DM/85/80

INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

Fiscal Policy Response to the External Shocks of 1979 In Selected Developing Countries: Theory and Facts

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December 26, 1985

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1/ This paper was completed during August-September 1984 when the author worked as a Summer Intern with the Tax Policy Division of the Fiscal Affairs Department. The author wishes to thank Ved Gandhi, Sheetal Chand, Mario Blejer, Parthasarathi Shome, Liam Ebrill, Fernando Sanchez-Ugarte, Ahsan Mansur, Alan Gelb, and Alberto Alesina for their suggestions, and Chris Wu for helpful research assistance. The responsibility for the views expressed herein and for all remaining errors is his own.

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Abstract

Non-oil developing countries suffered many adverse external shocks simultaneously in 1979 when the price of oil was increased, the real interest rates on their external debt rose, their terms of trade deteriorated, and their export volumes to developed countries stagnated. This paper attempts to assess the fiscal policies pursued by a sample of 48 non-oil developing countries in response to these external shocks.

A theoretical model is formulated to describe the "optimal" reaction of fiscal policy to temporary and to permanent shocks. Two cases are considered: one in which public consumption and tax rates are perfectly flexible policy instruments; another one in which they are not. It is shown that, in both cases, temporary shocks should be met with larger external borrowing than permanent shocks. Also, public capital expenditures and public borrowings should be smaller in the case in which reducing public consumption and/or raising taxes is subject to constraints than if the latter are perfectly flexible policy instruments.

An investigation of the actual fiscal policies pursued by these 48 non-oil developing countries in response to the 1979 shocks reveals that, on average, and contrary to the predictions of the theoretical model, the ratio of tax revenues to public current expenditures, net of interest payments, decreased sharply after 1979. A cross-section analysis of the countries in the sample indicates that: (a) countries with a larger stock of external debt outstanding had a systematically lower tax to current expenditures ratio, both before and after 1979; this inverse relationship between taxes and external debt is significantly stronger for the group of countries that have recently undergone debt rescheduling, and (b) the responsiveness of tax rates to the overall size of the budget to be financed seems to have decreased after 1979 for the sample of countries as a whole.

The paper concludes that, for many non-oil developing countries, the inadequate fiscal adjustment to the 1979 shocks may well have been an important cause of their present external debt-servicing difficulties.

I. Introduction

In 1979, non-oil exporting developing countries were hit by a number of adverse shocks: the price of oil rose; the real interest rate on their external debt went up by 2 to 3 percentage points; their terms of trade deteriorated; and their export volume to developed countries fell. These adverse trends continued until the end of 1982; and some of them are expected to persist for some time into the future, even under the most optimistic scenarios. As a group, non-oil developing countries reacted to the shocks by running large current account deficits in their balance of payments and by borrowing from international capital markets. In some countries, the borrowing was used to bring about an effective adjustment process that is now well underway; but for other countries, the adjustment was either begun too late or was inadequate to cope with the country's adverse situation. This second group of countries is now under serious pressure to repay the debt obligations that were accumulated in the years immediately following the shocks. 1/

The adjustment policies undertaken were generally of two sorts: policies aimed at creating additional supply in the traded goods sector, through measures such as devaluation, export subsidies, import substitutions--what Balassa (1983) has called "outward-oriented policies"--and policies aimed at reducing aggregate demand, mostly by means of fiscal instruments--that is, "inward-oriented policies." Balassa and McCarthy (1984) have recently shown that, in a sample of 23 non-oil developing countries and 7 oil exporting developing countries, those that pursued outward-oriented policies generally performed better than the others. However, their sample of countries is relatively small, and their indicators of fiscal performance are not very detailed and informative. 2/

This paper attempts to make a more detailed investigation of the fiscal policy response to the 1979 shocks in 48 non-oil developing countries. The sample has been chosen on the basis of data availability and comparability only. The large number of countries in the sample has made it possible to carry out the investigation by means of a cross-section analysis.

Section II presents a theoretical model of optimal fiscal behavior and optimal external borrowing, which serves as a benchmark for the empirical analysis of Section III that follows. Subsection 1 of

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1/ For a more detailed description of these problems, see Dornbusch (1983), Dornbusch and Fischer (1984), and the references cited therein.

