestic savings (by public and private sources)



Note: All are measured as percentage of GDP.
-·-·- Federal government budget surplus
----- Private sector surplus of savings over investment
——— Trade account balance

Public expenditure and investment (shares in GDP)



——— Public expenditure / GDP
- - - - Public investment / GDP

occurred. Instead the post-1980 adjustment was mostly achieved by private expenditure reduction and a consequent fall in GDP. This slow adjustment by the public sector contrasts sharply with Cameroon's experience.

The implications of Côte d'Ivoire's public sector "boom" for the real exchange rate closely follow the predictions of the model of section II: an initial real exchange rate appreciation between 1975 and 1977, accompanied by a sharper and sustained loss of competitiveness for the manufacturing sector (see figure 2). The developments following the commodity boom did not seriously reduce the prices of tradables relative to nontradables, which would have helped achieve expenditure switching toward nontradables and hence restore external balance. Two factors contributed. First, when the boom ended, taxation of coffee and cocoa was reduced, raising the relative price of a component of the tradable sector. Second, public investment had a sizable import component. Nevertheless, manufacturing lost competitiveness rapidly as the public sector deficit was financed by money creation. With a fixed exchange rate, expenditure switching would have been better achieved had the public sector curtailed its import-intensive expenditures. Unfortunately, this path was not followed.

Senegal

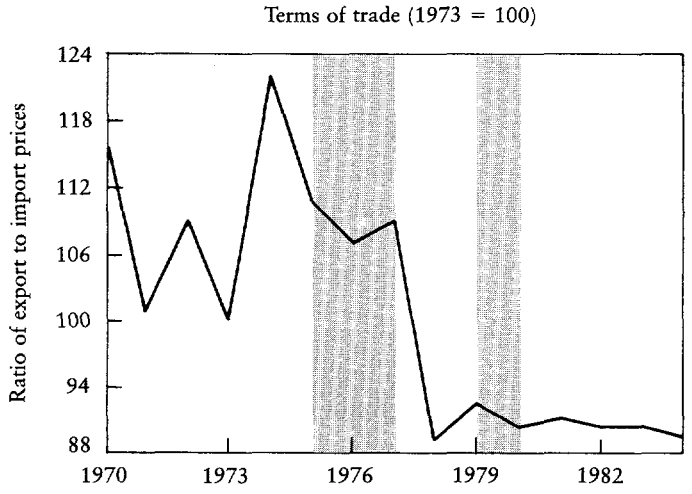
The 1970s were a particularly volatile period for the Senegalese economy. A phosphates boom in 1973–75[12] was followed by two droughts, in 1977–78 and 1979–80. Most observers agree, however, that the policies following these shocks, as much as the disturbances themselves, brought on the economic crisis that gripped the country in the 1980s.

The indicators in figure 3 lend credence to this view. Soon after the phosphates boom, the real exchange rate appreciated because there was little taxation of windfall gains as in Cameroon and Côte d'Ivoire. Windfall revenues were spent domestically on consumption rather than investment, as figure 3 shows. Net dissaving by the private sector dominated total net dissavings, and the share of public investment in GDP stayed almost constant.

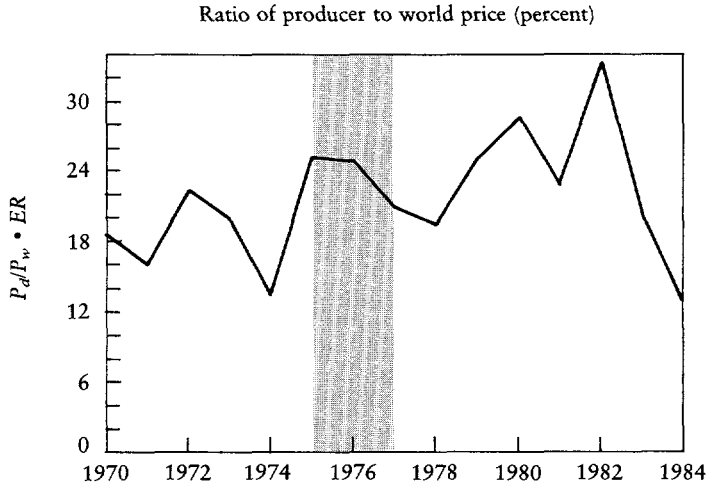
Moreover, when the terms of trade deteriorated after 1977, Senegal continued an expansionary policy of maintaining private consumption and expanding public consumption. The latter grew in real terms at an average rate of 6.7 percent a year during 1975–80, although per capita output fell by 0.6 percent a year during the period. This contributed to the continued real exchange rate appreciation. The government responded to the shocks of the 1977–78 and 1979–80 droughts by increasing consumer subsidies, public sector employment, and transfers to the parapublic sector. Meanwhile, incentives to produce exports showed little increase, since the domestic prices of the main cash crops remained well below their world levels. The successive droughts and declining terms of trade called for an alternative adjustment path, namely, for a real exchange rate depreciation. As the model below shows, this could have been

12. Phosphates account for 10 percent of the country's exports, and groundnuts for about 50 percent.

Figure 3. *Adjustment Indicators for Senegal*

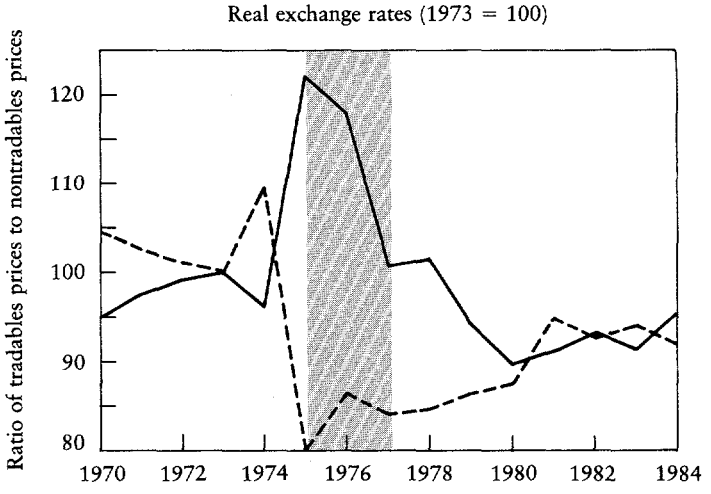


Note: Weighted index of prices of exported commodities to imported commodities.

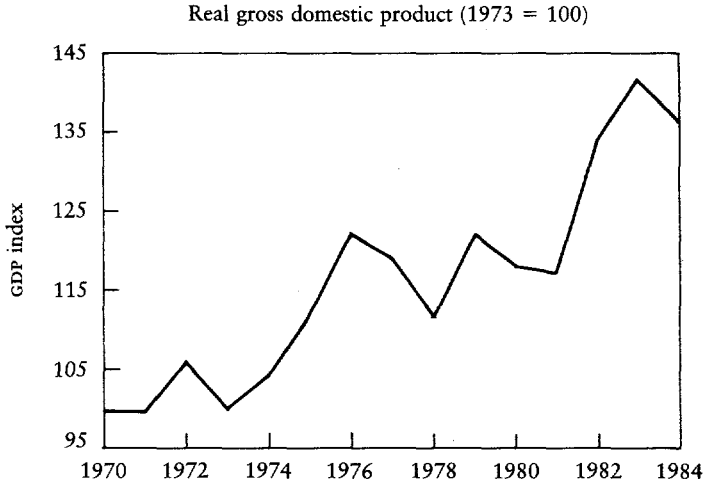


Note: For phosphates and groundnuts. P_d = domestic producer price; P_w = world price; ER = nominal exchange rate.

Figure 3 *(continued)*



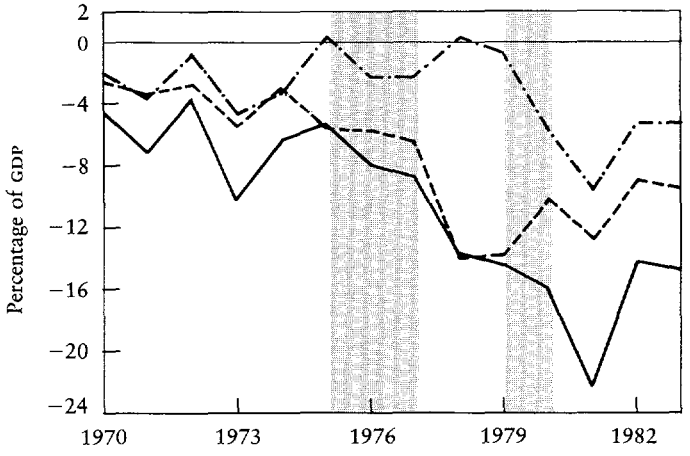
——— Price of tradables / price of nontradables
- - - - Manufacturing competitiveness index: import-weighted manufacturing wholesale price index of trading partners / domestic manufacturing WPI (a decline indicates a loss of competitiveness)



Note: Change in GDP from 1973 base value.

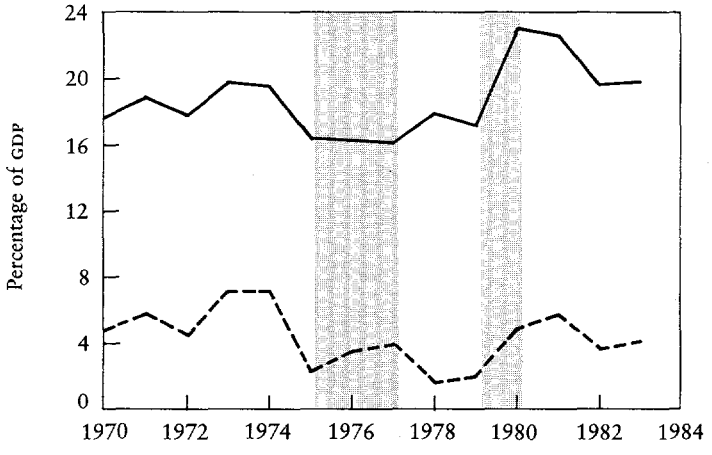
Figure 3 *(continued)*

Decomposition of net domestic savings (by public and private sources)



Note: All are measured as percentage of GDP.
-·-·- Federal government budget surplus
- - - - Private sector surplus of savings over investment
——— Trade account balance

Public expenditure and investment (shares in GDP).



——— Public expenditure / GDP
- - - - Public investment / GDP

achieved by cutting government expenditure, even if there had been relative price rigidities.

The outcome of all this is shown in the stubbornly negative trade balance and oscillating GDP figures of the last fifteen years. In addition, Senegal faces a debt crisis, or more appropriately a "creditworthiness crisis," in the mid-1980s. The government had to undertake draconian structural adjustment measures in 1984. The results of this program have yet to be seen. There is little doubt, however, that a different set of responses to the favorable and unfavorable shocks of the 1970s would have led to less drastic cutbacks in the 1980s.

In sum, despite similar characteristics and institutional frameworks, the three countries adjusted quite differently to a common sequence of terms-of-trade shocks. None avoided loss of external competitiveness in manufacturing, and only Cameroon avoided real exchange rate appreciation. Côte d'Ivoire's manufacturing sector experienced a sustained loss of external competitiveness, and Senegal's real exchange rate appreciated. Given the magnitude of these swings one must ask whether they could have been dampened so as to avoid costly resource shifts into, and then later out of, nontradables.

In our discussion above, we attributed these different patterns of real exchange rate behavior and loss of external competitiveness to different patterns of external borrowing, public expenditure levels, and taxation of windfall gains. Below we show that this interpretation is consistent with predictions from a two-sector model. The model is also useful to determine the relative impact of alternative instruments to maintain real exchange rate stability and reduce external deficits.

II. A Model of Medium-Term Adjustment

The popular model to analyze medium-term macroeconomic equilibrium (when nominal aggregate demand pressures are zero and the focus is on real variables) is the "dependent economy" model due to Salter (1959) and Swan (1960). In that model, the equilibrium real exchange rate or relative price between tradables and nontradables depends on fundamentals (tastes and technology in the relevant sectors), the level of capital inflows, and the extent of price rigidity in the labor market or the nontradable sector.[13] When a current account deficit (that is, absorption of goods and services exceeding current income[14]) must be eliminated, a policy that allows the real exchange rate to depreciate is required. The real exchange rate is defined as RER = $(PT/PN)e$, where e is the nominal exchange rate and PT and PN are price indexes of tradable and nontradable sectors. In the case of the CFA zone, where e is fixed, depreciation of the real

13. Recent presentations are Bruno (1976), Dornbusch (1980), Corden (1977). Jones and Corden (1976) present the analytics of the case with fixed nominal wages and sector-specific capital. Prachowny (1980) provides a detailed analysis of the standard model with sector-specific capital.

14. All one can say from a current account deficit is that the net financial asset position of the country is deteriorating. Private capital inflow could be so great that reserves are increasing. The country may be increasing its real assets (foreign direct investment) if expenditures are mostly for investment.

exchange rate requires a policy that lowers *PN* or the wage rate (in terms of foreign prices) or a fiscal policy that raises the relative price of tradables, *PT*. Thus a policy which *switches* expenditures toward nontradables is required in addition to an initial reduction in the *level* of expenditures so as to achieve external balance without experiencing a rise in unemployment.

The above analysis leaves out the role of monetary policy in dealing with external imbalance. A current account deficit means the net financial asset position for the nation as a whole is deteriorating (for example, private capital inflow may be so great that central bank reserves are increasing). As indicated by equation 1 above, the deficit may reflect a public or private sector deficit. With the exchange rate fixed, if there is a budget deficit that exceeds net private saving and autonomous capital inflow, foreign exchange reserves will be run down and, unless there is sterilization, the domestic assets of the banking system will decline. The automatic monetary mechanism will then tend to eliminate the deficit as the price of nontradables falls relative to tradables. In practice, of course, there is at least partial sterilization of these monetary effects so that the flow equilibrium deficit is partly maintained.

The implication of monetary union membership for CFA zone countries is that there is a limit to the extent to which any individual country can sterilize the monetary implications of its external deficit.[15] Effective monetary policy will thus speed up the *monetary* adjustments that are called for by a current account deficit if there is some relative price rigidity in the economy. But the implications for the real economy of a current account deficit remain, regardless of the effectiveness of monetary policy. In the remainder of the paper, we are concerned with these adjustments in the real economy.

We return therefore to the standard analysis of expenditure policy mixes to restore external balance that are analyzed in the Salter-Swan "dependent economy" model.[16] Here we propose to highlight more precisely what adjustment in real variables is required to correct an external deficit; this is done by extending the standard dependent-economy model to consider features typical of CFA zone countries.[17] First, a current account deficit is a national deficit. As such

15. In the CFA zone, the monetary mechanism to eliminate an external deficit implies ending sterilization so as to let the money supply fall. Even though the monetary reforms of 1974 included some decentralization of power, with credit policy becoming less controlled by the Bank of France and more by each union member, monetary policy remains by and large in the hands of each union's central bank, which sets targets for total central bank financing in each member state and has other means to control domestic credit (for example, setting reserve requirements for individual commercial banks and varying interest rates). In turn, the central bank of each monetary union must maintain a certain level of total external reserves for its union with the Bank of France (for example, the statutes of BCEAO require it to act whenever its level of external reserves falls below 20 percent of its sight liabilities).

16. For recent case studies of macroadjustment using this approach see Ahamed (1985).

17. So many applications of the dependent economy are available that most options we introduce have been treated in one form or another in the literature. For example, the distinction between private and public deficit, which is usually not made, has been exploited, though in a simpler model, by Soderstrom (1985). Perhaps our model is closest in spirit to Jones's (1974) two-sector model, in which the export good is not consumed domestically.

it is the sum of the private and public sector financial deficits, the private deficit being the excess of private investment over private savings and the public deficit being the budget deficit. The model recognizes this distinction and assumes—to approximate the case studies under review—that the private sector deficit is always zero (that is, the private sector does not borrow or lend to the government *or* from or to foreigners). Therefore the current account deficit *is* the budget deficit. Second, access to the French treasury implies that external borrowing is a possibility open to these countries whenever it is necessary to adjust to macroeconomic disequilibrium. Third, because the exchange rate cannot be used for expenditure switching, trade taxes or subsidies are an important means of adjustment to a current account imbalance. Hence, they are included in our analysis. Fourth, we consider structural characteristics in our selection of functional forms, thus departing from the standard dependent-economy analysis: the export sector is the traditional, price-taking sector but the rest of the economy produces a good which is imperfectly substitutable with the imported commodity. We refer to this sector as the "semi-tradable" sector, and the elasticity of substitution in use between this sector's output and imports reflects the extent of "dependence" of the economy.

The Model

A typical CFA zone member's economy is characterized by a primary sector producing a cash crop (coffee, cocoa, or groundnuts) that is almost entirely sold in world markets at an exogenously given dollar price, together with a small industrial sector and a sizable nontradable sector. The industrial sector produces goods and services that are imperfect substitutes for goods sold in international markets; by contrast, the cash crop is a homogenous, undifferentiated product. Hence the distinction between the two sectors. Without much loss of generality, we can aggregate the industrial and nontradable sectors into a semitradable sector. Since it includes manufacturing, the semitradable sector competes for demand with foreign goods, albeit partially.

For simplicity, we assume that output in each sector is produced by a Cobb-Douglas production function. To reflect the medium-term focus of the analysis, we assume sector-specific capital. This gives us the following production functions, with the terms for capital suppressed:

$$X = \overline{A}L_1^{\alpha} \tag{2}$$

where

X = output (equal to exports) of the primary sector
L_1 = labor employed in the primary sector

and

$$Q = \overline{B}L_2^{\beta} \tag{3}$$

where

Q = output of semitradables
L_2 = labor employed in the semitradables sector.

A bar over a variable indicates that the variable is exogenous.

The output of the semitradables sector is an imperfect substitute for imports, in private consumption. Assume that private sector preferences are described by a constant elasticity of substitution (CES) utility function. Then the demand for semitradables, C, and imports, M, is a function of the relative final prices of imports to semitradables:

$$\frac{C}{M} = \overline{K}\left[\frac{P_M^*(1+t)\overline{e}}{P}\right]^{\sigma} \tag{4}$$

where

P_M^* = exogenous world price of imports (chosen as numeraire)
P = domestic price of semitradables
$\overline{e}$ = exchange rate (fixed by assumption and set equal to unity by choice of units)
t = ad valorem tariff rate
σ = elasticity of substitution of semitradables for imports (equal to minus the own price-elasticity of demand for imports)
$\overline{K}$ = a constant
C = private demand for semitradables
M = private demand for imports.

Labor is the only mobile factor. If it is available in fixed supply ($\overline{L}$), then we have the constraint:

$$L_1 + L_2 = \overline{L}. \tag{5}$$

Alternatively, we consider the implications of a wage that is rigid in terms of consumption goods. We consider two variants suggested by the two consumption goods in the model. In the first one, we assume wage rigidity in terms of the (tariff-inclusive) import price so that any supply response will arise exclusively in the semitradable sector, unless the tariff rate changes. In the second variant, we assume rigidity in terms of the semitradable sector price, and thus supply response will come from the cash crop sector exclusively. In both instances, we relax the full employment assumption to incorporate Keynesian multiplier effects. In the first alternative, equation 5 is replaced by

$$W/[P_M^*(1+t)e] = \overline{W} \tag{6}$$

and in the second by

$$W/P = \overline{W}. \tag{7}$$

Finally, profit maximization and perfect competition require equality of the value of marginal product across the two domestic sectors:

$$\alpha P_X^*(1-s)\overline{e}\overline{A}L_1^{\alpha-1} = \beta P\overline{B}L_2^{\beta-1} \tag{8}$$

where P_X^* is the world price of the export sector and s is the ad valorem export tax rate.

We assume that the government exogenously purchases only semitradables, amounting to $\overline{G}$.[18] Material balance for semitradables requires that

$$Q = C + \overline{G}. \tag{9}$$

The government's budget constraint sets foreign borrowing plus import and export duty revenues equal to government expenditures:

$$\overline{e}(F + tP_M^*M + sP_X^*X) = P\overline{G} \tag{10}$$

where F is foreign borrowing (for example, borrowing from the operations account) by the government. Net private domestic savings are assumed to be zero.

By Walras's Law (the equality between income, including foreign borrowing by the government, and expenditure), the difference between the value of imports and exports equals the current account deficit, F, that is:

$$P_M^*M = P_X^*X + F. \tag{11}$$

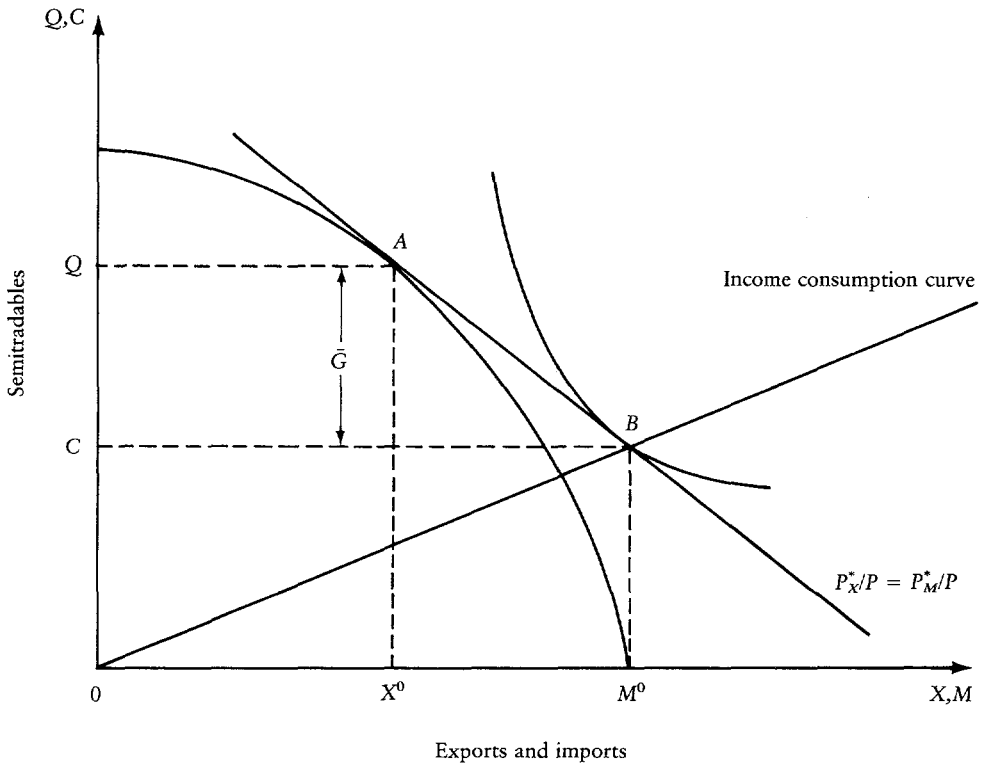
Since we have assumed for simplicity that the fiscal deficit is the current account deficit, this abstracts from any real effects arising out of the government's borrowing from the central bank, and from the fact that some foreign borrowing may be done by the private sector. This roughly fits the countries studied in which private borrowing was transitory whereas public borrowing was often sustained.