2/ Specifically, the chosen indicators of fiscal policy were the ratio of credit to the Government over gross domestic product (GDP) and the ratio of the budget balance to GDP. Similar international comparisons for the 1973/74 oil shock were performed in Balassa (1981 a, 1981 b, 1983), Mitra (1983), and Balassa, Barsony, and Richards (1981).

Section II illustrates the basic model, which is a simple extension of previous work by Kharas (1981 a, 1981 b), Sachs (1983), and Cooper and Sachs (1984). Subsection 2 solves the model when there are no constraints on public consumption, while subsection 3 analyzes the special case in which the fiscal authorities find it difficult to change public consumption and the tax rates from some exogenously determined desired values. In subsection 4 of Section II, the optimal reaction of the fiscal authorities to temporary and to permanent shocks is analyzed for two cases--when the fiscal constraints are binding and when they are not. In both cases, perceived temporary shocks are met with larger borrowing and larger current account deficits than perceived permanent shocks; moreover, the optimal rate of capital accumulation and the optimal size of borrowing and of public capital expenditures are lower under conditions of fiscal restraint than under conditions of perfectly flexible fiscal policy.

Section III sets up the conclusions derived from the theoretical model against the actual response of fiscal policies to the 1979 shocks for the 48 non-oil developing countries in the sample. Contrary to the findings of the theoretical model, subsection 1 of Section III shows that for the sample as a whole the ratio of tax revenues to current public expenditures, net of interest payments, decreases sharply after 1979, as does the ratio of capital to current public expenditures. Subsections 2 and 3 of Section III attempt to explain this apparent anomaly by comparing the estimates from two cross-section regressions, before and after the 1979 shocks. (The periods chosen are 1974-79 and 1980-82.) The conclusions that emerge from this analysis include the following:

1. Countries with a larger stock of external debt outstanding at the beginning of each subperiod have a systematically lower tax to current expenditures ratio.

2. The responsiveness of tax rates to the size of the revenues needed to balance the budget has presumably decreased after the 1979 shocks.

3. Fiscal policy in the countries that have recently undergone debt restructuring has differed significantly in the post-1979 period from the fiscal policy pursued by the other countries in the sample.

The first two findings run counter to the predictions of the theoretical model. Coupled with the third finding, they suggest that for many non-oil developing countries the fiscal policy response to the 1979 shocks may have been an important cause of the external debt servicing difficulties they are now encountering.

Section IV presents the conclusions.

II. Theory

1. The theoretical model

In this section a theoretical model of optimal fiscal policy for a developing country is analyzed. The model specification draws on Sachs (1983) and Kharas (1981 a, 1981 b). To the results obtained by these authors the model presented below adds an explicit analysis of public expenditures (current and capital) and a stochastic framework in which the optimal reaction to temporary and to permanent shocks can be analyzed.

Following Sachs (1983), the economy is described by the following set of equations: A production function

$$Q_t = F(K_t) + e_t + v_t, \qquad v_t = v_{t-1} + \varepsilon_t \tag{1}$$

$$e_t = \eta_t + \eta_{t-1} + \eta_{t-2}$$

where Q_t = aggregate output, and

K_t = stock of capital.

If $F(\cdot)$ is homogenous of degree 1, all variables can be thought of in per capita terms. η_t and ε_t are temporary (lasting three periods) and permanent stochastic shocks, respectively. 1/ η_t and ε_t are identically and independently distributed with mean zero.

An aggregate consumption (C_t) function, consisting of private consumption $(1-s)(1-\tau_t)Q_t$, and of public consumption, G_t:

$$C_t = (1-s)(1-\tau_t)Q_t + G_t \tag{2}$$

τ being the tax rate on output, and s being the average propensity to save out of aggregate output.

An aggregate investment function, consisting of private investment (identical to private saving), $s(1-\tau_t)Q_t$, and of public investment, I_t^g:

$$I_t = s(1-\tau_t)Q_t + I_t^g \tag{3}$$

1/ Temporary shocks are postulated to persist for three periods so that their effect on the desired capital stock may be traced without assuming that their realization is observed in the current period. In the empirical section (Section III) of this paper, ε_t and η_t will be interpreted as terms of trade shocks; accordingly, Q_t should be interpreted as income rather than output.