Note further that (excluding the effects of taxes and subsidies) there are two relative prices in our model: P_X^* and P. A rise in P_X^* is an improvement in terms of trade. A rise in P is a rise in the price of semitradables relative to imports. A rise in P_X^*/P represents a change in the relative price of exportables to semitradables. Excluding again the effects of taxes and subsidies, P_X^*/P is the real exchange rate facing producers. In the remainder of the paper, when we speak of the real exchange rate we shall mean the value of P_X^*/P (inclusive of export taxes) since its value signals the relative profitability of engaging in exportables versus domestic production (see figure 4).

The model represented by equations 2–5 and 8–11 is sufficiently simple for qualitative analysis. Its solution in log-differential form is given in the appendix, and comparative static solutions for typical parameter values are given below. The model can also be illustrated graphically. We do so below and show the effects of the shocks experienced by Cameroon, Côte d'Ivoire, and Senegal, as well as of the policy responses (import tariffs, export taxes, and changes in government expenditure). We restrict ourselves in the graphical analysis to the full-employment case, leaving the implications of wage rigidity for the multiplier analysis reported subsequently.

18. This assumption is subjected to sensitivity analysis. Appendix A formulates the model for the case where an exogenous fraction, m, of $\overline{G}$ is spent on imports.

Figure 4. *Equilibrium in the Dependent-Economy Model*



Graphical Analysis

Figure 4 portrays an equilibrium in the model for the full-employment case. Assume that export taxes and import tariffs are zero. Assume further that there are constant terms of trade, defined to equal 1 so that the price of imports equals that of exports: $P_M^* = P_X^*$. The production functions together with the full-employment condition imply that there is a well-behaved transformation frontier between X and Q, as shown. For a given price ratio P_X^*/P, production is determined at the point A, at which the slope of the tangent to the transformation frontier equals P_X^*/P. The private consumer's budget line is given by the line from the production point with slope P_M^*/P, which by assumption equals P_X^*/P, since $s = t = 0$. Private consumption is determined at the point B, where the indifference curve is tangent to this budget line. Equilibrium is defined as the price level, P, at which the production of the semitradable, Q, is exactly $\overline{G}$ units above private demand for the semitradable, C. The government budget deficit, which

is here assumed to equal its consumption of semitradables, $\overline{G}$, is equal in value to the current account deficit, $OM_1 - OX$.

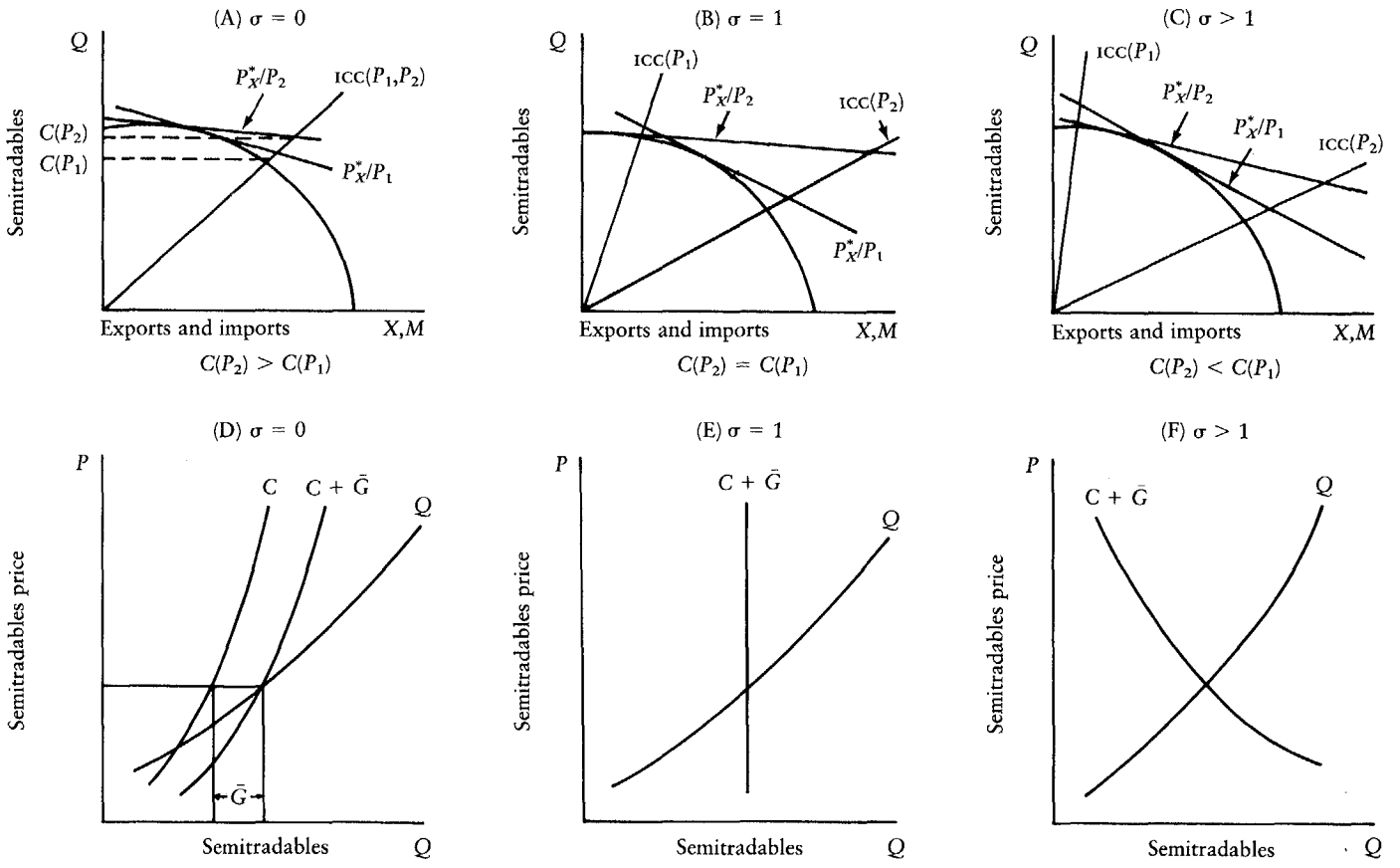
Now suppose an import tariff is imposed: $t > 0$. Holding P fixed, the consumer's budget line rotates clockwise (not drawn in figure 4) and is no longer equal to the producer budget line, as $P_M^*(1 + t)/P > P_X^*/P$. If the substitution effect dominates the income effect of the tariff, the demand for the semitradable, C, will rise and the relative price of the semitradable will have to rise to eliminate excess demand. In the new equilibrium, the income consumption curve (ICC) will rotate counterclockwise but by less than if P were to have remained unchanged.

In order to perform comparative statics exercises with this apparatus, it is useful first to describe the supply and demand curves for semitradables. This is done in figure 5, in which parts A–C are used to motivate the shape of the private demand curve, C, which is presented in parts D–F. For deriving total demand, we consider only cases of a budget deficit ($\overline{G} > 0$) so that the equilibrium production point on the transformation frontier is above the intersection point of the relevant income consumption curve with the budget line. As P rises, the slope of P_X^*/P flattens and Q rises. Hence, the supply curve of Q is upward-sloping. The slope of the demand curve depends on σ, the elasticity of substitution between imports and semitradables. Notice that for higher levels of P, not only does the slope of the consumer's budget line shift, but so does the point on the transformation frontier whence it is drawn. The latter represents the general equilibrium income effect while the slope rotation reflects the substitution effect. In equilibrium, the income effect of price changes for this nontraded good is not zero because the government buys a fixed amount of it, $\overline{G}$.

Now consider extreme elasticity values in parts A–C of figure 5. For $\sigma = 0$, the income-consumption paths for all prices are a unique ray through the origin. In this case, as P falls (the slope of the tangent gets steeper), private demand for Q declines. That is, the private demand curve for semitradables (C in figure 5D) is upward-sloping.[19] With $\sigma = 0$, there is no substitution effect; hence the general equilibrium income effect dominates. For values of $\sigma < 1$, the private demand curve will be upward-sloping. The intersection of C and Q in figure 5D is not an equilibrium, since exogenous government demand, $\overline{G}$, is not taken into account. Equilibrium is at the intersection of the demand curve for semitradables, $C + \overline{G}$, with the corresponding supply curve. By contrast, for very high values of σ (figure 5, parts C and F) small changes in prices bring about substantial changes in the income-consumption paths (recall that our indifference curves, being based on CES utility functions, are homothetic, so all income-consumption paths are rays through the origin). In this case, the substitution effect dominates, so that demand for Q rises as P declines and the demand curve is downward-sloping (figure 5F). When $\sigma = 1$, the income and substitution effects cancel each other and the demand curve is vertical (figure 5,

19. In the case of a budget surplus $\overline{G} < 0$, the demand curve for Q would be downward-sloping.

Figure 5. *Comparative Statics in the Dependent-Economy Model*



Note: $P_2 > P_1$

parts B and E).[20] Hence the demand curve is upward- or downward-sloping depending on the elasticity of substitution between imports and semitradables.

With this apparatus, we are able to anticipate much of the comparative statics multiplier results for different values of σ reported below. First, an increase in G always leads to an increase in P (and hence a real exchange rate appreciation). Whether or not the demand curve is downward-sloping, a rightward shift will raise P.

Second, the impact of a tariff increase is asymmetric depending on the elasticity of substitution. The effect of an increase in t is to make the slope of the consumer's budget line steeper in figure 4. As explained earlier, if the income effect dominates, this leads to lower demand for semitradables and imports (a decline in C and M), that is, when $\sigma < 1$. In turn, this implies that the demand curve in figure 5D shifts to the *left* so that P falls. In the extreme case where $\sigma = 0$, imports are noncompetitive so that a tariff is equivalent to a consumption tax. By contrast, if $\sigma > 1$, the tariff lowers M but raises C, causing the demand curve in figure 5F to shift to the right, raising P. Whether or not P declines, an increase in the tariff rate lowers the current account deficit. This is because we assumed no private borrowing. If the private sector always balances its budget, the increased tariff revenues contribute one-for-one toward reversing the government's deficit, and therefore the trade deficit.

Third, the same mechanism is at work for a favorable terms-of-trade shock (an increase in P_X^*). It will improve or worsen the current account deficit depending on the value of σ. This can be explained by observing that the effect of an increase in P_X^* is to shift the supply curve for Q to the left as producers move into production of exports, X. In addition, the demand curve for Q shifts to the right (the general equilibrium income effect). For low σ, this can lead to an increase in P and Q. If Q rises, X must fall, given the shape of the transformation frontier. Moreover, as P is higher, demand for M is greater. The higher M and lower X lead to an unambiguous increase in the current account deficit. For high σ, the substitution effect dominates and consumers demand less Q, thus releasing resources to the exportable sector and yielding an improvement in the current account deficit.

Finally, the effect of an increase in the export tax, s, is to shift the supply curves of semitradables in figure 5 to the *right*. Since exporting is less profitable, resources shift to semitradables. This always implies a decline in P. For $\sigma < 1$ (as in figure 5D) this shift also causes Q to decline, implying an increase in X. When $\sigma > 1$, the impact on X is in the opposite direction. In both cases, P declines. Moreover, the current account deficit improves because of the increased public revenues from the tax rise.

Adjustment with Rigidity: Parametric Analysis

We now supplement the graphical analysis with multiplier calculations derived from solving the model under different demand and supply elasticities and the

20. Note that, as drawn, figure 5B–F shows that for P private demand exceeds supply of the semitradable. Hence P will not be an equilibrium.

three different assumptions about labor market behavior embodied in equations 5, 6, and 7. Since the elasticity of substitution in demand between imports and the semitradable is an important parameter, we start with a systematic variation of σ under the three model variants. This allows us to examine simultaneously the influence of relative price rigidity and inflexibility in demand and supply.

For all calculations, we take as a starting point a small government sector in total expenditures (that is, a small budget deficit) and a small external deficit. Government expenditures are 5 percent of total expenditures, foreign exchange revenues are 95 percent of foreign exchange expenditures, and initial tariff and export taxes are 25 percent and 10 percent, respectively. These parameter values are roughly representative of the initial situation in the three countries.

Figure 6 displays the multipliers for the current account, F, and the real exchange rate, RER, where the plotted values are percentage changes in F and RER for a 1 percent change in the selected instrument (for example, the import tariff) or exogenous variable (for example, the terms of trade) under different values of σ.[21]

Starting with the current account multipliers, for a given government expenditure increase, the more elastic is domestic demand (that is, the higher the value of σ) the less is the real exchange rate appreciation and hence the smaller is the corresponding increase in the current account deficit (figure 6). The flexible wage, full-employment case lies between the two fixed wage cases. When the wage is fixed with respect to the world price of imports, the semitradable sector can expand without limit, offsetting the decline in the current account. Fixing the real wage in semitradables curtails its supply response, which raises the value of the current account multiplier. Sensitivity analysis with the assumption that all government spending is on semitradables reveals that this conclusion is qualitatively robust. If 20 percent of government spending is on imports, the full-employment deficit multiplier ranges from 3.7 to 3.4 as σ ranges from 0.2 to 100.

Besides a first-round positive impact on the current account, an improvement in the terms of trade raises real income, which contributes to an increase in the current account deficit. Recall from the earlier comparative statics discussion of a terms-of-trade shift, however, that for low values of σ an improvement in the terms of trade is likely to lead to a rise in P and an increase in Q. As shown in figure 5D, for low values of σ, the income effect dominates the substitution effect. P rises, attracting labor out of the cash crop sector (except when the wage is fixed in terms of semitradables). Regardless of supply response there will be a shift in consumption toward imports. Both effects work to raise the current account deficit. Thus when the price elasticity of demand for imports is low, the current account will deteriorate when the terms of trade improve (figure 6). For the initial conditions chosen here, the multiplier changes sign for values of σ around 2 except for the case when the wage is tied to the numeraire (P_M^*), which increases

21. Multipliers for the other endogenous variables are omitted since these variables were not discussed in the case studies.

Figure 6. *Current Account Multipliers*

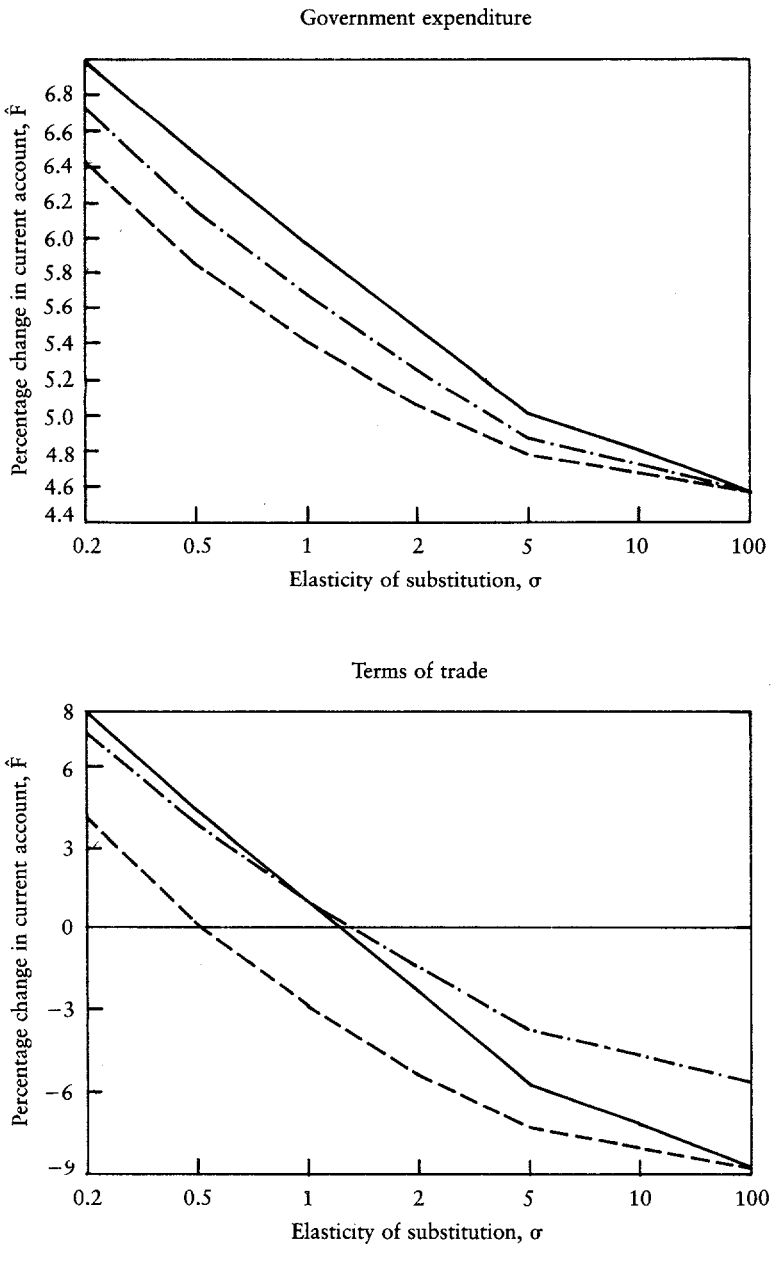
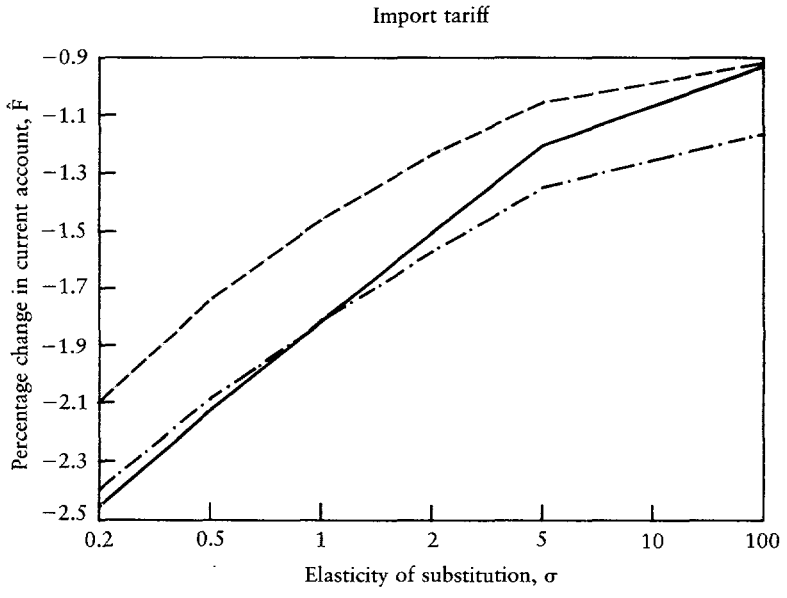
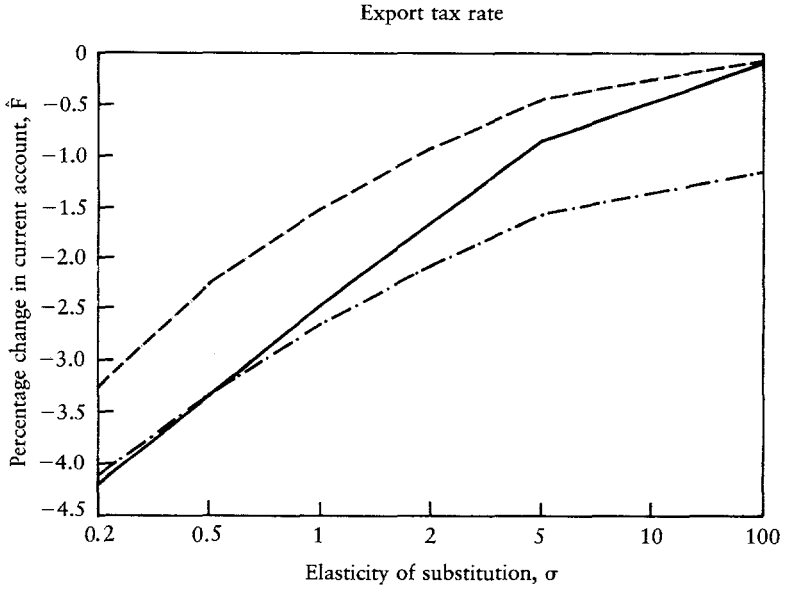


Figure 6 *(continued)*





Key: —·— flexible wage, full employment; – – – fixed wage, $P_M^*(1 + t)$; —— fixed wage, P.