Implicit in (3) is the hypothesis that the output market is in equilibrium or, equivalently, that the portion of aggregate output that is not consumed automatically goes to capital accumulation. As the focus in this paper is not on optimal stabilization policies, the assumption is not particularly restrictive. 1/

The laws of motion of the economy are summarized by the capital accumulation equation:

$$K_{t+1} = K_t(1-d) + I_t \tag{4}$$

d being the rate of depreciation, and by a consolidated government budget constraint and current account of the balance of payments: 2/

$$G_t + I_t^g = \tau_t Q_t + D_t - (1+r)D_{t-1} \tag{5}$$

where D_t = outstanding stock of public debt, by hypothesis consisting exclusively of external debt, and r = the real interest rate in international capital markets (nominal interest rate deflated by the domestic GDP deflator). It is implicitly assumed that domestic financial markets are nonexistent. All variables introduced so far are in real terms.

The basic economic assumptions behind equations (1) - (5) have been extensively justified in Kharas (1981 a, 1981 b), and Sachs (1983), and need not be repeated here. 3/ As distinct from those studies, the equations presented above include stochastic shocks in the production function and include the public expenditure variables, I_t^g and G_t. Notice that the shocks to (1), being additive, affect aggregate output, Q_t, but not the marginal productivity of capital, $F'(K_t)$. This feature of the model will considerably simplify the analysis that follows.

Throughout the paper it is assumed that the average rate of growth of public external debt in real terms is smaller than the real interest rate (i.e., it is assumed that the government is not able to run "Ponzi schemes" with its external debt), which has the following implication:

$$\lim_{N \to \infty} (1+r)^{-N} D_{t+N} = 0 \tag{6}$$

Equations (5) and (6) together imply that the real stock of debt at time t is less than or equal to the present discounted value of all future debt accumulation, net of interest payments.

1/ See also Kharas (1981 a).

2/ Since private savings is always equal to private investments, the current account deficit is identical to the budget deficit of the public sector.

3/ See also McDonald (1982) for a survey of some related literature.

$$D_t \leq \sum_{k=1}^{\infty} (1+r)^{-k} (\tau_{t+k} Q_{t+k} - G_{t+k} - I^g_{t+k}) \tag{7}$$

This is the familiar government budget constraint (or current account constraint) expressed in present values--cf., Barro (1979), Buiter (1983), and King and Plosser (1983). Equation (7) imposes an intertemporal consistency between the stock of debt outstanding in any period of time, on which interest has to be paid, and the present value of all future budget surpluses (or deficits), net of interest payments. The equation does not presuppose that the stock of public debt outstanding will eventually be repaid, but just that, over a long time span, the country will not be able to pay interest on its debt by means of further borrowing (cf., equation (6)).

The fiscal authorities choose the time paths of τ_t, I_t, G_t, I^g_t, and D_t, subject to the constraints (1) - (7) and to the additional requirement that

$$G_t \geq \overline{G} > 0 \tag{7'}$$

where $\overline{G}$ is some exogenous value determined by political or other unspecified constraints. The goals of the fiscal authorities are summarized in the following objective function:

$$V_t = \text{Max } E_t \sum_{k=0}^{\infty} (1+\delta)^{-k} \left[u(C_{t+k}) - \alpha(\tau_{t+k} - \overline{\tau})^2\right] \tag{8}$$

$$0 < \delta < 1, \ \alpha > 0$$

where E_t is the expectations operator, δ is the rate of time discount, and $u(\cdot)$ is a well-behaved utility function. Throughout the paper it will be assumed that E_t is formed conditionally on v_{t-1}, e_{t-1} (i.e, current shocks are not observable).

The first term inside the square brackets in equation (8) states that the country is solving a standard life-cycle problem of (private plus public) consumption; implicitly, it is assumed that private and public consumption are perfect substitutes. The second term states that it is "costly" to choose a tax rate different from a given desired target, $\overline{\tau}$. This second term attempts to capture the hypothesis that tax rates should be uniform through time in order to minimize collection costs and "excess" burden (cf., Barro (1979, 1981), and Buiter (1983)). In addition, the second term could reflect political opposition to changes in the tax rates. The value of $\overline{\tau}$ is related to the government budget constraint in present value terms (equation (7)), and changes whenever the economy is hit by a permanent shock. No attempt is made to derive the value of $\bar{\tau}$ from an optimizing model; however, $\bar{\tau}$ will be discussed further in Section III below, with reference to the empirical results of a cross-section analysis of developing countries.