Note: Multipliers are defined as the percentage change in $F = \hat{F} = P_M^* M - P_X^* X$ for a 1 percent change in the corresponding exogenous variable (for example, the import tariff).

supply response. This in turn contributes to a smaller current account deficit and hence to switching at a lower value of σ.

Multiplier values with respect to export taxes and import tariffs (figure 6) should be viewed together since they are alternative instruments for achieving expenditure switching toward semitradables.[22] Raising a tariff reduces the current account deficit both because it increases government revenues and because it lowers imports. The reduction in imports is much lower than the tariff increase, so that tariff revenues always rise. However, this positive effect is mitigated by the resource shift out of cash crops into semitradables as demand shifts out of imports. In addition, with the quantity of government purchases fixed, the higher semitradable price increases total government expenditures and thus the current account deficit.

An increase in export taxes also raises government revenues and hence reduces the budget deficit. Although exports decline, the net effect is an increase in revenues from this source. It appears from the multipliers in figure 6 that an export tax is a more potent instrument than an import tariff in reducing a current account deficit, even though we assume an infinite foreign elasticity of demand for cash crop exports. This is because the current account is endogenous in our model. If the current account were fixed, then Lerner symmetry would prevail and an import tariff would be equivalent to an export tax. The two multipliers do converge to the same value as $\sigma \rightarrow \infty$ because, in this case, $\hat{F} \rightarrow 0$ and we approximate balanced trade at the margin. However, for finite values of σ, especially in the plausible range $0.5 < \sigma < 2$, the export tax dominates the import tariff because of its impact on P. An export tax increase releases resources to the semitradable sector, increasing the latter's competitiveness and thereby lowering the deficit. By contrast, an import tariff, by increasing demand for semitradables, bids up P, which counters the favorable impact of the increased tariff revenues on the deficit. In sum, raising the export tax lowers the level of exports, but the revenue effects—in reducing the government deficit—are sufficiently strong to result in an improvement in the current account deficit.

The above analysis can be used to shed light on another issue of current interest to CFA zone members. Since they cannot devalue the nominal exchange rate, some zone members (Côte d'Ivoire and Senegal in particular) have introduced an import tariff combined with an export subsidy to "simulate" a real depreciation. In our framework, this amounts to combining the effects of the import tariff and a negative export tax. Our results show that, if the current account deficit were due to a fiscal deficit, such a tariff-cum-subsidy scheme may not have the desired effect. First, to the extent that the scheme is not revenue-neutral, it will affect the current account deficit, possibly in a perverse manner. Second, even if the scheme were revenue-neutral, it would not be "deficit neutral," given the effect on the semitradable price. Unless government spending is also reduced, the tariff-cum-

22. The export tax rate is defined as a positive number. Hence an increase in the export tax is defined as a positive number. See appendix B.

subsidy scheme can worsen the current account deficit and appreciate the real exchange rate.

In comparing the impact of various tax and subsidy schemes, we are not addressing the question of allocative efficiency or its analog, consumer welfare. An export tax or import tariff may improve the deficit, but what does it do to welfare? To answer this, an explicit welfare function must be introduced, which is somewhat problematic in our model which has separate government expenditure and a non-zero trade deficit. The only result we can claim is that, if the welfare function were that implied by the demand system in equation 4, then the welfare maximizing tax to raise a given level of revenue would be an export tax rate of zero, combined with an import tariff and domestic tax on semitradables at equal positive rates. This is a special case of the result of Diamond and Mirrlees (1971) and is one of the recommendations in Shalizi and Squire (1986) for tax policy in Sub-Saharan Africa.

Real exchange rate multipliers appear in figure 7. Their interpretation is straightforward. As $\sigma \rightarrow \infty$, the domestic relative price of semitradables becomes determined by the fixed world price. Multiplier values approach zero, regardless of labor market assumptions. Also labor market assumptions do not affect multiplier values significantly in the range $0.5 < \sigma < 2$. Finally, several of the tariff and terms-of-trade multipliers change sign at $\sigma = 1$ for reasons associated with the slope of the demand curve in figure 5.

We conclude with estimates of the likely range of real exchange rate and current account multipliers. The range is derived by assigning share parameters in the production functions that bracket the range of cash crop and manufacturing sector supply elasticities in the literature which we summarize in appendix C. This is done for the flexible wage model, which is also likely to be more representative of labor market behavior in CFA countries. The multipliers are displayed in table 1 for two sets of values for m, the import share of government expenditure.

How do these figures relate to the adjustment experience of Cameroon, Côte d'Ivoire, and Senegal? Consider first the multipliers displayed in table 1 resulting from a terms-of-trade improvement with and without increases in government spending and export taxation. The figures suggest that terms-of-trade improvements will result in real exchange rate appreciation if one considers the more realistic low-elasticity case. This appreciation will be dampened by windfall taxation but is nonetheless likely to prevail. Contrast the experience of Cameroon and Côte d'Ivoire. Even though export taxes were raised in Côte d'Ivoire, government spending was increased sharply and real exchange rate appreciation occurred. By contrast Cameroon avoided real exchange rate appreciation by avoiding increases in government spending and by taxing the windfall gain.

Now consider the adjustment phase that corresponds to the need to reduce external financing. This was the situation facing Côte d'Ivoire in the early 1980s. In the absence of devaluation, expenditure switching can be achieved in principle by a combination of decreases in export taxes and government spending and

Figure 7. *Real Exchange Rate Multipliers*

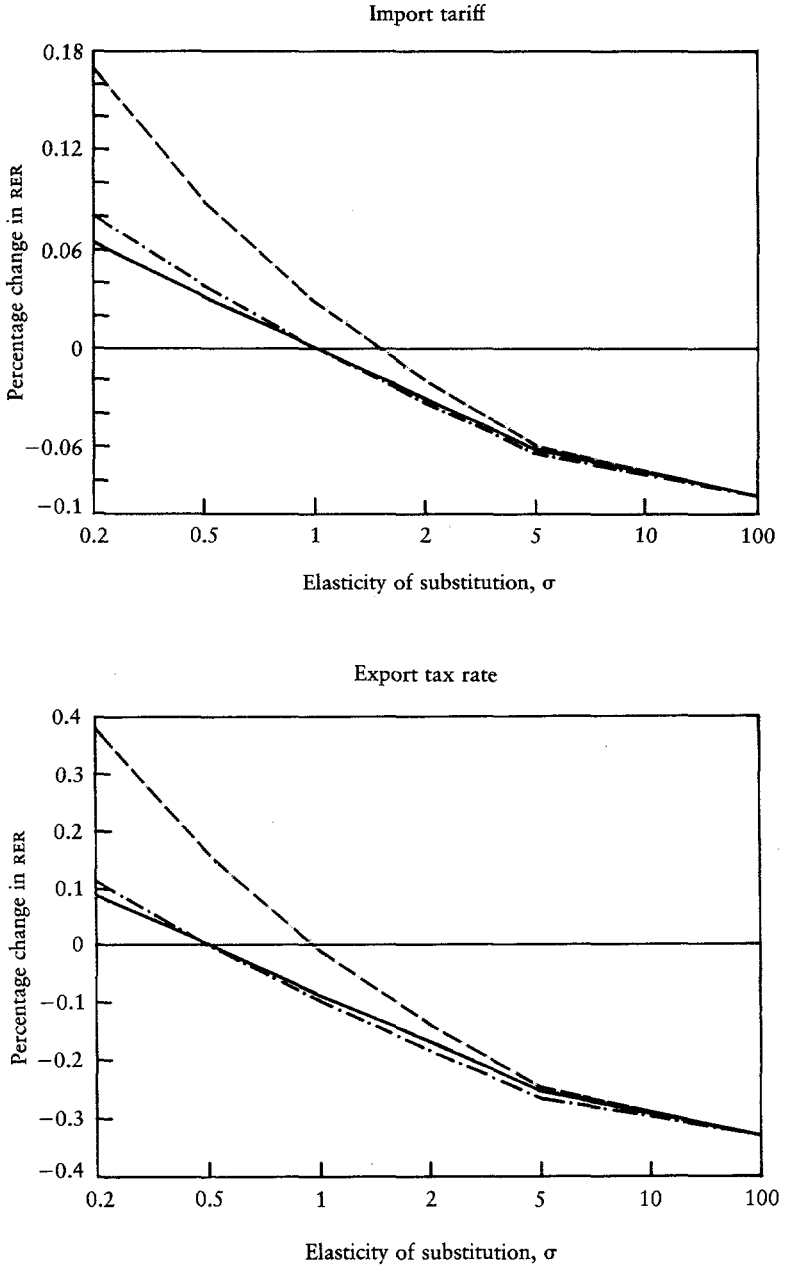
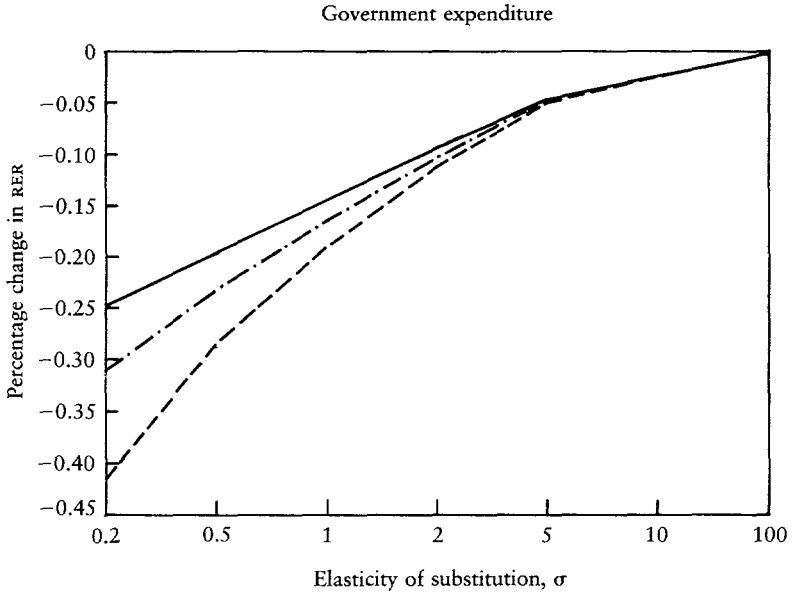
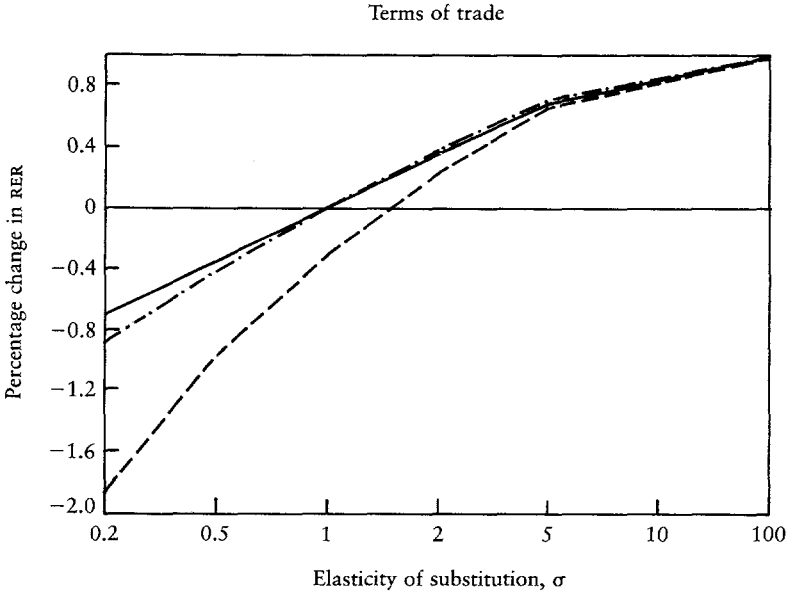


Figure 7 *(continued)*





Key: —·— flexible wage, full employment; - - - - fixed wage, $P_M^*(1 + t)$; —— fixed wage, P.

Note: Multipliers are defined as the percentage change in the real exchange rate RER = $(P_X^*(1 - s)/P)$ for a 1 percent change in the corresponding exogenous variable (for example, the import tariff).

Table 1. *Multipliers under Different Elasticities of Supply and Demand*

	Low elasticities[a]				*High elasticities*[b]			
	Real exchange rate		*Current account deficit*		*Real exchange rate*		*Current account deficit*	
	$m = 0$	$m = 0.2$	$m = 0$	$m = 0.2$	$m = 0$	$m = 0.2$	$m = 0$	$m = 0.2$
Terms of trade	−1.7	−0.6	4.9	2.9	0.3	0.3	−1.7	−2.4
Government expenditure	−0.4	−0.1	6.7	5.5	−0.1	0.0	5.3	5.1
Export tax	0.0	0.0	−3.3	−3.0	−0.1	−0.1	−2.0	−1.8
Import tariff	0.1	0.1	−2.2	−2.1	0.0	0.0	−1.6	−1.6

Note: See appendix C for definition and derivation of parameters ϕ and Ω, which stand for supply elasticities in agriculture and semitradable sectors, respectively; m is the share of government expenditure that is imported.

a. $\sigma = 0.5$; $\phi = 0.14$; $\Omega = 0.2$.

b. $\sigma = 2.0$; $\phi = 1.7$; $\Omega = 0.85$.

increases in tariffs. However, in the low-elasticity case, changes in export taxes have no effect on the real exchange rate, whereas when the elasticity is high, import tariffs become an ineffective instrument. Nevertheless, increases in export taxes are a more effective way of reducing the external deficit than increases in tariffs even when the supply elasticity in the cash crop sector is low. Reduction in the government deficit has the highest multiplier value on the current account and is not very sensitive to the range of elasticities considered. Note finally that the results are robust to variations in the import content of government expenditure, signifying that it is the size of the budget, rather than its composition, that is crucial.

III. Determinants of the Current Account and Real Exchange Rates

The case studies as well as the model results suggest some fundamental determinants of the current account and the real exchange rate for CFA zone countries. Therefore, we conclude with a statistical analysis of the current account and real exchange rate in the three countries. Ideally, econometric analysis would proceed from full-information estimation of a structural simultaneous equation model of the current account and the real exchange rate. Unfortunately, not enough restrictions can be imposed on the model in section II for it to be identified. Availability of time series data for the three countries imposes further limitations. These considerations lead us to concentrate on reduced form estimation for the current account and the real exchange rate. Since our model suggests that these two variables are jointly and endogenously determined, neither variable is included in the estimation equation of the other.

The results from estimating the current account and real exchange rate equations appear in tables 2 and 3. For the current account equation, the dependent variable is the current account surplus over GDP, $(X - M)$/GDP, and the regressors with expected signs are the public sector surplus, [PUBDR = $(GR - GE)$/GDP](+); real national income growth, DLNY(−); the manufacturing

Table 2. *Determinants of the Current Account (CAR)*

Country and years		*PUBDR (+)*	*DLNY (−)*	*WR (−)*	*DV (−)*	$\bar{R}^2$	*DW*	χ^2 *(prob)*	*ρ(−1)*
Côte d'Ivoire, 1965–84	1a	0.8 (2.4)**	−26.0 (2.5)**		−1.6 (0.7)	0.99	1.6	13.7 (0.13)	−0.4 (1.5)
	1b	0.9 (2.8)**	−19.1 (2.5)**	0.0 (0.0)		0.99	1.7	10.5 (0.40)	−0.4 (1.6)
Senegal, 1965–83	2a	1.1 (4.2)***	20.6 (2.5)**		−3.3 (4.9)***	0.99	2.2	9.5 (0.22)	−0.3 (1.6)
	2b	1.2 (5.2)***	18.9 (2.2)**	0.1 (2.1)**	−5.8 (4.2)***	0.99	2.1	5.9 (0.54)	(−0.3) (1.4)
Cameroon, 1965–83	3a	0.7 (4.6)***	20.9 (5.2)***		−0.3 (0.3)	0.92	1.9	7.5 (0.58)	−0.4 (1.8)
	3b	0.7 (4.5)***	20.7 (5.4)***	0.0 (1.2)		0.93	2.0	9.9 (0.45)	−0.3 (1.5)

***Significance at 1 percent level.
**Significance at 5 percent level.
*Significance at 10 percent level.

Note: Expected signs of the variables are given under each column heading in parentheses. Definition of variables (also see text): CAR = $(X - M)$/GDP; PUBDR = $(GR - GE)$/GDP; DLNY = first difference of natural logarithm of real national income; WR = real manufacturing wage; DV = dummy variable (set to 1 for 1974–85). Estimation: Ordinary least squares with first-order correction for autocorrelation after data deflation to remove heteroskedasticity. χ^2 is White's (1980) statistic for H_0: $E(u_i^2) = \sigma^2$; value in parentheses is prob > χ^2. The expression $\rho(-1)$ is the estimated value for the first-order autoregressive process. Intercepts omitted.

sector real wage, $WR(-)$; and a dummy variable, DV, taking a value of 1 for 1974 and beyond, zero otherwise. Since we do not report values for the intercept, a negative (positive) sign for DV implies a smaller (larger) current account surplus for the post-1973 period. The χ^2 statistic is White's (1980) joint test for misspecification and heteroskedasticity. Hence, the relatively low values of the statistic in table 2 are reassuring as they suggest both low heteroskedasticity and no serious misspecification.[23]

The results indicate that public sector deficits consistently exerted pressure on the current account in the three countries, supporting the model of section II. Real income growth also contributed to the worsening external position in Côte d'Ivoire but not in Senegal, where to the contrary the current account improved with income growth. This is not surprising since Senegal suffered from droughts which in turn hampered export earnings. The positive influence of income growth on the current account of Cameroon is also to be expected from the impact of the oil discovery. The regressions also show a marked deterioration of the average current account deficit after 1974 for Côte d'Ivoire and Senegal in comparison with the earlier period. Finally, the real wage variable does not enter significantly.

23. χ^2 values are final values after correction for heteroskedasticity. We corrected for heteroskedasticity by assuming a mixed form, that is, $E(u_i^2) = \alpha_1 + \alpha_2 Z_i$ where we chose the logarithm of real income as instrument to regress on the residuals. Estimated values of this regression were then used as deflators.

Table 3. *Determinants of the Real Exchange Rate Multiplier (RER)*

Country and years		*PUBDR (+)*	*TOT (−)*	*CONCR (−)*	*DV (−)*	$\bar{R}^2$	*DW*	χ^2 *(prob)*	ρ(−1)
Côte d'Ivoire, 1965–84	1a	0.7 (2.6)**	−0.5 (9.7)***		2.0 (2.0)*	1.0	1.8	16.7 (0.05)	−0.2 (0.8)
	1b	−0.9 (1.5)		−7.5 (1.8)*		0.99	1.6	11.3 (0.08)	−0.5 (2.7)
Senegal, 1961–83	2a	2.7 (3.2)***	−0.0 (0.4)		−1.8 (0.6)	0.99	1.9	11.6 (0.23)	−0.3 (1.4)
	2b	2.8 (3.4)***		2.0 (1.0)	−2.4 (0.9)	0.99	1.9	10.9 (0.28)	−0.3 (1.5)
Cameroon, 1965–83	3a	0.0 (0.1)	0.1 (2.7)**		3.1 (0.7)	0.99	1.2	16.0 (0.06)	−0.7 (4.0)
	3b	0.2 (0.6)		1.2 (0.5)	−2.4 (0.4)	0.99	1.1	16.3 (0.06)	−0.7 (3.9)

***Significance at 1 percent level.
**Significance at 5 percent level.
*Significance at 10 percent level.

Note: Expected signs of the variables are given under each column heading in parentheses. Definition of variables (also see table 2 and text): RER = ratio of agriculture and manufacturing price indexes to construction and services price indexes; PUBDR = see table 2; TOT = ratio of indexes of exports to imports; CONCR = official development assistance/GDP; DV = same as table 2. Estimation: Ordinary least squares with first-order correction for autocorrelation after data deflation to remove heteroskedasticity. χ^2 is White's (1980) statistic for H_0: $E(u_t^2) = \sigma^2$; value in parentheses is prob > χ^2. The expression $\rho(-1)$ is the estimated value for the first-order autoregressive process. Intercepts omitted.

This is not surprising since the wage series only pertains to manufacturing and had to be constructed from incomplete data.

Turning to the results from the real exchange rate equation estimations in table 3, the results are more mixed as misspecification and/or heteroskedasticity is present in most equations. Two new variables are introduced, concessionary lending/GDP, CONCR(−), and the terms of trade, TOT(−). For example, for Côte d'Ivoire, much of the variation is captured by the intercept. Though to a lesser degree, this also occurs for other equation estimates, probably suggesting that our measure of the real exchange rate index which corresponds closely to our model (namely the relative price of agriculture and manufacturing)[24] is inaccurately measured. However, the significantly negative value for the dummy variable in the equations for Senegal confirms a sharp real exchange rate appreciation after 1974, as government policy and droughts combined to sustain a deteriorating external balance.

IV. Conclusions

This article has addressed the theme of medium-term macroeconomic adjustment with a fixed exchange rate in three countries in the CFA zone: Cameroon,

24. Similar results were obtained when tradables were confined to agriculture. We do not include estimated equations with the real manufacturing wage, *WR*, as that variable was usually not significant.

Côte d'Ivoire, and Senegal. We showed how different adjustment responses to similar shocks took place in the three countries. In Cameroon, despite improved terms of trade and windfall gains from the oil price hike of the late 1970s, the government avoided real exchange rate appreciation by restraining public expenditure and sterilizing most of the foreign exchange gains. The real exchange rate was also stabilized by taxing the proceeds of coffee and cocoa exports during the boom and then raising producer prices when the boom was over. By contrast, Côte d'Ivoire expanded public sector investment, financing it partly by external borrowing. The real exchange rate appreciated and manufacturing sector competitiveness fell sharply for some time until adjustment to the growing external deficit took place. In Senegal, public sector subsidies continued to be financed by taxation of exports so the real exchange rate depreciation needed after successive droughts did not occur. The government remained in deficit and adjustment was postponed. Unlike Cameroon, therefore, neither Senegal nor the Côte d'Ivoire achieved the real exchange rate depreciation called for by adverse terms of trade and output trends.

We developed a stylized dependent-economy model to show the relationship between the instruments of adjustment (tariffs, taxes, and government expenditure) and the associated targets (the real exchange rate and the current account deficit). This model was then used to illustrate the combination of current account deficits and real exchange rate changes resulting from a terms-of-trade shock and different government expenditure patterns. The model also highlighted the implications for the real exchange rate of changes in taxation of cash crops and in restrictions on imports.

Finally, we used reduced-form estimation to analyze the determinants of the real exchange rate and current account in the three countries. The results indicate that a small number of variables explain a great part of the real exchange rate and current account variations in the three countries over the period 1963–85. Although a structural model corresponding to the stylized model would need to be estimated to explore further its usefulness, the reduced-form results are consistent with the model in the text, reinforcing the significance of the public sector deficit as a determinant of current account deficits and the real exchange rate in the countries analyzed.

Appendix A. Symbols used in the text

C = private demand for semitradables
CA = current account, expressed as percent of GDP
e = exchange rate, assumed fixed; units chosen to set e = unity
F = foreign borrowing (conducted by government only); also equal to the fiscal deficit and the current account deficit
g = government; public sector
$\overline{G}$ = total government expenditures (semitradables only in initial presentation)
I_i = investment; $i = \{g,p\}$
L_j = labor employed in sector j; $j = \{1, 2\}$
m = share of government expenditure composed of imports
M = private demand for imports
p = private sector
P_X^* = world price of the export sector product
P = domestic semitradables price
P_M^* = world import price (exogenous; the numeraire)
Q = output of semitradables
s = ad valorem export tax rate
S_i = savings; $i = \{g,p\}$
t = ad valorem tariff rate
W = wage rate
X = output of export sector (cash crops only)
α = share of payments to labor in export sector production
β = share of payments to labor in semitradables production
Ω = supply elasticity of semitradable sector
σ = elasticity of substitution in demand between semitradables and imports
ϕ = supply elasticity of agriculture
1 = primary sector
2 = semitradables sector

Appendix B. Solution of the Model

The model considered in the main text is repeated here for convenience in level form. Exogenous variables are indicated with a bar and parameters with Greek letters (except P_X^*, which is a parameter labeled thus for clarity). The equations describing the full employment version are

$$X = \overline{A}L_1^{\alpha} \tag{A-1}$$

$$Q = \overline{B}L_2^{\beta} \tag{A-2}$$

$$\frac{C}{M} = K\left(\frac{P_M^*(1+t)\overline{e}}{P}\right)^{\sigma} \tag{A-3}$$

(A-4) $$L_1 + L_2 = \overline{L}$$

(A-5) $$\alpha P_X^*(1 - s)\overline{e}\overline{A}L_1^{\alpha-1} = \beta P\overline{B}L_2^{\beta-1}$$

(A-6) $$Q = C + \overline{G}(1 - m)$$

(A-7) $$\overline{e}[F + tP_M^*M + sP_X^*]X = (1 - m)\,P\overline{G} + mP_M^*\overline{G}$$

(A-8) $$P_M^*(M + m\overline{G}) = P_X^*\,X + F.$$

This is a system of eight equations with the following eight endogenous variables: Q, M, X, C, L_1, L_2, P, and F. Exogenous policy variables are $\overline{G}$, t, s, and m, the fraction of government expenditures spent on imports. The terms of trade represented by P_X^* are also considered exogenous. The model is homogeneous of degree zero in all prices and the exchange rate, so we select $P_M^* = 1$ as numeraire and by choice of units we choose $\overline{e} = 1$. Thus, a terms-of-trade change will come from changes in the exogenous export price, P_X^*. When the wage is fixed in terms of the domestic price of the import good, equation A-4 is replaced by $W/[P_M^*(1 + t)\overline{e}] = \overline{W}$ and when it is fixed in terms of the price of the semitradable, P, equation A-4 is replaced by $W/P = \overline{W}$.

Log-differentiation of the above system of equations yields the following (where $\hat{Z} \equiv dZ/Z$):

(B-1) $$\hat{X} = \alpha\hat{L}_1$$

(B-2) $$\hat{Q} = \beta\hat{L}_2$$

(B-3) $$\hat{C} - \hat{M} = \sigma(\hat{\tau} - \hat{P})$$

(B-4) $$\lambda\hat{L}_1 + (1 - \lambda)\hat{L}_2 = 0$$

(B-5) $$\hat{P}_X^* + \hat{\zeta} + (\alpha - 1)\,\hat{L}_1 = \hat{P} + (\beta - 1)\hat{L}_2$$

(B-6) $$\gamma\hat{G} + (1 - \gamma)\hat{C} = \hat{Q}$$

(B-7) $$\mu_3\hat{F} + \mu_1(\hat{t} + \hat{M}) + \mu_2\,(\hat{s} + \hat{P}_X^* + \hat{X}) = (1 - \theta)\hat{P} + \hat{G}$$

(B-8) $$\hat{M} + \rho\hat{G} = \delta(\hat{P}_X^* + \hat{X}) + (1 - \delta)\hat{F}$$

where

$$\hat{\tau} = \frac{t}{1 + t}\,\hat{t}$$

$$\lambda = \frac{L_1}{L_1 + L_2}$$

$$\hat{\zeta} = \frac{-s}{1 - s}\,\hat{s}$$

$$\gamma = \frac{\overline{G}}{\overline{G} + C}$$

$$\mu_1 = \frac{tM}{mP_M^*\overline{G}},\ \mu_2 = \frac{sP_X^*X}{mP_M^*\overline{G}},\ \text{and}\ \mu_3 = 1 - \mu_1 - \mu_2$$

$$\delta = \frac{P_X^*X}{P_M^*(M + m\overline{G})}$$

$$\theta = \frac{mP_M^*\overline{G}}{(1-m)P\overline{G} + mP_M^*\overline{G}}$$

$$\rho = \frac{m\overline{G}}{M + m\overline{G}}.$$

When $W/(P_M^*[1 + t]) = \overline{W}$, B-4 becomes $\hat{W} = \hat{\tau}$, and when $W/P = \overline{W}$, B-4 becomes $\hat{W} = \hat{P}$.

Note from the definition of the parameters that an increase in the tariff rate implies an increase in $\hat{\tau}$ but that an increase in the export tax implies a *decrease* in $\hat{\zeta}$.

Combining B-1, B-2, B-4, and B-5 gives us the following output supply elasticities for the export and semitradables sectors:

(B-9) $$\hat{X} = \phi\,(\hat{P}_X^* - \hat{P} + \hat{\zeta})$$

(B-9′) $$\hat{X} = \phi^*\,(\hat{P}_X^* + \hat{\zeta})$$

(B-10) $$\hat{Q} = \Omega\,(\hat{P} - \hat{P}_X^* - \hat{\zeta})$$

(B-10′) $$Q = \Omega^*\,\hat{P}$$

where

$$\phi = \frac{\alpha\,(1-\lambda)}{\lambda(1 - \beta) + (1 - \lambda)(1 - \alpha)};\ \phi^* = \frac{\alpha}{1 - \alpha}$$

and

$$\Omega = \frac{\lambda\beta}{\alpha(1 - \lambda)}\,\phi \geq 0;\ \Omega^* = \frac{\beta}{1 - \beta}.$$

In the above expressions, an asterisk denotes the value of the parameter for the case when the wage is fixed in terms of $P_M^*\,(1 + t)$. Similar expressions can be derived for the case when the wage is fixed in terms of P. Expressions B-9 and B-10 show that an increase in the relative price of the semitradable ($\hat{P} > 0$) elicits a positive supply response for the semitradable sector and that an increase in the export tax ($\hat{\zeta} < 0$) decreases the supply of the cash crop sector.

The model is solved by matrix inversion. Letting $\hat{Y}$ and $\hat{Z}$ denote the vectors of endogenous and exogenous variables respectively and A and B the corresponding coefficient matrixes, the multipliers are obtained as

$$\hat{Y} = A^{-1}\,B\,\hat{Z}.$$

Appendix C. Parameters for Model Simulation

The parameter values used to calculate the multipliers in table 1 are

Low case	*High case*
$\sigma = 0.50$	2.0
$\alpha = 0.40$	0.8
$\beta = 0.30$	0.6
$\lambda = 0.40$	0.4
$\gamma = 0.05$	0.05
$\mu_1 = 0.40$	0.4
$\mu_2 = 0.40$	0.4
$\mu_3 = 0.20$	0.2
$\delta = 0.95$	0.95
$t = 0.10$	0.10
$s = 0.25$	0.25

The parameter values for the multipliers reported in figures 6 and 7 are the same except that $\alpha = 0.6$, $\beta = 0.4$, and $\lambda = 0.5$.

The parameter values for α, β, and λ are chosen to calibrate supply elasticities. In agriculture, the range is $0.4 < \phi < 1.7$ and in manufacturing $0.2 < \Omega < 0.85$. Berthelemy and Morrison (1985) report the following supply elasticities for agriculture from estimation of a Nerlovian production function (t-values in parentheses): Cameroon: 0.8 (3.2); Côte d'Ivoire: 0.4 (3.3); Senegal: 0.2 (1.4). Their results are statistically more significant than those reported in Bond (1983) and for the most part fall within the range of elasticities implied by our parameter choice. The crops included in their analysis are export crops: Cameroon (cocoa, coffee, cotton); Côte d'Ivoire (cocoa, cotton); Senegal (groundnuts, cotton). Berthelemy and Morrisson also find a statistically significant elasticity of agricultural supply to manufacturing output (elasticities around 0.4) which is consistent with our full employment formulation in which ϕ depends on β.

In other calculations reported in Castillo, Devarajan, Jakobeit, and de Melo (1986), we also varied the share of labor in semitradables. The resulting supply elasticities have a wider range of values, but the qualitative implications of the multiplier analysis remain unchanged.

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Consequences of a Commodity Boom in a Controlled Economy: Accumulation and Redistribution in Kenya 1975–83

D. L. Bevan, P. Collier, and J. W. Gunning

The economic theory of "Dutch disease" is extended and applied to the 1976–79 coffee boom in Kenya in this article. When a commodity boom is perceived as temporary, a large fraction will tend to be saved out of transient income. The spending effect of the boom is supplemented by relative price changes resulting from capital stock increases. In the presence of foreign exchange and import controls, the benefits of a sudden export price increase may be transferred intersectorally. Using a general equilibrium model, it is estimated that in Kenya the benefits of the boom were largely transferred from coffee growers to urban groups.

During the 1970s many developing countries experienced commodity "booms," sharp but temporary increases in the prices of their primary exports. Statistical work on the simulation of commodity markets (Gilbert 1985) implies that the price fluctuations which are common in such markets are generally not symmetrical about the mean but take the form of sporadic peaks followed by long, shallow troughs. In studying the economic consequences of fluctuations in commodity prices, we focus upon these boom phases.

The effect of the coffee boom of 1976–79 upon growth and income distribution in Kenya is analyzed in this article. Virtually no tax was imposed on coffee so that private agents received the entire windfall which, because it resulted from a frost in Brazil, was understood to be temporary.[1] In allocating this temporary windfall, however, private agents faced government-imposed constraints in the form of foreign exchange controls, import controls, interest rate ceilings, and biased investment allocation. We address below three questions related to these constrained choices. First, a priori, how would such controls alter allocative

1. Its precise duration, however, was uncertain. Government responses to the boom in ten coffee producing countries, including Kenya, are compared in Davis (1983). Kenya is atypical in Davis's sample in having virtually no taxes on coffee exports.

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decisions? Second, did the actual allocation of the Kenyan windfall conform to these theoretical expectations? Third, what were the consequences of this allocation for growth and the distribution of income between rural and urban households?

Three distinct literatures have addressed the economics of commodity price fluctuations. One investigates whether there is a relationship between "instability" and growth primarily using multicountry cross-section data. The concern with the macroeconomic effects of instability on commodity markets has a long history, including Keynes's wartime plea for buffer stocks. A more recent and rigorous literature (Newbery and Stiglitz 1981) explores the theory of the microeconomic consequences of price fluctuations. Finally, the chronic macroeconomic problems currently besetting many developing countries have prompted a literature on "stabilization" and "structural adjustment" which is largely a policy-driven analysis of the responses to balance of payments constraints induced by terms of trade deterioration (Ahamed 1986). This literature does not provide detailed comparative case studies combining micro- and macroeconomic analyses of price fluctuations.

This article reports on a component of our research on the coffee boom of 1976–79 in Kenya and Tanzania. The scope of the project encompasses private sector responses to windfall income and relative price changes, public sector revenue and expenditure behavior, and the consequences of these changes for distribution and growth. Within the private sector, the analysis of peasant behavior is derived from panel data generated by purpose-designed surveys in both countries. That analysis will be reported subsequently, this article being confined to macro and general equilibrium aspects of the boom. A second important component of the project which is not reported here is the behavior of the public sector. The loss of control over government expenditure induced by a temporary increase in revenue had such powerful macro repercussions that it warrants separate treatment. Finally, the behavioral responses in Kenya and Tanzania were profoundly different because, at times, quantity-rationing was in effect in Tanzania. Although this makes the comparison more interesting, it requires that in the first instance the two cases must be modeled differently. Since we have reported our Tanzania model elsewhere (Bevan, Bigsten, Collier, and Gunning 1986, forthcoming, and Bevan, Collier, and Gunning 1986), this article is confined to Kenya. The entire project is reported in Bevan, Collier, and Gunning (forthcoming).

The theory of how economies respond to permanent external shocks has been intensively studied in recent years (Corden 1984, Neary and van Wijnbergen 1986). Much of this analysis has been conducted in a static framework, which is appropriate to one-time changes in the external environment.[2] However, many

2. For example, Neary and van Wijnbergen (1986, chap. 1) do introduce investment in a two-period version of the standard Dutch disease model, but under the assumption that there are no market imperfections. Conversely, when they consider imperfect capital markets (p. 31) investment is assumed away.

shocks are essentially temporary in character, and for these it is necessary to extend the usual analysis into a more dynamic framework. The coffee boom in Kenya is a good example of this type of temporary shock, and in the next section we attempt to make the appropriate extension.

In a static, one-sector economy, with no government controls, long time horizons, and perfect markets for goods and factors, the theory of private response to a temporary shock is straightforward and familiar. A rational economic agent experiencing a windfall gain will save (invest) it all to enhance his permanent income; incremental consumption will be confined to what can be sustained from this enhanced permanent income.

Once these restrictions are relaxed, matters become more complicated. The existence of nontradable goods permits changes in their price relative to that of tradables, and movements in this relative price play an important part in the story. This is the central insight of the literature on Dutch disease. When it is combined with the intertemporal aspect already noted, it is necessary to distinguish further within the nontradable category between consumption and capital goods.

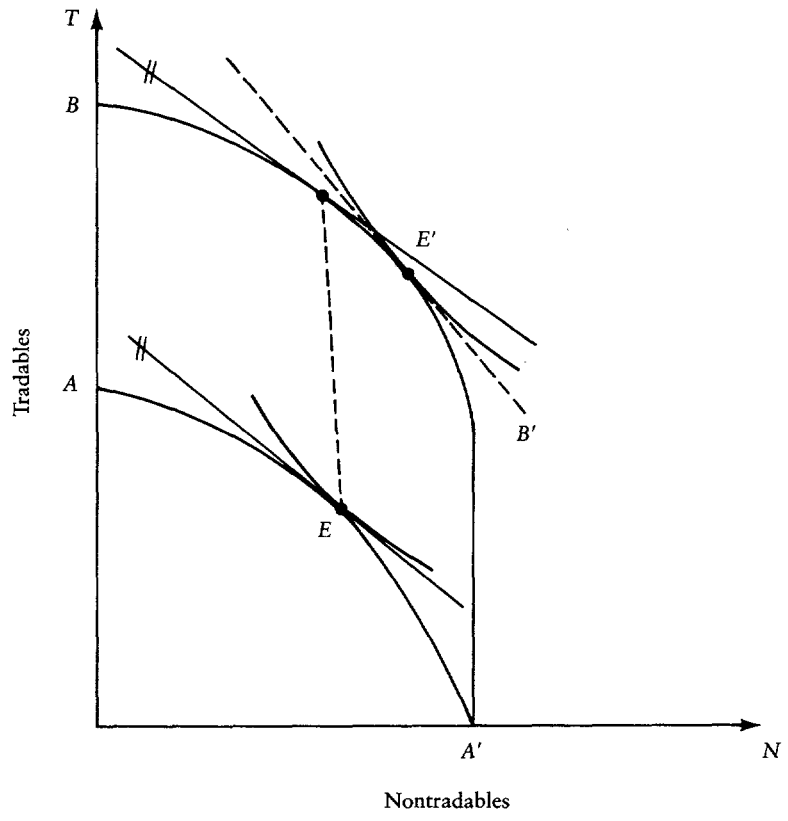
These relative price changes engender powerful effects of two kinds. The first involves transfers between agents, particularly between the rural and urban sectors. The second involves real effects, notably a reduction in the proportion of a windfall that is invested. These effects are likely to be amplified in the presence of government controls that prevent full market adjustment.

In Kenya, the coffee boom amounted to a terms of trade gain of K£339m (m = million; 1975 prices) in the period 1976–79, equivalent to 32 percent of 1975 gross domestic product (GDP). While in Tanzania the price increase was largely taxed away, in Kenya the producer price of coffee rose almost as much as the world price so that coffee producers, predominantly smallholders, were the initial beneficiaries of the boom. The following section provides some theoretical groundwork to trace the effects of this shock through the economy. In section II, estimates are made of relative price changes, private investment expenditure, and real changes in assets, using standard National Accounts data. In section III, this is supplemented by a general equilibrium analysis using a simulation model. This enables us, in particular, to estimate the extent to which farmers lost their initial gains through transfers to urban groups.

I. The Theory of Accommodation to Temporary Shocks

When an economy benefits from an exogenous change, such as a favorable movement in its terms of trade, some adjustment is necessary. The enhanced income implies increased domestic demand for both tradable and nontradable goods. This normally requires a rise in the price of nontradables relative to tradables, an expansion of nontradable production, and a contraction of tradable output. This type of effect has been extensively analyzed in a static framework under the general description of Dutch disease.

Figure 1. *Effect of a Permanent Windfall*



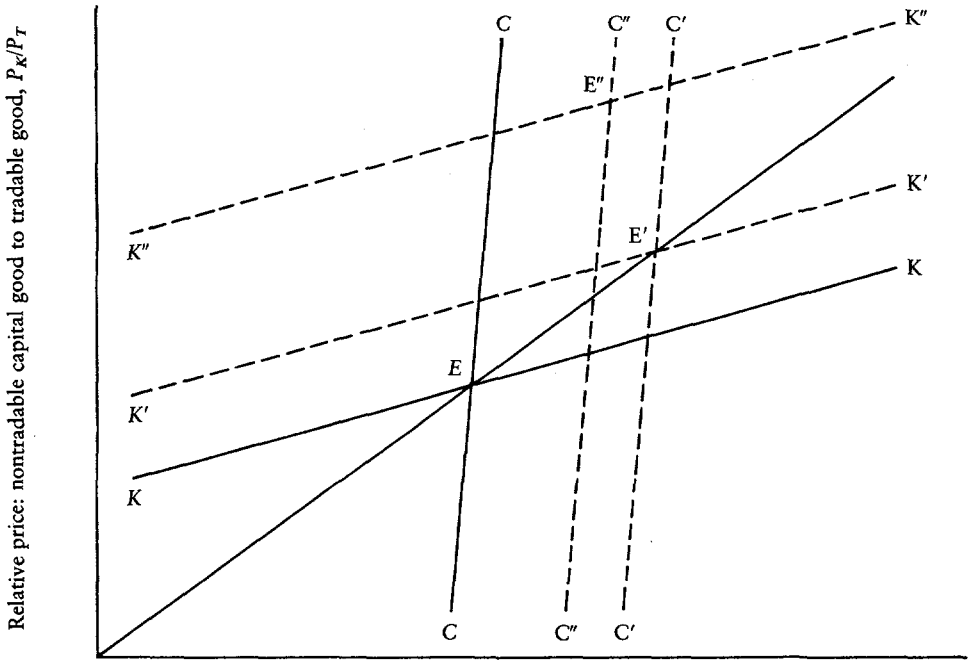
Key: N = nontradables; T = tradables (other than coffee).

While the present article addresses this issue, we also wish to focus on the time dimension, which here assumes particular importance because of the temporary nature of the coffee boom. Given that the windfall was perceived to be temporary, beneficiaries would wish to devote a large proportion of it to asset accumulation. In the normal case, to which we restrict attention, the price of nontradable capital goods will therefore be driven up further than those of nontradables in general. The allocation of these capital goods between productive sectors will in turn influence relative prices by altering the conditions of supply.

The effect of a *permanent* windfall is depicted in figure 1, which portrays the production possibility set for nontradables, N, and for tradables other than coffee, T. The windfall of AB shifts the set vertically, raising it from AA' to BA'. The relative price of nontradables is higher in the new equilibrium, E', than at the initial equilibrium, E.