2. Solution when the constraint on public consumption is not binding

In this case, the first-order conditions for the fiscal authority optimization problem 1/ can be transformed so as to imply:

$$F'(K_t) = r + d \tag{9}$$

$$\hat{u}_{ct}/\hat{u}_{ct-1} = 1+\delta/1+r \tag{10}$$

where $\hat{u}_{ct} = E_t(\partial u(\cdot)/\partial c_t)$ is the expected marginal utility of consumption in period t. Equation (9) is the standard condition equating the marginal productivity of capital to its marginal cost. If $F(\cdot)$ is well behaved, it identifies an optimal capital stock $K^* = h(r+d)$, $h'(\cdot) < 0$. Equation (10) identifies the optimal intertemporal allocation of expected consumption:

$$E_t(C_{t+1}) \gtrless E_t(C_t) \text{ as } \delta \lessgtr r \text{ for all t.} \tag{11}$$

If the rate of time preference, δ, is larger than the international interest rate, r, consumption decreases over time, as the country borrows now and pays interest in the future, and vice-versa, if $\delta < r$. 2/

The remaining first-order conditions, together with (9) and (10), identify the optimal time path of the instruments of fiscal policy. Assuming for simplicity that $u(\cdot)$ is quadratic, so as to apply the certainty equivalence theorem 3/, we get (the asterisk indicates the optimal value):

1/ Similar problems have been extensively studied in the literature; for instance, see Bardhan (1967), Sachs (1983), Blanchard (1983), and Alesina (1984).

2/ In the limit, and if $\delta \neq r$, consumption either tends to zero or diverges to infinity. This implausible result can be avoided by means of some technical devices (for instance, having a variable discount factor or an endogenous interest rate (Blanchard (1983)), or by imposing a finite time horizon (Sachs (1983)), or by working with an overlapping generations model (Buiter (1981)).

3/ If the certainty equivalence theorem does not hold, then $\tau_t^* \neq \bar{\tau}$. However, all the other results follow, as stated in the text, with τ_t^* replacing $\bar{\tau}$ everywhere.

$$\left.\begin{array}{lr} \overset{*}{\tau}_t = \bar{\tau} & \text{(i)} \\ I_t^{g*} = K^*_{t+1} - (1-d)K_t - s(1-\tau)(F(K_t) + v_{t-1} + \eta_{t-1} + \eta_{t-2}) & \text{(ii)} \\ \lambda_{1t} = \hat{u}_{ct} & \text{(iii)} \end{array}\right] \quad (12)$$

where λ_{1t} is the Lagrange multiplier corresponding to equation (4)--i.e., the marginal utility of capital evaluated at the optimum. Thus, the government can set the tax rate at the desired target $\bar{\tau}$. Public capital expenditures add to private capital accumulation so as to reach the desired capital stock, K^*_{t+1}. Finally, the utilities of public expenditures on consumption and on capital formation are equated at the margin--equation (12)(iii). 1/

The present value of the whole stream of public consumption is determined residually from the government budget constraint (equation (7)), given the stock of public debt outstanding and the expected path of I^{g*}_{t+k} and of $\overset{*}{Q}_{t+k}$. And the time path of G_t is set so as to satisfy the condition for an optimal intertemporal allocation of consumption (equation (11))--recall the assumption that private and public consumption are perfect substitutes in the government objective function.

$$G_t^* = C_t^* - (1-s)(1-\bar{\tau})(F(K_t) + \eta_{t-1} + \eta_{t-2} + v_{t-1}) \qquad (13)$$

If $\delta = r$, C_t^* is constant over time and, if there are no shocks (i.e., if $\eta_{t-2} = \eta_{t-1} = v_{t-1} = 0$), so is G_t.

3. Solution when the constraint on public consumption is binding

Here, the first-order conditions to the dynamic optimization problem can be shown to imply: 2/

$$F'(K_t) = (\delta+r)/[1-(1-\theta_t)(1-\tau_t(1-s))] \qquad (14)$$

$$2\alpha(\tau_t-\bar{\tau}) = (1-\theta_t)(1-s)(F(K_t) + \eta_{t-1} + \eta_{t-2} + v_{t-1})(1+\delta/1+r)^t\lambda_2 \qquad (15)$$

1/ Notice that net investment in the long run is zero, unless in the previous period a shock to output has caused private investment to exceed (or fall short of) the expected amount, in which case $K_t \neq K_t^*$; this undesirable feature of the model could be modified by adding adjustment costs, or "time to build" (cf., Kydland and Prescott (1982)).