The effect of a *temporary* windfall is depicted in figure 2. Nontradables must now be disaggregated into capital, K, and consumer, C, goods, and two

Figure 2. *Effect of a Temporary Windfall*



Key: C = consumer goods, nontradable; K = capital goods, nontradable; N = nontradables; P_C = price of consumer goods, nontradable; P_K = price of capital goods, nontradable; P_T = price of tradables; T = tradables (other than coffee).

independent relative prices, p_K/p_T and p_C/p_T, define the space for the figure. *KK* and *CC* are the prewindfall equilibrium price loci for the two nontradables, *E* being the initial equilibrium. A permanent windfall, in which demand for these two goods expanded proportionately, would leave p_K/p_C unaffected (unless supply elasticities differed), shifting the equilibrium to E'. A temporary windfall, in which the investment rate rises, raises the *KK* locus proportionately more than the *CC* locus, shifting the equilibrium to a point such as E''. Hence p_K/p_T rises by more than p_C/p_T.

These relative price changes are likely to have two important effects on supply and demand besides those usually expected. First, they will have significant distributional consequences, as part of the initial incremental spending accrues as rents to suppliers of nontradable goods. That is, part of the windfall to coffee producers is transferred to other agents within the economy. Second, the relative price changes will also markedly reduce the proportion of the windfall which is

invested and raise the proportion consumed.[3] This involves two mechanisms. The first is the direct effect, with the high relative price of capital reducing the quantity demanded. At the first round, this induces both a substitution effect and a reinforcing income effect, since the purchasing power of the windfall in the hands of the initial recipients is reduced. The second mechanism is the income transfer already noted. To the extent that the rise in the price of nontradables is fully accounted for by rents, these will be spent and there is no economywide income effect. In the aggregate, the diversion of the windfall from asset accumulation reflects only the substitution effect. To the extent that the rise in price reflects a rise in resource costs, there will be, in addition, some residual income effect.

The supply curve of nontradables is likely to be more sharply upward-sloping in the short than in the long run. This suggests that an attempt to absorb quickly the windfall resources into the domestic economy may be very costly. This raises three questions. First, what proportion of the windfall should be invested; second, how much should be utilized for domestic capital formation; and third, how should this investment be phased? Each question is considered, in turn, below.

The Consumption-Investment Choice

We may distinguish two cases. In the first, a household's current consumption is constrained by liquidity rather than by net worth. It then appears likely that part or all of a windfall may be consumed directly, with the residue being invested to provide an increment to permanent consumption. In the second, consumption is not constrained by liquidity, and the whole windfall will be invested, with consumption rising in line with the income from this investment. Kenyan farmers are typically credit constrained, with on-farm investment limited by the level of household savings. An income windfall would permit higher consumption and higher investment; in the textbook case of declining marginal product of capital, the optimal consumption path would then jump to a higher, flatter path.

This argument suggests that the first case is the relevant one. It does not account, however, for the nature of the investment choices facing the farmer. These frequently involve choices between relatively safe, low return strategies and relatively risky, high return ones. If relative risk aversion rises as income falls, as is commonly supposed, and if there are economies of scale in high yield strategies, then a windfall income gain may permit or induce a switch from low to high return investments. In this case, the windfall induces investment in excess of its own value, and consumption temporarily drops.

To summarize, it appears that even in the credit constrained case, private agents may attempt to save a high proportion of the windfall. This was the case in Kenya, as established by the calculations reported below.

3. There may also be distributional effects on the average savings rate; consideration of this is deferred until section III.

Investment in Domestic Capital

Under perfect international capital markets, and in the presence of imperfectly correlated risk, part of the increased asset holding would be in the form of domestic real assets, and part in the form of foreign financial assets. International capital markets are not perfect, however. A country like Kenya can lend, but not borrow, at the world interest rate. The borrowing rate for Kenyans is higher than the world rate, is country specific, and is upward sloping in the aggregate. If the domestic capital market is reasonably efficient, the domestic rate of return will be equated to the borrowing rate if the country is a net debtor, to the lending rate if it is a creditor, and otherwise lie between the two. For a capital-short economy, the domestic rate of return will lie above the lending rate, so additional assets should be held in the form of domestic real capital, once adequate working reserves of foreign exchange have been acquired.

It might be objected that the discrepancy between borrowing and lending rates is a risk premium and that the appropriate comparison is between equivalent riskless rates. But the risk premium embodied in the borrowing rate is appropriate to the risks faced or perceived by the international financial community, and these need bear little relation to the risks faced by the country's own nationals.

Phasing of Investment

It was noted earlier that an attempt to invest the windfall domestically might prove very costly if carried out too quickly. This is because the supply of nontradable goods is likely to be less elastic in the short run than in the long, as there are lags in the production process and administrative difficulties arise in absorbing and managing rapid changes. These are the familiar reasons for supposing that the marginal efficiency of investment schedule will slope down more steeply than the marginal efficiency of capital schedule.

At the same time, too slow a rate of investment will also prove costly. This is because the part of the windfall earmarked for investment but not yet invested in domestic capital must be held in the form of foreign financial assets, and these yield only the relatively low lending rate of interest.[4]

It follows that there will be an optimal phasing of domestic investment. During the windfall phase, domestic investment should only increase up to the point at which its return (taking into account the capital losses incurred as the price of capital goods subsequently falls) falls to equality with the world interest rate. Beyond this point foreign financial assets should be accumulated. The holding of such assets can only be temporary, however, since once capital goods prices have reverted to their initial level, then, by assumption, the domestic return exceeds the world interest rate. Foreign financial assets are run down after the windfall in such a way as to preserve the marginal equality between returns on foreign financial and domestic real investment.

4. There have, of course, been periods recently when the real world rate of interest has been very high, but this is not usually the case and was not the case in the immediate aftermath of the coffee boom.

The Effect of Controls

The discussion so far has been confined to the optimizing behavior of private agents given capital market imperfections but allowing for no other complications. In Kenya private behavior is further constrained by a variety of government controls, and the behavior of the government itself is a crucial determinant of the outcome. In this article we restrict ourselves to a positive treatment of government behavior;[5] the control regime is part of the description of the system, and no attempt is made to model optimum modifications of it. Of course, there is likely to be some change in controls during a windfall; in Kenya the principal change was a temporary relaxation of import controls, and this is the case considered here.

Foreign Exchange Controls. Kenyan citizens are not allowed to hold foreign financial assets, and this policy was maintained throughout the boom. Its effect was to restrict their asset choices to either domestic real or domestic financial assets. In the aggregate, however, Kenyan households and firms could only acquire extra net financial assets from the monetary authority. At best this would have involved the central bank issuing extra fiat money during the boom backed by its own extra holding of foreign financial assets. This foreign currency held on behalf of private agents would then be run down as the latter spent their temporary extra holdings of fiat money on capital goods.

Two problems are created by this control. First, there is an inflationary potential caused by the injection of extra fiat money if the banks are able to increase their advances, thus increasing the money supply by more than the increase in fiat money. Since the Kenyan banking system was subject to financial repression, as discussed below, banks were indeed able to increase advances. This could only be offset by a large increase in the legal minimum cash or liquidity ratio for the duration of the increase in fiat money. Second, the central bank must recognize that as the fiat money is spent on real assets the extra foreign exchange which augments the reserves as the counterpart of the increase in fiat money will shortly be claimed by private agents.

Import Controls. The Kenyan government has a complex set of quantitative controls on imports involving separate authorizations for import of goods and access to foreign exchange. This has the important consequence that the economy started the boom with suppressed demand for imports.

The boom increased the demand for imports. In the limiting case, had all imports been subject to quantitative restrictions, the foreign exchange windfall would have been depleted only through a reduction in the volume of exports, as capital and labor were diverted from export production to the formation of capital goods. Hence, the windfall would still gradually be transformed from foreign exchange into domestic real assets, but less efficiently, so that the increase in assets would be smaller.

5. We intend to provide a normative treatment on another occasion.

Monetary Controls. The central bank imposed on bank lending an interest rate ceiling (generally negative in real terms) and a minimum liquidity ratio, creating financial repression. Only a small proportion of investment was financed through bank intermediaries (the other possible financial intermediaries, bond and equity markets, were practically nonexistent). The economy thus started the boom with a pent-up demand for loans.

If these banking controls were unaltered during the boom, as a result of the monetary expansion described above there would be a *temporary financial liberalization.* This would be beneficial in that just at the peak flow of investment in the economy, the banks would increase the proportion of savings efficiently allocated. Because of its temporary nature, however, it has some harmful effects which will be detailed below.

II. An Analysis of National Accounts Data

In applying the preceding analysis to Kenyan data we encounter two problems. First, statistics are generally not aggregated so as to accord with the conceptual distinction between tradable and nontradable goods. Second, the analysis is fundamentally concerned with a hypothetical question, namely, how outcomes would have been different without the boom. For some purposes a reasonable proxy for this hypothetical case is the preboom economy (1975) projected on some trend. In addition to the difficulty of correctly identifying the trend, however, actual outcomes differed from trend not only because of the coffee boom but because of two other shocks. One was the oil shock of 1979–80, and the other was the public expenditure boom consequent upon, but conceptually distinct from, the increase in coffee earnings, from which we wish to abstract in this paper. The only way of quantifying the pure coffee earnings effect, which is the comparison of two hypothetical states, is by means of simulations generated by a computable general equilibrium (CGE) model. Because CGEs introduce their own weaknesses, however, we begin by investigating actual events as portrayed in the national accounts.

In table 1, the national accounts data are used to present output and relative price series for the period 1975–79. The coffee boom is identifiable as an improvement in the terms of trade. Further, there is a considerable increase in the relative price of domestically produced capital goods which accords with the preceding theoretical analysis. The quantities series indicates that increases in the volume of exports were only a minor component of the boom in export earnings. To give an indication of the magnitude of the terms of trade windfall, had the relative price of (nonoil) exports to (nonoil) imports been constant at its 1975 level through 1976–79, and had export quantities been unaffected by this, then export earnings would have been K£338.9m lower (at 1975 prices[6]).

During 1976–79, the savings from the windfall income were accumulated partly as real and partly as financial assets. We estimate windfall accumulation

6. We use 1975 prices throughout, using nonoil imports as the numeraire and deflator.

Table 1. *Indexes of Output and Relative Prices 1975–79*
(1975 = 1.00)

Sectors	*1976*	*1977*	*1978*	*1979*
Quantities				
Exports[a]	1.08	1.10	1.03	1.04
"Market sector" GFKF[b,c]	0.99	1.24	1.47	1.30
Manufacturing GFKF[b]	1.20	1.49	1.74	1.64
Nonoil imports	0.97	1.27	1.47	1.15
Price relative to nonoil imports[d]				
Exports[a]	1.23	1.69	1.28	1.16
Domestic capital goods[e]	1.09	1.10	1.18	1.22

a. Excludes reexports of oil.
b. GFKF = gross fixed capital formation.
c. Excluding GFKF in the traditional and government sectors.
d. Net of duty.
e. Derived from the deflator on market sector GFKF, the deflator for nonoil imports, and the ratio of imported capital goods (excluding government imports) to market sector GFKF. It is assumed that the price of imported capital moved in line with the nonoil imports deflator.
Source: Statistical Abstract, 1980, 1983 tables 39, 43, 66, and 70.

of real assets by market sector agents[7] at K£215.8m. We arrive at this figure by a chain of calculations shown in table 2, adopting a simple specification of counterfactual growth in the economy, namely, that in 1976–79 the contributions of the boom were the K£338.9m previously measured, plus the output consequent upon this windfall investment.

Recall that the only way that private agents could accumulate net financial assets was by an increase in holdings of fiat money. The real increase in fiat money over the end-1975 to end-1979 period was K£49.4m. We attribute K£12.3m of this to the nonboom growth in market sector real incomes (based on the 1975 ratio of fiat money to market sector income). Hence, the boom-attributable increase in holdings of net financial assets is estimated at K£37.1m.

To convert the above estimates of real and financial windfall private accumulation into rates of savings out of windfall income might seem straightforward since the direct taxes levied on the windfall export revenue of K£338.9m were negligible. There are four reasons why the gross increase in incomes (which induced the observed accumulations) might have been greater than the direct export revenue effect, however. First, if this real asset accumulation generated extra output during the period 1976–79, then income would increase by more than the extra export revenue. Second, in an underemployed, fixed-price economy, an injection would have multiplier effects on real income. Third, the windfall expenditure caused changes in relative prices; in particular it increased capital goods prices, which generated rents on existing production. These rents, which did not use resources, generated second round income in the same way as if the

7. Kenyan data permit a clearer distinction to be drawn between market and nonmarket than between public and private sectors because of the poor quality of data on "parastatals." For most purposes these organizations can be regarded as private agents with privileged access to public finance.

Table 2. *Private Sector Capital Formation, 1976–79*
(K£ million)

Growth in market sector gross fixed capital formation:	270.1[a]		
Attributed to nonboom growth[b]		28.4	
—of which: Financed by government[c]			2.8
Financed by market sector			25.6
Attributed to boom		241.7	
—of which: Financed by market sector			215.8
Financed by government[d]			25.9

a. Annual GFKF deflated by the nonoil imports deflator to 1975 prices, less GFKF in 1975.

b. In 1975 market sector GFKF was 20 percent of market sector GDP. We assume that this proportion applied to nonboom income, 1976–79. Thus nonboom growth in market sector income is calculated as monetary GDP (excluding producers of government services) for each year deflated by the nonoil deflator to 1975 prices less GDP in 1975, minus the terms of trade windfall of K£338.9m less K£26.6m of windfall investment output.

c. In 1975, 9.7 percent of market sector GFKF was financed by the government. This percent is applied to nonboom growth in market sector GFKF 1976–79.

d. Constructed from disaggregated data on government expenditure.

expenditure had purchased previously idle resources. Thus rents arising from price changes generate quasi-multiplier increases in income and expenditure. This effect should not be confused with the Keynesian multiplier, however, for it depends upon capacity constraints rather than idle resources. Fourth, if the government collects extra revenue as a result of the boom and permits its expenditure upon transfers to increase, then incomes increase in a manner analogous to the effect of extra rent.

Of these nondirect sources of private accumulation, the first two cannot be quantified directly from national accounts data but can be estimated using information from our CGE simulation. In the model there is classical unemployment in the urban formal sector. While real wages are fixed in terms of consumer prices in this sector, a windfall reduces products wages and hence increases employment. Incorporating this effect, the model finds a real rate of return on windfall investments of 16 percent a year. Combining this return with our estimate of the propensity to invest in real assets (0.49; see below) and an assumed two-year gestation period, by 1979 output had increased by K£26.6m.

To characterize the effect of transfers through rents and government payments, let W denote the terms of trade windfall. In Kenya, virtually no direct taxes were levied on this windfall so that in the first round it all accrued to the market sector. In the second round, rents accrued on windfall expenditure and government revenue increased from indirect taxes on expenditure, permitting an increase in expenditure on transfers. Thus income, Y, evolves as:

$$Y_1 = W \tag{1}$$

and

$$Y_2 = [(1 - t_k)r_k\, k + (1 - t_c)r_c c + z(t_k k + t_c c)]W \tag{2}$$

where

t_k = indirect tax rate on capital goods
t_c = indirect tax rate on consumer goods
k = the propensity to invest
c = the propensity to consume
z = the propensity of the government to make transfers
r_k = rental component of investment expenditure at factor cost
r_c = rental component of consumption expenditure at factor cost

In subsequent rounds, government revenue is supplemented by direct taxes on rental incomes:

$$Y_3 = [.][1 - d\,(1 - z)]\; Y_2 \tag{3}$$

where d = the rate of direct taxation and [.] is the term in square brackets in equation 2. More generally, total income from the windfall is

$$W^1 = \Sigma\, Y_i = \left\{ \frac{1 + d(1 - z)[.]}{1 - [1 - d(1 - z)][.]} \right\} W. \tag{4}$$

Although from the viewpoint of society, the windfall is only equal to W, windfall incomes accruing to the market sector are W^1. The observed expenditure on capital goods, K£215.8m, can therefore be characterized as kW^1, so that k, the propensity to invest out of windfall income, can be determined (as $215.8/W^1$) once W^1 is estimated.

Although equation 4 formalizes the concept of windfall income, it cannot be used as a basis for estimation since some of the propensities are unknown. We therefore estimate directly the two components of $W^1 - W$, rents and government transfers.

Recall from table 1 that during 1976–79, by far the largest relative price change was the increase in the price of domestic capital goods. We estimate the rents, net of tax, generated by this, $[rkW^1\,(1 - d)]$, at K£66.8m, our derivation being set out in table 3. In principle, this procedure could be applied to changes in rents on other goods. Since other relative price changes are very small (and the components in the calculation are offsetting), however, these changes in rents are neglected. We estimate the increase in government transfers at K£6.8m, our derivation being set out in table 4.

Adding these income components to the direct windfall and the output from windfall investment yields an estimate of W^1 of K£439.1m. The propensities to invest in real and financial assets out of windfall income therefore were around 49.1 percent and 8.4 percent respectively, implying an overall savings rate out of the windfall of near 60 percent. This compares with a preboom savings rate of around 20 percent.

In section I we suggest that the accumulation of fiat money as a financial asset would (unless sterilized) generate a temporary financial liberalization, permitting

Table 3. *Estimated Rents on Domestic Capital Goods Production, 1976–79*
(K£ million)

Market sector gross fixed capital formation (GFKF), 1976–79, at 1975 nonoil import-deflated prices[a]	991.3		
of which: market sector GFKF 1976–79 at 1975 GFKF-deflated prices[b]		903.1	
expenditure due to increase in capital goods relative price		88.2	
of which: increase from import duty due to boom			14.5
increase in expenditure due to price			73.7
Growth in GFKF attributed to boom[c]	241.7		
of which: increase in capital goods relative price		88.2	
expenditure on extra quantity		153.5	
of which: capital goods imports due to boom			138.6
domestic production of capital goods			14.9
Extra imports of capital goods to market sector	163.8		
of which: attributed to nonboom growth[d]		10.7	
attributed to boom		153.1	
of which: increased rate of duty[e]			14.5
extra quantity			138.6
Market sector GFKF at 1975 relative prices	991.3		
of which: imports of capital goods to market sector		435.0	
domestic production of capital goods		556.3	
of which: boom-attributed expenditure			88.6
nonboom output (1975 relative prices)			467.7
Total quantity purchased at 1975 prices	482.6		
of which: prior quantity of capital goods purchased		467.7	
extra domestic production of capital goods		14.9	
Increase in production due to boom[f]	3.2%		
Increase in price due to boom[g]	15.3%		
Supply elasticity: percentage change in quantity/percentage change in price	0.2		
Boom-attributed expenditure on domestic capital goods	88.6		
of which: resource cost of extra production[h]		16.0	
Rents, of which: average direct tax on factor income (8%)[i]		72.6	5.8
Total rents, net of taxes			66.8

a. Deflated to 1975 prices using the nonoil import deflator.
b. Deflated to 1975 prices using market sector GFKF deflator.
c. From table 2.
d. In 1975 imports met 37.6 percent of market sector GFKF. We apply this proportion to nonboom GFKF (estimated in table 2).
e. The increase in the rate of duty thus accounts for part of the relative price change.
f. Extra production of capital goods (14.9) over prior levels of capital goods production (467.7).
g. Increase in price (73.7) over total quantity purchased at 1975 prices (482.6).
h. Taking a linear approximation to the supply curve, the cost of the 14.9 increase in quantity was 16.0, so that 1.1 was absorbed in increased unit costs.
i. Sales taxes on domestic capital goods were negligible.

Table 4. *An Estimate of Boom-Attributable Government Transfers*
K£ million (at 1975 prices)

Total increase in transfers 1976–79 on 1975	14.1
Of which: nonboom increase	7.3
attributable to boom	6.8

Note: In 1975, transfers were 42.5 and the increment in market sector nonboom income 1976–79 on its 1975 level was 17.1 percent. Nonboom transfers are prorated with nonboom income, that is, 0.171 × 42.5.

increases in financial intermediation and consumer credit. This can be investigated through central bank data on advances which are classified partly by sector and partly by use. This classification enables us to construct reasonable proxies for advances used to finance capital formation and advances used for consumer credit.[4] According to our proxy for advances for capital formation, in 1975 only 11 percent of market sector capital formation was financed through advances, whereas in 1976–79, despite the large increase in capital formation, 50 percent of the increase in gross fixed capital formation (GFKF) was so financed.[5] This 40 percent increase in financial intermediation suggests that prior to the boom there was considerable financial repression.

Our proxy for advances for consumer imports shows a markedly different time path from advances for capital formation. Over the entire boom and postboom period (1975–83), real advances for consumer imports rose by only K£1.6m against K£77.0m for capital formation. By contrast, at the peak of the boom (end-1978), consumer imports advances had increased by K£47.4m against K£66.2m for GFKF. This trajectory of consumption indebtedness, with agents anticipating income during the temporary trade and financial liberalization phase and repaying it afterward, accords with our theoretical analysis.

While such a large, albeit temporary, financial liberalization might have improved the allocation of investment resources, this is by no means certain, for banks which have operated for a long period under conditions of financial repression have acquired expertise in only a restricted class of lending. As suggested in table 1, GFKF was strongly skewed toward import-substituting manufacturing. The analysis of section III, to which we now turn, suggests that by 1983 this sectoral skew in investment had caused such a substantial fall in the relative price of import-substitutes that the allocation was unlikely to have been either privately or socially efficient.

III. General Equilibrium Analysis

In this section we use a general equilibrium model to analyze the effects of the boom.[6] The use of a model has two advantages. First, it allows us to widen the scope of the analysis. In addition to changes induced by the boom in asset formation, relative prices and resource allocation, we consider the question of who benefited from the boom. We have already noted that the boom must have

4. Our proxy for capital formation advances is advances to manufacturing, construction, transport, and large-scale agriculture. That for consumer credit is import and domestic trade, and advances to households for other than housing.

5. In the sectors listed above, GFKF was K£569.2m, an increase of K£63.4m over the 1975 rate (all at 1975 prices). The proportion of incremental real advances to GFKF in 1975 was 10.9 percent. The actual increase in advances was K£87.6m. This can be decomposed into K£505.8m of GFKF supported by K£55.1m of advances (had 1975 behavior persisted) and K£63.4m of extra GFKF supported by K£32.5m of extra advances, an incremental advances ratio of 51.3 percent.

6. The model is described in Bevan, Collier, and Gunning (forthcoming), chap. 5. An earlier version was published in Gunning (1983). In the appendix we give an outline of the present version.

caused large changes in relative prices. By comparing the simulation experiments, we can trace the distributional effects of these price changes. In particular we consider changes in the incomes of smallholders and urban households. Second, the model allows us to eliminate the shocks (other than the coffee boom) which affected the Kenyan economy in the 1975–83 period. It thereby enables us to extend the analysis to the postboom period, 1980–83. Since by 1983 most of the boom's effects had occurred, we take this year as the endpoint of our simulation experiments. In particular, the long-run consequences of the extra investment for product supplies and hence prices had largely occurred. The shocks in the postboom period which we here eliminate include large increases in public expenditure and foreign borrowing and the second oil price increase of 1980–81. We analyze those shocks elsewhere (Bevan, Collier, and Gunning, 1986, chap. 5); here we consider only the rise of coffee and tea prices. We will compare two simulation experiments: a "boom run" in which export prices and producer prices for both coffee and tea have their actual values, and a "counterfactual run" in which these prices grow at the same rate as the price of nonoil imports in the period 1976–80. All other assumptions are the same in the two runs so that the differences between them can indeed be attributed to the rise of coffee and tea prices.[11] Details of the model are given in the appendix, together with a sensitivity test of key assumptions.

Of particular interest is the boom's effect on the incomes of smallholders. They constitute the largest group of the poor in Kenya and as significant producers of coffee and tea (accounting, in 1975, for 48 percent and 28 percent of total production respectively) they might be expected to have benefited enormously from the increase in world prices which was passed on to farmers. The model finds that smallholder incomes increased by 20.8 percent as a result of the boom: 16.7 percent as a result of the price rise itself and the remainder as a result of indirect effects (see table 5). These indirect effects include a substantial rise in coffee and tea production (more labor is allocated to these crops, partly at the expense of other crops, partly at the expense of leisure); increases in remittances received by smallholders from urban households; and finally, a rise in income from nonfarm enterprises and from (both agricultural and nonagricultural) wage employment. The most important thing to note about table 5, however, is not the composition of the 21 percent income increase, but the fact that it is, to a considerable extent (more than 40 percent) offset by adverse relative price changes. The consumer prices which are relevant to smallholders rise so much that their *real* income gain is reduced to 11.2 percent.

Before we attempt to explain this result it should be stressed how surprising it is, given what we know about the composition of smallholders' consumption

11. The most important of these assumptions are: the share of public consumption in GDP remains constant in real terms (22.1 percent); foreign savings grow at 7 percent a year in constant world prices; real wages in the formal sector remain constant; and the price of oil grows at the rate of the price of nonoil imports after 1979. Note that actual coffee and tea prices are used for 1981–83 in both runs: prices differ only in the 1976–80 period.

Table 5. *Simulation of the Effects of the Tea and Coffee Price Boom on Kenyan Smallholders, 1977*

Source of change in real income	*Actual value*	*Results of simulation using actual price as percentage of counterfactual results*
Increase in volume of output: mean value, shillings per household (1975 prices)		
Coffee	282.4	125.6
Tea	98.9	124.4
Changes in price indexes		
Producer prices (1975 = 1.0)		
Coffee	3.718	292.8
Tea	2.660	209.4
Consumer prices (1974 = 1.0)	2.080	108.7
Increase in value of output: mean value, shillings per household (current prices)		
Coffee	1,050.0	367.6
Tea	263.2	260.7
All crops plus livestock	4,740.2	117.7
Changes in income: mean value, shillings per household		
Current prices		
Total income	6,696.1	120.8
"Other" (wage and non-farm employment)	1,955.9	128.8
1975 prices		
Total real income	3,220.0	111.2

Note: This simulation uses actual values of export and producer prices for coffee and tea. In the counterfactual simulation, these prices grow at the rate of increase of the nonoil imports, 1976–80.

expenditure. They have a high marginal propensity to consume food (0.7), and food commodities are modeled as tradables which are not subject to any quantitative restrictions. In the extreme case—if coffee and tea were only grown by smallholders, if they had not adjusted their production, and if they had spent all of the additional income on food—very little would have changed outside the smallholder sector. Since domestic food prices are tied to world prices and the market is cleared through changes in imports, food consumption and imports would both have increased by the amount of the terms of trade gain and the balance of trade would have been preserved without any other change in real variables. This mental experiment is not completely unrealistic: given the absence of quantitative restrictions on food imports, smallholders' high marginal propensity to consume food does tend to isolate the rest of the economy from the effects of changes in smallholder incomes. But, of course, part of the extra income is saved, part of it is used to increase nonfood consumption, all of the extra spending requires trade and transportation activities, coffee and tea are also produced on large farms, and, finally, input-output linkages and the government's spending of its extra tariff and tax revenue spread the effects to other sectors. This increased demand for urban commodities requires, in the case of

nontradables, increases in domestic production. But in the short run (with a given capital stock) supply elasticities are low: the output increases are accompanied by substantially higher prices (as predicted in section I). At the peak of the boom, gross output prices for nontradables are 50 percent higher than in the counterfactual run,[12] with particularly large price increases in trade and construction.

To what extent relative prices also increase for importables depends critically on trade policy. The model distinguishes between food and nonfood importables; only nonfood imports are subject to quantitative restrictions. Hence food prices are unaffected by the boom: extra demand is reflected in an increase in food imports rather than in price rises. Nonfood imports are subject to import controls, and if controls are maintained, the relative price of nonfood importables would rise as a result of the boom, just as for nontradables. Kenya did relax import controls during the boom, however. In the model, trade liberalization is made endogenous. Up to a point, controls are in force and the domestic price adjusts to clear the market. Demand for imports in excess of the controlled level is then choked off by increases in price. We assume, however, that if a price ceiling is reached then controls are relaxed, so that imports clear the market at the ceiling price. This defines a maximum level of protection for domestic producers.

This specification has powerful effects on the results. In 1978, for example, import controls are effective in the counterfactual run, but in the boom run, the price ceiling[13] is reached and extra imports account for 43 percent of total imports in that year. Clearly, if trade liberalization were less substantial the domestic prices of nonfood manufactured consumer goods would be higher and the income gains of smallholders would be further eroded.

In table 5 we aggregated over all smallholder households, which masks the differences between coffee and tea growers and other smallholders. It is often argued that the boom benefited only the former group and therefore led to a large increase in rural inequality. Smallholders who did not grow coffee or tea were affected in several ways by the boom. First, total labor use on smallholdings increased by over 20 percent, and wages in the smallholder sector rose by 29 percent. Since those smallholders who did not benefit directly from the boom were net suppliers of hired labor, they experienced a terms of trade gain, realizing a substantial increase in their income from employment. Second, the spending of coffee and tea growers raises the income from nonfarm enterprises accruing to

12. This is a relative price increase since the price of the nonoil imports which we used as numeraire in section II is the same in the two runs.

13. The maximum price is defined in terms of the tariff equivalent of the controls: the maximum equivalent tariff rate is set equal to the rate in 1976 in the counterfactual run. Hence the government is modeled as being unwilling to let the boom lead to an increase in the protection of domestic producers. If one were to relax this assumption, nonfood importables would behave more like nontradables and the model would then generate even higher estimates of the distributional effects of the boom. Since world prices and foreign savings (the value of the resource deficit) are exogenous in the model, export volumes determine the value of total imports. Hence the trade policy assumption does not affect the total import volume but only its distribution over sectors. Trade liberalization implies an increase of imports of manufactured consumer goods at the expense of other imports.

other smallholders. Third, their income from remittances increases with boom-induced growth in urban income. Finally, there is a negative effect: all smallholders are affected by the rise in rural consumer prices which is due to the boom.

Since the model is regionally disaggregated, we are able to investigate changes in the regional distribution of income. We find that income gains are not restricted to Central and Eastern provinces, where smallholder coffee growing is concentrated. Smallholders in Coast and Nyanza provinces also benefit. Only in the Rift Valley and Western Province is the change in income negligible or slightly negative. In these provinces, the direct employment and nonfarm enterprise income effects are very weak, and since households do not have strong urban ties (unlike those in Central Province) the third effect operating via urban-rural remittances is also weak. The rise in consumer prices therefore dominates the other three effects.

The overall effect of the boom is thus to slightly increase rural inequality: the income share of the bottom 40 percent of smallholders falls from 31 to 29 percent. Absolute poverty decreases: the number of smallholder households below the poverty line used in the model falls by 11 percent.

In table 5 we showed the model's results for only one year, 1977. After this peak year, the differences between the two runs (both for income components and for rural wages and consumer prices) become progressively smaller, until, at the very end of the simulation period (1983), the difference in real income is only 3.1 percent.

During the boom, coffee growers invested quite heavily in coffee and tea trees, livestock, housing, water supply, education, and financial assets. Using survey data, we analyze the details of those decisions (and their consequences for permanent income) elsewhere (Bevan, Collier, and Gunning, 1986). Here we treat smallholders as if they invested only in coffee and in financial assets, our concern being the extent to which savings are eroded by price changes. In the previous section we calculated the marginal savings rate of private agents out of the extra income generated by the boom as 0.575. Adopting this savings rate, we calculate that smallholders save a total of K£128.3m during the boom. Part of this (19 percent) is withdrawn in the first four years after the boom, but smallholders leave the bulk of their savings (K£103.9m) deposited with the banking system after 1983.

Much of this savings consists of claims on crop authorities and of demand deposits so that the rate of return on these assets is close to zero. Transaction costs (which, in the case of time deposits, are very high for smallholders) and long delays in payments for crops effectively preclude investment in financial assets with a positive return. Hence, the financial assets acquired during the boom do not add to smallholders' permanent income.[14] Nevertheless, their income in 1983

14. Note that, in any case, the rate of return on financial assets would have to be very high (8.7 percent) by Kenyan standards to give even a modest 1 percent increase in permanent income [0.01(901.1) / 103.9 = 0.087].

Table 6. *Initial Impact and Long-Run Effects of the Beverage Boom on Smallholders (Actual Price Simulation Results as Percentage of Counterfactual Simulation Results)*

Source of change in real income	*1977*	*1983*
Coffee production[a]	125.6	105.2
Producer price	292.8	100.0
Value of coffee output[a]	367.6	105.2
Value of production (all crops plus livestock)[a]	117.7	100.2
Other income components[a]	128.8	107.3
Total income[a]	120.8	101.4
Consumer prices	108.7	98.4
Real income[b]	111.2	103.1
Formal wages	119.9	94.1
Informal wages	128.6	101.6

a. Mean value per household.
b. Deflated by consumer prices.

is 3 percent higher in the simulated boom run than in the counterfactual case (table 6). Even if smallholders had invested 100 percent of their extra income in the boom period in real or financial assets yielding 12 percent a year, they would not have realized a permanent income increase of 3 percent.

Hence the simulation experiments demonstrate that the indirect effects of a commodity boom can be strong. There are two such effects. First, smallholders receive benefit in the form of remittances and higher incomes from non-agricultural activities from boom-induced urban growth (which is, it should be noted, partly financed out of smallholders' savings). This accounts for about half of the 3 percent income gains. The other half is due to relative price changes, which now favor smallholders: the adverse, short-run effect which we discussed earlier is reversed in the long run. This is because in the postboom period domestic demand drops but the supply curves of urban goods have shifted to the right because of investment. Table 6 indicates the importance of the resulting difference in relative prices between the two runs: it accounts for a 1.6 percent increase in the real income of smallholders, more than half of their total income gain in the final year.

The real income gain for urban households is about 15 percent in the short run and 8 percent in the long run (table 7). Since the incomes of urban households are much higher than those of smallholders these figures reflect a massive redistribution of income from rural to urban groups. Measured in current prices, total transient household income (the difference between runs in incomes of households in the period 1976–79) amounts to K£1019.3m and of this total K£804.4m (or 79 percent) accrues to urban households. Hence the bulk of the boom income ends up in urban hands.

There are two reasons for this transfer to urban households, one static and one dynamic. In a static model, if imports are controlled, the boom would have

Table 7. *Urban Incomes, Employment, and Prices: Actual Price Simulation Results as Percentage of Counterfactual Simulation Results*

Source of change in real income	*1977*	*1983*
Employment; number of labor force members who are:		
Wage employed	119.0	107.6
Self-employed in the informal sector	87.5	101.1
Unemployed	79.7	76.7
Household income (in current prices)	136.0	103.5
Real incomes (in 1974 prices) of:		
Wage earners	100.0	100.0
Self-employed in the informal sector	119.7	116.8
All urban households	114.9	107.8
Consumer prices	118.3	96.0

resulted in increases in the relative prices of importables and nontradables (the Dutch disease effects). Smallholders do not produce these commodities and hence the benefits of these price changes accrue (as higher wage and profit income) entirely to other groups. Second, the boom leads to a very large increase in the level of investment: gross fixed capital formation (in constant prices) in the boom period is 48 percent higher than in the counterfactual case. In Kenya, the allocation of investment was already heavily biased toward the urban sectors and, as we saw in the previous section, this bias increased during the boom. Hence the benefits of the rise in coffee and tea prices accrue largely to urban areas, partly because of the relative price changes discussed before and partly because of the way in which investment was allocated.

Table 7 shows that in 1977 urban groups already benefited more from the boom than smallholders. Household incomes in that year are 36 percent higher than in the counterfactual case (as opposed to the 21 percent income gain for rural households—table 6). Urban consumer prices rise by 18.3 percent so that price changes affect about half of the income gains, leaving a real income gain of 14.9 percent.

Since three-quarters of the urban labor force is wage employed, the income gain is largely explained by the increase (19 percent in 1977) in formal sector wage employment.[15] As discussed previously, the spending of the proceeds of the boom (whether on consumption or investment) requires increased output from the urban sectors.[16] Since the capital stock is given in the short run, this requires increased employment: the unemployed and self-employed are drawn into formal sector wage employment. As a result of the reduction in the number of people

15. Note that in the two runs, the real wages are assumed to be the same, so that the increase in wage income is entirely a quantity change.

16. An increase in output may seem inconsistent with profit maximization, since the capital stock is given in the short run and real wages are constant. The paradox is easily resolved. The real wage is defined in terms of urban consumer prices, which (since food prices are unaffected by the boom) rise much less than the output prices of the urban sectors. Hence the product wage falls and this induces profit maximizing firms to increase employment and production.

Table 8. *National Accounts: Actual Price Simulation Results as Percentage of Counterfactual Simulation Results*
(1972 prices)

Macroeconomic variable	*1977*	*1983*
GDP at factor cost, of which:	104.4	106.8
Agriculture	102.8	100.3
Industry	92.4	115.7
Other	108.0	107.2
GDP at market prices	105.4	106.6
Private consumption	100.5	104.3
Public consumption	105.4	106.6
Investment	178.1	113.4
Exports	105.3	107.9
Imports	137.4	106.8
Domestic savings	124.4	114.7

competing with each other in the informal sector, incomes there rise considerably, by 20 percent in real terms.

The investment boom leaves the urban economy with a larger capital stock at the end of the simulation period. In addition, while in the short run product wages fall so that labor is substituted for capital, in the long run differences between prices in the runs diminish substantially so that the capital intensity of the urban sectors falls back to what it would have been in the absence of the boom. The net result is a permanent increase in wage employment in the formal sector.

Finally, we consider the boom's effects on national accounts variables (table 8). Note that the boom increases GDP at factor cost by 4.4 percent in the short run and by almost 7 percent in the long run.[17] Largely because of the way investment is allocated, output growth is increasingly concentrated in the industrial sector. The second part of the table illustrates the investment boom to which we have traced many of the income effects of the terms of trade gain. At its peak in 1977, investment is 78 percent higher than in the counterfactual case. At the end of the period, investment is still 13 percent higher, partly as a result of multiplier effects, partly because the boom redistributes income to urban groups who save a much larger fraction (out of nonboom income) than rural groups.

There is some reason to believe that in view of the controls on asset acquisition and consumer imports, Kenyans saved too large a fraction of the boom income. While private and public consumption is 2.8 percent higher than in the counterfactual case in the boom period, GDP (at market prices) is 6.6 percent higher in 1983. We would expect the optimal short-run increase in consumption to be at least as large as the permanent income increase. As we noted in section I, in the Kenyan case there were bottlenecks in implementation of new investments, and the attempt of many agents to quickly acquire real assets changed relative prices and eroded the real value of savings. Given these

17. Use of resources ($C + G + I$) increases by much more: since GDP is measured in constant relative prices it does not capture the terms of trade gain.

circumstances, there are good reasons to have expected consumption out of boom income to have been larger.

V. Conclusion

On theoretical grounds we would expect the use made by private agents of a temporary windfall to be strongly influenced by the presence of government controls on assets and international trade. Our investigation of the Kenyan coffee boom has lent support to the theoretical analysis and has indicated that such considerations may be quantitatively important. Kenyans indeed appear to have attempted to save a high proportion of their windfall incomes (around 60 percent), but their asset choices were so restricted that this drove up the relative price of nontradable capital goods. Similarly, as their attempts to increase consumption were constrained by import controls, there were short-run redistributions in favor of domestic producers of import-substitutes. In the longer run, the skewed sectoral allocation of windfall investment produced further powerful redistributions.

Our analysis thus suggests an unorthodox interpretation of the effects of a commodity boom in a controlled economy such as Kenya. Conventional wisdom would imply that most of the benefits would accrue to coffee and tea growers since the Kenyan government chose to pass the rise in world prices on to farmers. Yet our model indicates that the effects of the boom depend critically not just on producer pricing, but also on trade policy and investment allocation. The distortions created by these policies cause a very large part of the total gain to end up in urban rather than in rural hands.

Appendix: The Computable General Equilibrium (CGE) Model

The model is a fairly disaggregated general equilibrium model. There are thirty-six commodities (goods and nonfactor services), which fall into four categories: *exportables* (largely agricultural commodities, in particular coffee and tea), which are traded at given world prices; *food commodities,* which are subject to tariffs but not to quantitative restrictions; *nonfood importables,* which are subject to quantitative import controls; and *nontradables* (services). For each of these commodities, the market must clear, either through changes in quantities (for example, excess demand for food at given domestic prices being met through imports) or through changes in relative prices (for example, the price of nonfood manufactured products rising until domestic supply plus the controlled level of imports is equal to domestic demand).

There are forty-eight groups of peasants in the model. They are distinguished by the size and location of their holding, location being an indicator of the crops which can be grown, the possibilities for nonagricultural activities, and land quality. Peasants earn their incomes from crops, from livestock, from wage employment (partly on other small holdings or on large farms, partly outside

agriculture), and from nonfarm enterprises (for example, trading). The producer prices which they receive for their crops and livestock products are set by the government. Their consumption consists partly of self-produced items (in particular food) and partly of goods which are imported or produced domestically by urban firms. The combination of the endogeneity of the consumer prices paid by peasants and the exogeneity of the producer prices they receive is the main reason why changes in relative prices strongly affect the real income of peasants.

There are eight groups of urban households, distinguished by their endowments (for example, educational qualifications) which determine their access to formal sector wage employment and high-income self-employment. Real wages in the formal sector are given at a level at which there is excess supply of labor. As a result, firms face a horizontal labor supply schedule since urban workers can be drawn into formal sector employment, out of unemployment or low-income self-employment in the informal sector. Nevertheless, since capital is fully employed, output can only expand in response to changes in the product wage, which unlike the real wage is flexible. The effect of imposing a horizontal labor supply schedule is to flatten commodity supply schedules. Since the general equilibrium transfers, which are at the heart of our analysis, are diminished by this flattening, the model specification makes it something of a "devil's advocate."

The government receives its revenue from direct and indirect taxes and tariffs. It uses this revenue partly for public consumption (which implies a demand for goods and labor, but which does not add directly to anyone's utility) and partly for investment. Utility maximization determines the composition of households' consumption, but private saving is not determined by intertemporal optimization. Each household saves a fixed proportion out of its (nontransient) income. These savings rates differ between household groups, being very low for peasants and much higher for urban households. Rural-urban transfers therefore affect the rate of investment. All households save a large part of the income they consider transient (the increase in household income due to the boom being so classified). Here we use the savings rate of 0.575, derived in section I.

The capital inflow from abroad (that is, the value of the resource deficit, or the concept of foreign savings used in the national accounts) is given in terms of world prices. Hence an increase in the value of exports, such as occurred during the coffee boom, is automatically matched by an equal increase in the value of total imports. Changes in the external environment are fully and instantaneously passed on to the domestic economy.

In the model, savings determines investment rather than vice versa: the given amount of foreign savings is added to the endogenously determined amount of private and public savings and this gives the total value of investment. The allocation of investment between sectors is given exogenously. As a result, rates of return are not equalized and, without modeling the microeconomic distortions in the investment process in detail, the model incorporates the bias in investment in Kenya against agriculture and in favor of manufacturing.