2/ As before, it is assumed that $u(\cdot)$ is quadratic, so as to facilitate recourse to the certainty equivalence theorem.

where λ_2 is the Lagrange multiplier corresponding to equation (7); thus $(1+r)^{-t}\lambda_2$ is the discounted marginal utility of wealth, and

$\theta_t = \hat{u}_{ct}(1+\delta)^{-t}/\lambda_2(1+r)^{-t}$ is the ratio between the marginal utility of consumption and the marginal utility of wealth, both in present value terms and evaluated at the optimum. 1/ If the constraint on public consumption is not binding, then $\theta_t = 1$, and the solution is identical to the one illustrated in subsection 2 above. But if the constraint on G_t is binding, then it can be shown that $\theta_t < 1$: the marginal utility of consumption is "too low" relative to the marginal utility of wealth (i.e., current consumption is "excessively large" relative to future consumption). Associated with this distortion are the following results:

a. As implied by equation (14), $F'(K_t) > (\delta+r)$: whenever $\theta_t < 1$, *the optimal capital stock is smaller than in the case in which* $\theta_t = 1$; investment should not be carried up to the point at which the marginal productivity of capital equals its marginal cost. A similar result is obtained by Sachs (1983) and by Kharas (1981 b). Moreover, the investment decisions and the consumption decisions are no longer separable: the optimal capital stock depends, among other things, on the form of the utility function, on the average propensity to save, and on the minimum possible level of public consumption, $\underline{G}$.

b. As implied by equation (15), $\tau_t > \bar{\tau}$: since public consumption cannot be reduced below $\underline{G}$ to reach its optimal level (or since it is costly to do so), the authorities will be forced to vary τ_t so as to achieve the two objectives of: (1) smoothing fluctuations in consumption over time; and (2) satisfying the government budget constraint given the optimal path of the other fiscal variables. However, by hypothesis, deviations of τ_t from the desired target, $\bar{\tau}$, are "costly." Thus, unless $\alpha = 0$, the fiscal authorities will find it optimal to tolerate some intertemporal fluctuations in consumption:

$$\hat{u}_{ct}/\hat{u}_{ct-1} = (1+\delta)\theta_t/(1+r)\theta_{t-1} \qquad (16)$$

1/ All the results presented in this section, except for the determination of G_t, will identically hold in the case in which, rather than imposing a binding constraint on G_t, the objective function is modified by adding a cost element penalizing the fiscal authorities for all deviations of G_t from $\bar{G}$--for instance, by means of the term $\beta(G_t-\bar{G})^2$. In this case, the first-order condition for public current expenditures implies:

$$2\beta(G-\bar{G}_t) = (1-\theta_t)(1+\delta/1+r)^t\lambda_2$$

which is easily comparable with equation (15) in the text. As with tax rates, every time that θ_t is reduced (for instance by a larger stock of debt outstanding), the fiscal authorities will be forced to set G_t further away from the desired value $\bar{G}$ (see the discussion in the text below).

Except under fortuitous circumstances, $\theta_t/\theta_{t-1} \neq 1$, since θ_t is affected by the shadow price associated with the constraint on public consumption.

c. As a corollary to points (a) and (b), whenever $\theta_t < 1$, the the marginal value of public capital expenditures is larger than the marginal utility of public consumption (i.e.: $\lambda_{1t} > \hat{u}_{ct}$). The two utilities cannot be equated at the margin since, by hypothesis, public consumption cannot be reduced (or can be reduced at some cost), and capital expenditures cannot be increased without either violating the wealth constraint or raising taxes in excess of the desired target, $\bar{\tau}$.

d. Unlike in the case of the unconstrained optimum, both public investment decisions and tax rates will depend on the size of the outstanding stock of external debt. Specifically, a higher initial stock of debt will be associated with a higher marginal utility of wealth (i.e., a larger λ_2, the Lagrangian multiplier associated with the wealth constraint). This in turn will be associated with a smaller θ_t, and thus with a smaller capital stock and a higher tax rate.

e. Finally, the higher the minimum level of public consumption (i.e., the higher $\bar{G}$), the lower is θ_t, and, as a consequence, the lower is the optimal capital stock and the more tax rates have to be set above the desired rate $\bar{\tau}$.