In the context of the present article, three characteristics of the model should be emphasized. First, for most urban sectors constant elasticity of substitution (CES) production functions are used. In the case of manufacturing, the substitution elasticity was estimated. This gave a value close to 0.5 and this value was imposed for the other sectors. Our results obviously depend on these values, but the effect of changes in substitution elasticities is modest. For example, if we raise the imposed substitution elasticities to 0.9, the boom's contribution to long-run (1983) real income growth for smallholders is 90 percent of the case where substitution elasticities are equal to 0.5; for urban real incomes it is 70 percent; for investment 90 percent; and for industrial value-added 80 percent. Hence the model's long-run results are not very sensitive at all to the values assumed for the elasticities. In the short run, there are more substantial differences. Recall that in 1977 about 40 percent of the boom-induced increase in nominal smallholder incomes was offset by relative price changes. If substitution elasticities (σ) rise to 0.7, then 23 percent of the increase is offset, and for $\sigma = 0.9$ only 16 percent of the income gain is lost through price changes. This comparison is an extreme case, however. This is because (under our trade liberalization assumption), in 1977 prices of manufactures do not differ between the two runs. Since agricultural prices are tied to world prices this implies that smallholders can lose *only* through increases in prices of services. This gives the substitution elasticities in those sectors atypical importance. In the very year when the boom peaks, so that prices of services are being pushed up, prices of manufactured goods are unaffected because import controls are relaxed. For this reason, we repeat the calculation for 1978 (a year in which prices of manufactured goods do differ between runs). For $\sigma = 0.5$ we find that 27 percent of the income gain is offset by price increases; for $\sigma = 0.7$ this is 20 percent; and for $\sigma = 0.9$ this is 14 percent. Hence our results do not appear to be overly sensitive to changes in σ values.

Second, nonfood manufacturing is modeled as subject to import controls, but when a maximum price level is reached the regime changes endogenously. Import controls are then relaxed and changes in demand are no longer reflected in price changes, but instead in changes in quantities (imports). This is designed to capture the fact that trade control, while politically determined, changes endogenously.

Finally, in the urban labor market, there is excess supply at a given real wage rate. If instead, labor supply curves are upward sloping, then to that extent the model *under*estimates the magnitude of boom-induced relative price changes.

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THE WORLD BANK ECONOMIC REVIEW, VOL. 1, NO. 3:515–520

A Comment on "Growth and Equity in Developing Countries: A Reinterpretation of the Sri Lankan Experience," by Bhalla and Glewwe

Graham Pyatt

The inaugural issue of this journal contained an article by Bhalla and Glewwe which addresses some problems that arise in attempting to assess "the relative success or failure of policies in different countries or policy regimes" (Bhalla and Glewwe, 1986, p. 36). Their conceptual framework contrasts two approaches to raising economic welfare: "the direct or basic needs approach and the indirect or economic growth approach" (p. 61). From 1960 to 1977 Sri Lanka is seen as approximating the first regime, while the subsequent period, following the change of government in 1977, is cast as having a closer correspondence to the second. The general conclusion invited by the paper is that the change in policy orientation has been for the better: "the evidence . . . suggests that the post-1977 policies have not been detrimental to equity objectives and may offer more promise than those which they replaced" (p. 62).

In what follows I will suggest that Bhalla and Glewwe have exceeded the interpretations which their data will support. Accordingly, their case cannot be sustained, much as one would like to have answers to the questions they raise. For my own part, I share the majority view that Sri Lanka's system of food subsidies was (and to some extent remains) inefficient. But it is surprising to find that Bhalla and Glewwe also question performance in the social field between 1960 and 1977, and that they totally ignore Sri Lanka's current state of disruption in their optimistic prognosis.

I. Sri Lanka's Achievements in the Social Field

It is well known that, in relation to countries at similar levels of per capita income, Sri Lanka has been exceptionally successful in such social fields as health and education. As a result, studies like those of Isenman (1980) and Sen (1981),

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which effectively plot social statistics (for example, life expectancy or infant mortality) on a scatter diagram against some measure of per capita income, invariably show Sri Lanka to be an outlier. This is taken as evidence of benefits, to be set against the cost of high levels of social welfare expenditures which Sri Lanka has incurred.

To ascertain whether these expenditures were efficient in producing results would ideally require formal modeling of production processes in the social field, as Bhalla and Glewwe have noted (p. 37). Rather than attempt this, they argue that previous authors have misinterpreted the evidence of the scatter diagrams. Sri Lanka is admittedly an outlier with respect to, say, life expectancy in 1960 and again in 1978. But to justify the social expenditures of the period 1960–78, it is not enough to show that Sri Lanka is again an outlier in 1978, according to Bhalla and Glewwe. To justify expenditures which were exceptional over the period, they claim, it is necessary to demonstrate that life expectancy *improved* exceptionally over the same period (subject, perhaps, to an allowance for lags). But this did not happen. Life expectancy remained exceptionally high, but it did not improve exceptionally. Hence Bhalla and Glewwe conclude that Sri Lanka's performance in the social field from 1960 to 1978 was "nonexceptional" (p. 49).

This argument is not acceptable as it stands. Gross social expenditures can be divided between expenditures needed to maintain given levels of achievement, and expenditures over and above maintenance costs, the purpose of which is to achieve improvements or extensions in social services. Naturally, starting from a low base, gross expenditures are largely net or improvement expenditures in most developing countries. Hence, if little or no improvement is observed, then it is reasonably safe to conclude that the expenditures were inefficient. But this is obviously not a reasonable assumption in Sri Lanka: to maintain primary school enrollment ratios at around 90 percent obviously requires a good deal of resources. Accordingly, high social expenditures on education in Sri Lanka after 1960, with relatively little improvement in literacy, are not evidence that these expenditures were inefficient: it is evidence that it is expensive for any country to maintain a 90 percent literacy rate.[1]

To show that, by international standards, Sri Lanka's social expenditures were inefficient, Bhalla and Glewwe would either have to build a structural model or they would have to show that other countries which started in 1960 with similar levels of performance were better able to maintain and improve on that performance, and at less cost. As far as I know, there are no countries which

1. Bhalla and Glewwe recognize that their argument breaks down if high levels of a social indicator require high levels of expenditure to maintain. However, this recognition is confined to a footnote to discussion of the sharp fall in death rates in 1947 and their low value subsequently, following a highly successful malaria eradication program in 1946. Bhalla and Glewwe say: "The implicit assumption is that the expenditures needed to maintain a particular level [of the death rate] are much smaller than the initial capital expenditure needed to improve (it)" (p. 39, footnote 8). This may or may not be a reasonable assumption in this particular instance. But it is clearly not reasonable across the whole field of social services, especially when, as in Sri Lanka, high levels of performance have already been achieved.

dominate Sri Lanka in this sense. It then follows that a fairer assessment of the Sri Lanka performance might therefore be that, while their policies may or may not have been the most efficient, it was nevertheless a remarkable performance for Sri Lanka to maintain its exceptional position throughout the period.

Bhalla and Glewwe formally fit equations which relate levels of each social indicator to income per head for the period 1960 to 1978. They note that "In principle, the same methodology for assessing comparative performance could be conducted for the shorter time period from 1977 to 1984" (p. 49). Or they could have simply used the post-1977 data to make explicit econometric tests for structural breaks consequent on the change in policies. It is regrettable, therefore, that we are offered only casual empiricism to support their suggestion that "the growth orientation of the economy from 1977 to 1984 was accompanied by improvement in the living standards of the population and the poor" (p. 49). This is hardly persuasive when formal testing was possible.

Bhalla and Glewwe give no reason for not involving data for the period after 1977 in any formal statistical analysis. However, we can note that had they attempted to do so they would have run into trouble. Granted that there was faster growth after 1977, their regression equation leads to the expectation of improved performance on social indicators as a consequence. But this statement is based on the a priori expectation that the slope parameter of the regression equation is positive. In fact, both for primary school enrollment and life expectancy, a negative value is found empirically, so that faster growth since 1977 leads to the prediction of rapid deterioration subsequently! Thus, had Bhalla and Glewwe submitted their hypothesis and data to formal testing, their methodology would be seen to have broken down at this juncture.

II. Output and Employment

As a second step in their argument, Bhalla and Glewwe provide a brief discussion of economic growth in Sri Lanka from 1960 to 1984. They characterize the period 1970–77 as one of economic stagnation and refer to the period since 1977 as one of "recovery" characterized by a "growth strategy" (p. 52). They note the marked reduction in unemployment over recent years and the growing share of manufacturers in exports. But they fail to mention that much of this growth is attributable to the opening of a free trade zone, the advent of which had little to do with decisions on the level of social expenditures. They cite the 84 percent increase in paddy production from 1976 to 1984 but do not mention how far this is due to market forces as opposed to the opening up of new lands under a major social intervention, namely, the Mahaweli Ganga irrigation scheme. There is no mention of the growing importance of employment in the Persian Gulf, both in reducing domestic unemployment and in easing the balance of payments constraint through remittances which grew to the extent of becoming second only to tea as a source of foreign exchange. And there is no mention of the very large external deficit which grew after 1977, facilitated by

the considerable inflow of development aid and assistance from abroad in support of the new government (and not least to continue financing further stages of the Mahaweli project). In short, granted that there has been an acceleration of growth since 1977, at least up until the riots of 1983, at no point do the authors discuss how far this growth is sustainable or the extent to which it has been dependent on the choice of social welfare policy.

III. Changes in Inequality and Poverty

Sri Lanka has undertaken a number of household surveys of incomes and expenditures over the years. These include two Socio-Economic Surveys, for 1969–70 and 1980–81, and three Surveys of Consumer Finances, for 1973, 1978–79, and 1981–82. The third and final step in the analysis provided by Bhalla and Glewwe is to look at these surveys to ask what has happened to income and consumption levels, especially among the poor, over the period in question. Of course, the answer depends in part on the sources chosen. Bhalla and Glewwe are therefore at pains to discredit the 1969–70 Socio-Economic Survey results on the grounds that they reflect a relative abundance of rice (the basic wage good in Sri Lanka) which was politically engineered. This is most helpful to their argument since the survey results for 1969–70 dominate those for subsequent years. But even if one accepts their point, there then remains the question of whether the other surveys are comparable among themselves, not on account of underlying economic and political considerations, but because different surveys use different designs, definitions, and questionnaires. The World Bank Living Standards Measurement Study (Altimir and Sourrouille 1980; Booker, Singh, and Savane 1980; Chander, Grootaert, and Pyatt 1980; Scott, de Andre, and Chander 1980; Visaria and Pal 1980; and U.N. Statistical Office 1980) brings together much of the evidence, including evidence from Sri Lanka, on the extreme difficulty (if not the ultimate impossibility) of using different surveys to answer questions about changes in living standards over time. It is really quite surprising therefore that Bhalla and Glewwe do not at any point discuss the conceptual and technical comparability of the different surveys. Had they done so, then it would have been apparent immediately that the 1981–82 Socio-Economic Survey is not comparable with the three Surveys of Consumer Finances. If one is then, at best, prepared to accept some comparability only among the three Surveys of Consumer Finances (1973, 1978–79, and 1981–82) then the picture that emerges is not especially encouraging for the Bhalla and Glewwe thesis. One ought perhaps, therefore, to be circumspect about the conclusion of Bhalla and Glewwe "that growth has indeed trickled down; that is food subsidies have been replaced by labor income" (p. 60). The facts are that there is no clear upward trend evident in the levels data from 1973 to 1981–82 provided by the Consumer Finance Surveys; the income inequality data show a deteriorating situation; and one can only agree with Bhalla and Glewwe when they say that "too much should not be read into the figures on expenditure inequality" (p. 60). Perhaps they are right

in their view that the condition of the poorest has not deteriorated. But that is at best a very minimal qualification for an acceptable policy regime. What is more certain is that Bhalla and Glewwe have failed to make the case for growth with equity in Sri Lanka: there is no evidence here of the advent since 1977 of an accelerated and sustainable growth of living standards in which all have shared.

IV. A Final Comment

To end on a more constructive note, the questions raised by Bhalla and Glewwe are important, and the challenge for researchers of how they should be addressed has been around for some time. Chander, Grootaert, and Pyatt (1980) set out some of my own thinking on these matters. Here I would simply like to emphasize two points.

First, in asking questions about how living standards are affected by policy, it is invaluable to recognize a taxonomy of socioeconomic groups. There is some concession toward this view by Bhalla and Glewwe in a footnote which discusses the lack of fairness toward Indian estate workers under the new food subsidy system (p. 54, footnote 28). Recognizing that these are among the poorest groups in Sri Lanka, it would have been most constructive, and by no means particularly difficult, to investigate whether, for this group, "food subsidies have been replaced by labor income" (p. 60). And the approach could be extended. It is arguable, for example, that the riots of 1983 and the continuing conflict between Singhalese and the Tamils in the northern provinces has roots in government policy with respect to land settlement, education, and employment opportunities. It would therefore have been interesting and to the point if Bhalla and Glewwe had taken advantage of the separate data collected in the surveys they cite to see whether the northern provinces have indeed shared in Sri Lanka's growth. They say that "the post 1977 policies have not been detrimental to equity objectives" (p. 62). I suggest that it is an open question as to whether an analysis according to socioeconomic groups would allow this conclusion to be sustained.

Finally, if we are to move beyond description of what has happened to the living standards of different groups and begin to explore why, then it is necessary to set the questions within an integrated macroeconomic framework. Policies, production structures, and the distribution of incomes are inextricably interwoven. They therefore need to be investigated simultaneously in the quest for development strategies to stimulate growth with equity. Bhalla and Glewwe have provided the latest attempt at a short-cut to this problem. The lack of conviction carried by their results serves only to confirm that an integrated macroeconomic framework is necessary if we are to progress in this area.

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THE WORLD BANK ECONOMIC REVIEW, VOL. 1, NO. 3: 521–531

A Comment on "Growth and Equity in Developing Countries: A Reinterpretation of the Sri Lankan Experience," by Bhalla and Glewwe

Paul Isenman

In the first issue of this journal, Bhalla and Glewwe (1986) called into question Sri Lanka's record on social indicators and contrasted their views with those expressed by Sen (1981) and myself (1980a). This comment discusses three points relating to their analysis. The first is whether Bhalla and Glewwe have applied an appropriate yardstick to judge the change in Sri Lanka's social indicators. The second relates to questions about specification of Bhalla and Glewwe's regression equations. Reestimation of some of these equations suggests that they have overstated the effect of growth on social indicators; the reestimation also reconciles the apparently internally inconsistent results of their two regression specifications. The third and most important point is that Bhalla and Glewwe's interpretation of the Sri Lankan experience as a test of the "direct" versus "indirect" approaches to poverty alleviation obscures the evolving synthesis of the two in development policy and theory. While I have some other concerns about Bhalla and Glewwe's analysis, the accompanying comment by Pyatt in this issue of the *Review* (see above) covers most of them.[1] It is ironic to be debating the issue of Sri Lanka's social progress at this time of communal strife and violence there; but Bhalla and Glewwe are right in thinking that Sri Lanka's experience illustrates some important lessons for development policy.

1. On another point, see Isenman (1980b) on why "Kravis" prices, which revalue services at rich-country prices, should not be used to compare incomes among low-income countries. Bhalla and Glewwe also argue that even at conventional prices and exchange rates, Sri Lanka had a relatively high per capita income in 1960, equal to that of the Republic of Korea. It is certainly true that Sri Lanka, like most other countries, has not kept pace with the torrid pace of development in Korea and some other East Asian countries. It is worth noting, though, that with the "hindsight" provided by 1980 weights Korea's per capita income in 1960 was already 2.7 times that of Sri Lanka.

Paul Isenman is on the staff of the World Bank. He would like to thank those who have reviewed the draft of this comment or discussed the issues that it raises, including Jagdish Bhagwati, Sidney Chernick, Dennis de Tray, Paul Glewwe, Greg Ingram, Anne Krueger, Deepak Lal, Sarwar Lateef, Graham Pyatt, Adrian, Wood, and Satya Yalamanchili.

I. What Is the Relevant Question?

Bhalla and Glewwe's argument on Sri Lanka's social indicators, in a nutshell, is that its record since 1960 is unexceptional, and hence that "the conclusion pertaining to Sri Lanka's 'exceptional' status in the mid-1970s may have resulted from a methodology which ignored the important effect of initial conditions." Bhalla (forthcoming, a) is even stronger in his criticism of Sen (1981) and Isenman (1980a) for allegedly ignoring initial conditions. Sen and I simply showed that in the mid-1970s Sri Lanka had exceptional social indicators for a country at its income level. Neither of us attempted to analyze Sri Lanka's relative progress during different time periods, let alone said that Sri Lanka had reached its exceptional relative status only after 1960.[2]

Bhalla and Glewwe's quantitative analysis focuses on change since 1960. They indicate that Sri Lanka's record has been, with some caveats, "comparatively nonexceptional" (p. 61). But this is not the point. To rephrase a key point of Pyatt (1987), *if Sri Lanka was one of the leaders in 1960, the more relevant question is whether it kept up the pace expected of a leader, not whether it increased its lead.*

Let us look at what Bhalla and Glewwe actually found. They estimated eight equations on change in health and fertility indicators (life expectancy, death rate, infant mortality, and fertility rate, each estimated for log-log and logistic equations). Sri Lanka performed better than its expected value in six of them, significantly so in two cases. On the four education equations (primary enrollment and literacy, again with log-log and logistic equations), Sri Lanka fell below its expected values, although not significantly so. Overall, while Sri Lanka seems to have done better on health than education, there are no grounds, in terms of statistics or common sense, to say that Sri Lanka has not kept pace. Bhalla and Glewwe's own findings thus appear to contradict their negative evaluation of Sri Lanka's record on social indicators.

II. Questions on Regression Specifications

Bhalla and Glewwe also use their regression equations to attempt to show that growth has such a powerful effect on social indicators that any decline in social indicators caused by low social expenditures would have been rapidly offset by improvements induced by growth (pp. 50–51). The regression specifications and results, though, raise a number of questions about the robustness of their findings on either Sri Lanka or on the effects of growth. Why is the effect of income growth on change in social indicators apparently *negative,* and significantly so, in the only specification (log-log) that they themselves say controls adequately for initial conditions (that is, that accounts for the slowdown in progress on social

2. My article emphasized Sri Lanka's social indicators, not only before 1960, but before independence as well. See also Sen's comment (forthcoming) on Bhalla (forthcoming, a) and Bhalla's reply (forthcoming, b).

indicators as countries approach maximum feasible levels)?[3] Why do their two specifications also produce opposite results on some indicators for whether Sri Lanka does better or worse than expected? And how does their restricted sample affect their results?

In an attempt to resolve these questions, Bhalla and Glewwe's regressions on change in one of their indicators, life expectancy,[4] were respecified and reestimated. An alternate larger country sample (62 countries versus Bhalla and Glewwe's 43 countries) was estimated as well.[5] Results are reported in the appendix; the equations are annotated to explain why they were tried and what they showed.

Overall, the results seem robust and unequivocal. For the log-log equations, income growth consistently has a *negative* (but not always statistically significant) effect on life expectancy for the Bhalla and Glewwe country sample (equations 1–3 in appendix). Reassuringly, with the larger sample, the effect of income growth turns consistently, although far from significantly, positive (once the curve is no longer forced through the origin) (equations 7, 8). For the logistic equations, *the effect of income growth weakens and is no longer significant once a variable is added to take account of the initial life expectancy* (equations 5, 10). (Recall the emphasis that Bhalla and Glewwe themselves put on initial conditions.) In their sample, income growth has virtually no effect at all once initial life expectancy is added to the equation. In the larger sample, income growth does retain a more noticeable, if not significant, effect. Still, in order for growth to raise life expectancy by even one additional year, Sri Lanka would have to have had an implausibly high annual growth rate of 11 percent per capita for the 1960 to 1978 period; this compares with its actual growth rate of 2 percent. (See the note to equation 10.)

Thus, with the reestimation, Bhalla and Glewwe's two models now yield consistent results on the effect of income. Income growth does help social indicators, but by nowhere near as much as they state.

3. Regarding the specification problem on initial conditions, they state, "If the logistic form is used (*but one which does not weight initial conditions as the log-log form can*) then Sri Lanka's performance in terms of life expectancy and death rate appears more favorable" (p. 47, emphasis added).

4. Life expectancy was chosen because they used it as an example of the effects of income growth on social indicators and because their two specifications gave conflicting results on the effect of income growth on life expectancy and on Sri Lanka's residuals.

5. Bhalla and Glewwe's stratification of their sample by per capita income level raises problems for their log-log specification. Although they state that "in all the regressions, income is an exogenous variable" (p. 45), this is not the case for their log-log specification, where only the growth and not the level of per capita income occurs. In practice, their restriction of the sample to countries with per capita incomes under about $300 in 1960 means that a disproportionate number of countries with high initial indicators are omitted (since, as they show, social indicators are highly correlated with per capita income). In fairness, though, it would be complex, often unnecessarily so, if analysts had to change their samples each time the original variable (properly) used for sample stratification did not appear directly in the equation being estimated. In any event, there should be no objection to *not* stratifying the sample, since as they note this may improve the efficiency of estimation and since the larger sample eliminates anomalous results on the effect of income growth and on Sri Lanka's residuals. I am grateful to Paul Glewwe for his suggestion, on reading a draft of this comment, that the 5 oil countries included in my initial larger sample be dropped, thus reducing the sample from 67 countries to the 62 reported on here.

The reestimation also substantially reduces the discrepancy between the two specifications on whether Sri Lanka's improvement in life expectancy is better or worse than expected. With the improvements in specification for the Bhalla and Glewwe sample, and even more so for the larger sample, Sri Lanka looks increasingly less "good" than suggested by their logistic results and less "bad" than suggested by the log-log results.[6] In other words, by both specifications, Sri Lanka did just about as well as expected for a country with its high life expectancy in 1960. In contrast with the case of income growth, then, these results *strengthen* the finding of Bhalla and Glewwe that Sri Lanka's record on change in social indicators from 1960 to 1978 was "comparatively nonexceptional." However, as discussed above, the question should be whether Sri Lanka kept up the pace, not whether it accelerated it.