4. The reaction of fiscal policy to exogenous shocks

Suppose that the country has been hit by a temporary negative shock to output (i.e., $\eta_{t-2} < 0$). If the constraint on public consumption is not binding, tax rates will not be adjusted. However, both current and capital public expenditures will go up, so as to maintain the optimal intertemporal allocation of consumption and the optimal capital stock (see equations (13) and (12) (ii)). Moreover, tax revenues will fall with output, so that the country will borrow from international capital markets by running a current account deficit.

If the constraint on public consumption is binding, the country will also run a current account deficit. However, the response of fiscal policy instruments is now somewhat different than in the previous case. As shown in subsection 2, the constraint on public consumption drives a "wedge" between the marginal utility of wealth and the marginal utility of consumption (i.e.: $\theta_t = \hat{u}_{ct}(1+\delta)^{-t}/\lambda_2(1+r)^{-t} < 1$). A temporary shock to output affects only (or mainly) the marginal utility of consumption, $\hat{u}_{ct}$. If the shock is negative, the "wedge" is reduced (i.e., θ_t gets closer to 1), and the fiscal authorities will set their tax rates and their public expenditures closer to the unconstrained optimum (which implies a lower tax rate, a higher capital stock, and possibly higher public consumption). So, as in the unconstrained optimum, tax revenues will fall, public expenditures will rise, and the country will borrow from abroad.

If the negative shock to output is permanent ($\varepsilon_{t-1} < 0$), however, a different reaction is observed. In the unconstrained optimum, the desired capital stock is unaffected. 1/ Since private savings fall, public capital expenditures will increase and will remain permanently at a higher level. Moreover, unless the target rate, $\bar{\tau}$, increases to offset the permanently smaller tax base, the present value of the stream of public consumption will have to decrease. Since the shock is permanent, in order to maintain the optimal intertemporal allocation of consumption, both future and current values of G have to drop. The net effect on borrowing is now as follows: while the rate of net investment is positive (which occurs here only in the period immediately subsequent to the shock), the country runs a deficit. As soon as the optimal capital stock is regained, public capital expenditures are decreased to a level just sufficient to cover the residual amount of depreciation on that optimal stock. At this point, the current account will move into surplus, to pay for the interest on the newly accumulated debt. The time path of all these variables is illustrated in Figure 1, under the assumptions that $\delta = r$ (so that G is constant over time), that there are no adjustment costs 2/, and that the shock occurs in period -1 and is perceived in period 0. 3/

If the constraint on public consumption is binding, the response of policy variables to the permanent shock is somewhat different. If neither $\bar{\tau}$ nor $\bar{G}$ is affected by the shock, the distortion in the intertemporal allocation of consumption is made even worse by the permanent negative shock (i.e., θ_t falls even further below 1 as the country "overconsumes" to an even larger extent than before). As indicated by equations (14) and (15), this overconsumption leads to a lower desired capital stock and to higher tax rates. Thus, public capital expenditures can either rise (since private investment has fallen) or fall

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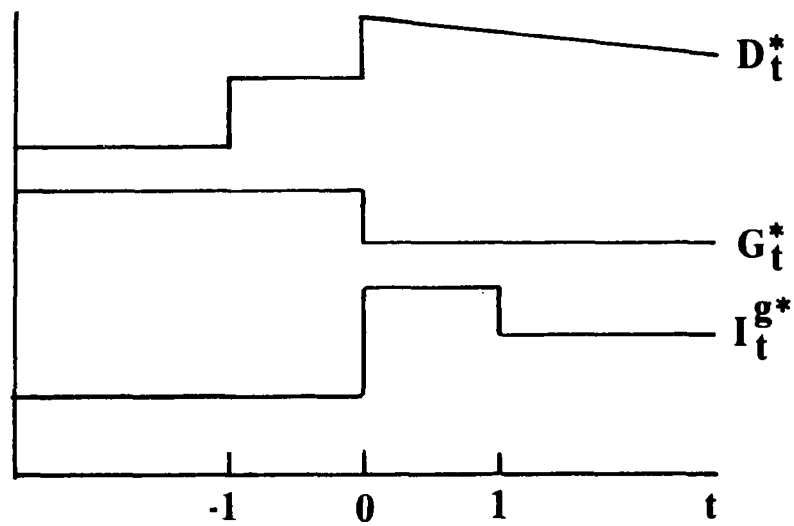
1/ Recall that by hypothesis the shock does not affect $F'(K_t)$, the marginal productivity of capital.