III. Broader Implications

In sum, neither Bhalla and Glewwe's regression results nor the more detailed results on life expectancy presented here support the contention that Sri Lanka fell behind the pace on progress in social indicators that would be expected for a country with its initial conditions. Rather, the most important and robust statistical result is that countries that wish to achieve rapid progress on social indicators should not count on growth to do the job automatically. Growth is clearly important, whatever these (single-equation) regressions say, because of its effect on the incomes of the poor and on government revenues for social programs. But what the regression results are clearly saying is that growth is not enough. This reemphasizes that it is also important to encourage a pattern of growth that increases the productivity of the poor and that pays careful attention to programs that can (efficiently) improve social indicators.

So the relationship between the "direct" and "indirect" approaches to poverty alleviation is more complicated than Bhalla and Glewwe suggest. Their central hypothesis would have been more relevant a decade ago. Then there were many more, among researchers and among policymakers, who believed in a direct approach in which growth is substantially deemphasized. Today, although the battle between the direct and indirect approaches undoubtedly rages on in some quarters, it is gradually giving way to an emerging consensus that both approaches are important and in many ways complementary.

Some elements of this consensus can be seen by comparing the discussion of Sri Lanka in Bhalla and Glewwe (1986), which is in effect a brief for the indirect approach, and in Isenman (1980a), which attempted to draw on both approaches. There was strikingly little difference between the two on economic policy. Both condemned the poor economic policies followed before 1977 equally strongly, as well as the inefficiency and lack of targeting of the food rationing

6. Moving from Bhalla and Glewwe's log-log equation (1) to the preferred log-log equation with the larger sample (8), Sri Lanka's residual improves from 1.5 to only 0.1 standard errors below its expected value. For the logistic equations, Sri Lanka's residual worsens from 2.1 standard errors better than its expected value (equation 4) to 0.2 standard errors below it (equation 10).

program[7] (see Isenman 1980a, pp. 245–51). Both also expected increased growth from the policy reforms begun in 1977. However, two points illustrate the differences that remain. First, Bhalla and Glewwe lump together (and largely condemn) all social programs, rather than distinguishing between the generally quite good health and education programs and the nutritionally effective, but wasteful and fiscally disastrous, rationing program. Second, Bhalla and Glewwe ignore entirely the effect of human capital on growth potential.[8]

The debate over direct, indirect, and integrated approaches to poverty alleviation should be seen in the context of the evolution of thinking on development policy. Development economics has been subject to changing fashions, some of which have been "direct" and others "indirect." We now see flaws in and caveats to these fashions as initially stated, and even more so as popularized. Lal (1983) has pointed to these as indications of the "poverty of development economics." But parts of core insights of these fashions, to a varying extent, become accepted as a part of the mainstream of development economics.

During the 1970s the major "direct" fashions included (in rough chronological order): employment, integrated rural development, income distribution, and basic needs. None of these is now widely seen as the main focus of development efforts, let alone as a panacea. Yet each has left its mark on the mainstream practice of development economics. For example, regarding basic needs, today virtually no one believes in the popularized view of this approach that relegated growth to minor status. But the basic needs approach has contributed to an increased recognition both that growth alone is not a sufficient objective or measure of development strategies, and that steps to meet basic health and educational needs can contribute to increasing incomes directly and through reducing population growth (see World Bank 1980).

The useful cores of these fashions of the 1970s have been grafted onto a base of the "indirect approach which emphasizes economic growth and less government intervention" (Bhalla and Glewwe 1986, p. 36).[9] Indeed, with hindsight,

7. Bhalla and Glewwe note the progress on social indicators since the policy turnaround of 1977. This is highly encouraging, and it would be interesting to explore its causes. However, the remarkable increase in primary enrollment they cite is essentially a statistical fluke. The primary enrollment ratio had dropped sharply earlier in the 1970s when the school enrollment age was raised from 5 to 6 years. The enrollment ratio went sharply up again in 1977 when this change was reversed. Also, although my article (1980a) cited the "politically bold and highly desirable step of reducing the coverage of the ration programme" (p. 241), the nutritional value of the program to those still covered has been eroded to the point that effects on malnutrition, particularly among estate workers, are now a subject of debate (see Edirisinghe 1985 and Sahn, forthcoming).

8. On growth prospects after 1977, Isenman (1980a) stated: "For the future, acceleration of growth seems much more feasible in Sri Lanka than in most other slow growing countries. Sri Lanka's potential for per capita income growth has been enhanced by its relatively highly developed human resources, its low rate of population growth and its comparatively low wage rates. Whether it will achieve accelerated and sustained growth depends heavily on the quality and stability of growth policies . . ." (p. 257).

9. The economic devastation among many developing countries in the 1980s, particularly in Africa and in Latin America, has been increasingly laying to rest any residual views among those interested in poverty alleviation that growth is not important. With declines in incomes, for example, primary school enrollments have declined in many African countries (World Bank, 1986, p. 29). These declines suggest

one can say that the presumption of market failure and of public sector success was the single most important fashion in development economics of the 1960s and 1970s. Interestingly, this fashion relates more to how to achieve growth than to the appropriate amount to spend on social services or other direct means to achieve poverty alleviation. Like the other fashions cited, this interventionist fashion contributed to the evolution of development economics. Few today would deny the vital role of the public sector in development in even completely market-oriented economies. Yet today there is better appreciation that market failure is less pervasive and public-sector failure more pervasive than was believed, and that more attention needs to be given to concentrating the limited resources of the state where they are most needed.

It is difficult to judge the extent of acceptance of an integrated view of development economics. The trend in this direction in the World Bank, for example, is indicated in World Bank (1980, 1984, 1986). It is also reflected in the inclusion of recommendations for increased allocations to primary education, health, and small farm production in the Bank's (generally growth-oriented) reviews of public expenditure programs. Bhagwati (1985), who Bhalla and Glewwe cite approvingly and who deals primarily with the resurgent emphasis on growth issues, concludes on a similar point: "The experience of the post-war years has essentially taught us to supplement this basic (growth-route) strategy for assaulting poverty by policy instruments whose significance was insufficiently appreciated at the beginning of the development and planning process. There is evidence already in the policies of many developing countries that these lessons have been learnt" (p. 23).

Appendix: Regression Equations

Equations are presented in sequences beginning with Bhalla and Glewwe's equations. Reasons for modifications in the specifications and the results of these modifications are summarized in the notes under each equation. Some variations on these specifications were also tried, all with results consistent with those reported here.

H_{it} = life expectancy in 1960 in country i
H_{iT} = life expectancy in 1978 in country i
Y_{it} = Gross domestic product (GDP) per capita (in 1960 U.S. dollars) in 1960 in country i
Y_{iT} = GDP per capita (in 1960 U.S. dollars) in 1978 in country i
R^2 = adjusted R^2
S.E. = standard error of regression; figures in parentheses are "t" values
S.L. residual = Sri Lanka's residual

that Bhalla and Glewwe should not use the term "*fixed* effect" interchangeably with "initial condition." Rather they reinforce the point made by Pyatt that maintenance of the social programs that affect social indicators is expensive and should not be taken for granted.

Bhalla and Glewwe Sample: Forty-Three Countries

$$(1) \qquad \ln H_{iT} - \ln H_{it} = \underset{(27.143)}{0.695} \cdot \frac{(1)}{\ln H_{it}} - \underset{(-2.189)}{0.032} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.22$
S.E. = 0.032
S.L. residual = −0.049

This simply repeats the Bhalla and Glewwe log-log equation (their equation 8)—using the same specification and the same data—for comparison purposes. The results of the next two equations are not very interesting for this smaller sample, although they are for the larger sample (equations 7 and 8).

$$(2) \quad \ln H_{iT} - \ln H_{it} = \underset{(-0.297)}{-0.055} + \underset{(1.329)}{0.896} \cdot \frac{(1)}{\ln H_{it}} - \underset{(-1.169)}{0.027} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.20$
S.E. = 0.032
S.L. residual = −0.045

This is the same Bhalla and Glewwe equation, but with a constant added to avoid forcing the curve through the origin. The *t* values deteriorate in this smaller sample. The sign of income growth remains negative.

$$(3) \qquad \ln H_{iT} - \ln H_{it} = \underset{(-0.632)}{-1.611} + \underset{(0.754)}{1.017} \ln H_{it} - \underset{(-0.803)}{0.143} (\ln H_{it})^2$$
$$- \underset{(-0.889)}{0.021} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.20$
S.E. = 0.032
S.L. residual = −0.028

This is the same as equation 2, but a more flexible log quadratic specification of initial conditions is substituted for the Bhalla and Glewwe log inverse specification. This smaller sample shows no improvement in fit, and the sign of income growth remains negative.

$$(4) \quad \ln \left(\frac{76 - H_{iT}}{H_{iT}}\right) - \ln \left(\frac{76 - H_{it}}{H_{it}}\right) = \underset{(-8.265)}{-0.397} - \underset{(-4.369)}{0.001Y_{iT}} + \underset{(1.780)}{0.001Y_{it}}$$

$R^2 = 0.38$
S.E. = 0.138
S.L. residual = −0.291

This simply repeats the Bhalla and Glewwe logistic equation (their equation 7) for comparison purposes. The "76" in the dependent variable is the upper limit

on life expectancy they chose. Note that (unlike in the log-log equations) a negative residual indicates a *better* than expected performance.

$$(5)\quad \ln\left(\frac{76 - H_{iT}}{H_{iT}}\right) - \ln\left(\frac{76 - H_{it}}{H_{it}}\right) = \underset{(2.906)}{2.211} - \underset{(-0.281)}{0.028} \ln Y_{iT} + \underset{(0.091)}{0.092} \ln Y_{it} - \underset{(-2.993)}{0.695} \ln H_{it}$$

$R^2 = 0.44$
S.E. = 0.133
S.L. residual = −0.036

This equation improves Bhalla and Glewwe's preferred specification in two ways. First, changing the income variables from linear to log terms reflects the effect of *percentage* growth in income. This is preferable to their linear specification, which less plausibly (and with lower t values) reflects the effect of the *dollar* increase in income. Second, adding a term (the log of initial life expectancy) to control for initial conditions refines their logistic specification in the manner they themselves refined their log-log specification. The most important result is that *the coefficients for income growth are no longer significant.* (This effect held once initial conditions were accounted for, whether the income variables were in log or linear form). Sri Lanka now falls very close to its expected increase in life expectancy.

Larger Sample: Sixty-Two Countries

$$(6)\quad \ln H_{iT} - \ln H_{it} = \underset{(23.865)}{0.655} \cdot \frac{(1)}{\ln H_{it}} - \underset{(-1.289)}{0.019} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.16$
S.E. = 0.041
S.L. residual = −0.044

This is the Bhalla and Glewwe log-log equation, but with a larger sample. The sign of income growth is still negative, but this is because their specification (without a constant) forces the curve through the origin.

$$(7)\quad \ln H_{iT} - \ln H_{it} = \underset{(-2.375)}{-0.335} + \underset{(3.643)}{1.878} \cdot \frac{(1)}{\ln H_{it}} + \underset{(0.717)}{0.014} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.22$
S.E. = 0.039
S.L. residual = −0.019

The sign of the coefficient of income growth is positive but far from significant once a constant is added. The significant coefficient for the constant suggests that

a part of the "exogenous effect" (Bhalla and Glewwe 1986, p. 46) is independent of initial conditions.

$$(8) \qquad \ln H_{iT} - \ln H_{it} = \underset{(-2.634)}{-5.041} + \underset{(2.852)}{2.833} \ln H_{iT} \underset{(-2.988)}{-0.384} (\ln H_{it})^2 + \underset{(0.606)}{0.011} (\ln Y_{iT} - \ln Y_{it})$$

$R^2 = 0.32$
S.E. = 0.036
S.L. residual = −0.004

The more flexible quadratic specification of initial conditions improves the statistical fit with this larger sample. This is the preferred log-log specification (and sample size). The sign of the coefficient of income remains weak but positive. Sri Lanka is almost exactly at its expected value.

$$(9) \quad \ln\left(\frac{76 - H_{iT}}{H_{iT}}\right) - \ln\left(\frac{76 - H_{it}}{H_{it}}\right) = \underset{(-11.186)}{-\ 0.484} - \underset{(-2.203)}{0.0005 Y_{iT}} + \underset{(1.003)}{0.0005 Y_{it}}$$

$R^2 = 0.16$
S.E. = 0.230
S.L. residual = −0.275

This is the Bhalla and Glewwe logistic equation with the larger sample. The statistical fit, surprisingly, deteriorates with this larger sample. We know, from the following equation, that this is because of the lack of control for initial conditions. Sri Lanka's favorable residual is no longer significant.

$$(10) \qquad \ln\left(\frac{76 - H_{iT}}{H_{iT}}\right) - \ln\left(\frac{76 - H_{it}}{H_{it}}\right) = \underset{(4.204)}{2.713} - \underset{(-1.223)}{0.110 \ln Y_{iT}} + \underset{(1.560)}{0.143 \ln Y_{it}} - \underset{(-4.404)}{0.891 \ln H_{it}}$$

$R^2 = 0.51$
S.E. = 0.176
S.L. residual = 0.042

The rationale for this improved specification, controlling for initial conditions and logging income, is given in the note to equation 5. As with the smaller sample, the effect of income growth is no longer significant. Sri Lanka falls below its expected value, but by only 0.2 standard errors.

The calculation cited in the text of the additional growth required to raise Sri Lanka's life expectancy from 69 to 70 years is done by taking first differences of two versions of equation 10 in which these life expectancies are (respectively) substituted; the only term on the right-hand side that changes is $\ln Y_{it}$. The

resultant *increase* in required annual growth is 8.8 percent. *Even with Bhalla and Glewwe's own equation* (equation 4), and so without the improvements noted above, *the income growth rate required to increase Sri Lanka's life expectancy by only one year would be 5.2 percent,* which would have put it third in the growth sweepstakes, behind only Korea and Taiwan. While the choice of a one year increase in life expectancy is arbitrary, this is a more meaningful measure than their calculation of how long it would take Sri Lanka to make up for lower social expenditures through higher growth. They calculated this (from equation 4) at 16 years, which they compare to Sen's estimate of 77 years (Bhalla and Glewwe). Their comparison is inappropriate, though. Sen estimates 77 years for Sri Lanka to make up its "lead" over other countries accumulated *over the generations;* they estimate 16 years to make up the lead (that is, residual) that Sri Lanka accumulated *in only 18 years.* In addition, when we consider the case of a country with a zero residual (or, like Sri Lanka in the present equation, with a near zero residual), it becomes clear that the Bhalla and Glewwe calculation leaves something to be desired as a measure of the trade-off between growth and social indicators.

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A Response to Comments by Graham Pyatt and Paul Isenman

Paul Glewwe and Surjit S. Bhalla

In their comments, Isenman and Pyatt raise six questions regarding our analysis of growth, equity, and living standards in Sri Lanka:

1. Does our methodology accurately control for initial conditions? (Isenman)
2. Should we have added more countries to our sample? (Isenman)
3. How can we explain the negative effect of income on living standards when using the log-log functional form? (Isenman and Pyatt)
4. Are the data from the different household surveys comparable over time? (Pyatt)
5. Why do we not distinguish between maintenance and other expenditures? (Pyatt)
6. Why did we not analyze the time period 1977–84? (Pyatt)

Although we appreciate these comments, we do not think that they have a substantial effect on either our analysis or the conclusions we have drawn. The following paragraphs address these comments individually.

Initial conditions. The methodology that controls for initial conditions has been discussed in considerable detail in two forthcoming papers.[1] Allow us to state this as simply as possible: our method of controlling for initial conditions is to take first differences of the level-level (static) regressions (equations 6 and 7 in our article) to remove the fixed effect term λ_i, which gives equations 6′ and 7′.[2] Equation 8 is simply a refinement of 7′ and should not be interpreted as the "real" or "correct" method of controlling for initial conditions. Finally, if an appropriate functional form is available (we prefer the logistic version in 7′) then one need not search for countries with comparable levels of achievement in 1960, as suggested by Pyatt.

1. Although these have not yet appeared in print, Isenman and Pyatt have seen both papers, particularly the first, upon which they have commented (Bhalla, forthcoming, a and b). At no point do we use our analysis to claim that "Sri Lanka has not kept pace" (Isenman). What we state is that Sri Lanka's performance in raising living standards from 1960 to 1977 has not been exceptional.

2. For example, when the fixed effect is explicitly entered into equation 6, we have $\ln H_{it} = \lambda_i + \alpha + \beta \ln Y_{it}$. This is then transformed into equation 6′: $d \ln H = \ln H_{iT} - \ln H_{it} = (\alpha_T - \alpha_t) + \beta(\ln Y_{iT} - \ln Y_{it})$. Note that the initial conditions effect, λ_i, is not a function of time and thus drops out of 6′.

Surjit S. Bhalla and Paul Glewwe are at the World Bank.

Appropriate sample. We have tried a variety of functional forms, and none of them changed our basic conclusion. Isenman has taken a step further and added some more countries. Though some differences appear, in his comment above Isenman himself admits that his efforts "strengthen the finding of Bhalla and Glewwe that Sri Lanka's record on change in social indicators from 1960 to 1978 was 'comparatively nonexceptional,'" which is our main point.

Negative income coefficient. The only reason the log-log regression was estimated was to highlight the drawbacks of the conventional level-level approach used by Isenman and Sen. If a log-log equation is properly specified, both level-level and change-change regressions should give broadly similar coefficients on the income variable. The switch from a positive coefficient in the former to a negative income coefficient implies that the log-log functional form is a poor choice. This does not occur when the logistic functional form is used, which (apart from its intuitive appeal) is another reason to prefer it over the log-log form. We do not think it necessary to defend a functional form which we have already discarded for its implausible results.[3] In effect, Pyatt and Isenman are in agreement with us on this, yet they ignore the more appropriate logistic model.

Comparability of survey data. We have presented a variety of data from different sources (national accounts, survey data, food balance sheets, living standards indicators) in order to evaluate the Sri Lankan experience as thoroughly as possible. Changes in inequality are best measured by survey data, though one must always be careful regarding comparability over time. If one rejects these data what other data can one use? We presented both food and total expenditure data from five surveys, three of which were undertaken by the same institution (Central Bank of Ceylon) and to a great extent by the same group of people. Why would there be a comparability problem for these three surveys (1973, 1978–79, and 1981–82), which by themselves support our conclusions? In addition, food expenditure information is collected in a very similar manner in all five surveys and also supports our conclusions. For a detailed analysis, particularly a critique of the income data, see Glewwe (1986, and forthcoming).

Maintenance expenditures. We agree that appropriate consideration should be given to maintenance expenditures in order to make a proper assessment of the relationship between living standards and social expenditures. This was explicitly discussed in Bhalla (forthcoming, a). We can go further and take the example of education expenditures. From 1960 to 1977 maintenance (current expenditures) costs averaged Rs33.43 per capita (in 1970 prices), with a low of 27.5 in 1974 and a high of 37.7 in 1970.[4] From 1978 to 1984 maintenance costs averaged Rs29.60 per capita, which is 11 percent lower than those prevailing in

3. "The importance of functional forms is indicated by the 'wrong' log-log functional forms" (Bhalla, forthcoming, a, p. 26); "implausible results are generated by the log-log functional forms" (Bhalla and Glewwe 1986, p. 47).

4. This is calculated from the data in Alailima (1985) and the gross domestic product deflator.

the 1960–77 period. Yet, as noted in our article (p. 49), primary school enrollment dropped from 1960 to 1977 but rose substantially from 1978 to 1982.[5]

Exclusion of 1977–84 period. Pyatt contends that repeating our statistical analysis for the time period 1977 to 1984 would cause us to "run into trouble." Such an analysis was not done because: (1) recent data are not available for many countries in our sample; and (2) such a short time period may not be long enough to make an assessment—progress in living standards is often slow and is best measured over longer periods of time. Yet we find Pyatt's prediction strange, given the statistics reported in our article (particularly in table 1). The preliminary data we offer from 1982 show striking improvements in primary school enrollment and infant mortality in Sri Lanka. Improvements in these indicators may well have a progressive incidence—the rich are always able to send their children to school and pay for their medical care. In addition, the Sri Lankan economy has grown at a much faster rate since 1977,[6] which "requires" a commensurately greater improvement in living standards to be "typical" than would be the case if the economy grew at the rates prevailing before 1977. Thus being typical with a higher rate of economic growth would, in a very real sense, imply an *improvement* for Sri Lankan living standards (relative to being typical at the former lower rates of growth). Finally, both of the above-mentioned indicators are subject to ceiling (or floor) constraints, so it is noteworthy that their improvements have proceeded at a more rapid pace in the post-1977 period than during 1960–77. Contrary to Pyatt's assertion, we expect that a formal statistical analysis of the 1977–84 period is likely to show Sri Lanka to be an exception.

In conclusion, we welcome the comments by Isenman and Pyatt on the general issue of which policies promote living standards in developing countries. It would seem that all of us agree that a mix of "direct" and "indirect" policies is needed (see p. 61), and we also agree that further analysis of the issues needs to incorporate an "integrated macroeconomic framework" (Pyatt). However, we fear that these exercises have not always been terribly illuminating in regard to Sri Lanka. Our contribution is much more modest and also more specific: we sought to discuss "alternative methodologies of analyzing cross-country performance in terms of living standards" (p. 60) and to examine Sri Lanka's performance in terms of growth and living standards before and after 1977.

5. The primary school enrollment ratios are: 1960, 95 percent; 1977, 86 percent; 1978, 94 percent; and 1982, 103 percent. Even if one uses 1978 rather than 1977, as suggested in Isenman's footnote 7, the main point still holds.

6. Pyatt's request that we discuss the causes and sustainability of growth in Sri Lanka since 1977 is beyond the scope of our article (see p. 61). This is discussed to some extent in Bhalla and Glewwe (1985), which was mistakenly omitted from the list of references in our article.

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