2/ Adjustment costs would smooth out the time path of all variables and would raise the optimal level of borrowing (cf., for instance, Martin and Selowsky (1981)).

3/ In a recent paper, Razin and Svensson (1983) reached a somewhat different conclusion: in a two-periods model with an optimizing fiscal authority, they showed that temporary shocks would create current account deficits, and permanent shocks would have no effect on either the private or the government current account. The reason for the difference between their results and those illustrated above is their neglect of public capital expenditures. When these are explicitly included, and if the shocks do not affect the marginal productivity of capital, then a permanent shock affects public capital and current expenditures in opposite directions; in the period immediately subsequent to the shock, the increase of capital expenditures prevails over the cut in public consumption.

Figure 1



(since the desired capital stock is lower); tax revenues can also either rise or fall (depending on whether the rise in tax rates does or does not offset the lower time path of the tax base); and public consumption falls only if the negative shock reduces the lower limit on public consumption, $\overline{G}$.

Summarizing the results obtained so far: a temporary negative shock will always be met with borrowing, so as to regain the desired pattern of consumption and to maintain the optimal rate of investment. A permanent negative shock, on the other hand, which permanently reduces private investment, will force the country to undergo some fiscal adjustment: in the unconstrained case, this adjustment will mainly take the form of lower public consumption; in the constrained case, it will mainly take the form of higher tax rates; in addition, the reaction of capital public expenditures is positive in the unconstrained optimum and ambiguous when the constraint on public consumption is binding. 1/

III. Evidence

The results presented in subsection 4 of Section II enable us to judge the actual response of fiscal policies in developing countries to the 1979 shocks. If the shocks were perceived to be temporary, tax rates should have been lowered or public consumption should have been increased; moreover, capital public expenditures should have been stepped up. But if the shocks were perceived to be permanent, the current account deficit should have been accompanied by an increase in tax rates, or by a reduction in current public expenditures, or both; the reaction of capital public expenditures could have gone either way. Moreover, the adjustment should have been harsher for those countries with a larger stock of debt outstanding. This section looks at the evidence in terms of these conjectures.

1. A preliminary look at the evidence

The simultaneous occurrence and magnitude of many adverse shocks in 1979 (increase in the price of oil, increase in the interest rate, reduction in the export volume, deterioration in the terms of trade) could have left little doubt in the minds of the fiscal authorities of most developing countries that these shocks had a large permanent component. Yet, simple indicators of fiscal performance suggest that, on average, no adjustment was undertaken during the first two or three

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1/ Analogous results can be shown to arise in the case of interest rate shocks, with only one relevant difference: in the case of permanent increases to the real interest rate, the fiscal adjustment should be larger, the larger the stock of external debt outstanding.

years after the shocks. The ratio of tax revenue to current public expenditures net of interest payments for a sample of 48 non-oil exporter developing countries 1/ dropped from 106.57 percent during the 1974-79 period to 100.97 during 1980-82. 2/ The drop was largest for the countries in Africa and in the Western Hemisphere; the ratio increased slightly for Asian countries. Moreover, the ratio of public capital expenditures to public current expenditures, net of interest payments, also dropped, from 49.07 percent to 46.77 percent. Finally, the ratio of tax revenue to total public expenditures, net of interest payments, dropped from 72.22 percent to 68.09 percent.

These numbers can still be consistent with widespread increases in tax rates if the tax bases of developing countries shrank more than the proportionate changes in their tax rates. Moreover, the averages are likely to conceal large differences in the behavior of individual countries in the sample: for instance, for 17 out of the 48 countries, the ratio of tax revenues to current public expenditures, net of interest payments, actually increased in the second subperiod (1980-82).

In order to gain a better understanding of these issues and to evaluate the appropriateness of the adjustment (or lack thereof) to the particular situation of individual countries, an attempt is made in the remainder of this paper to explain the reduction in the tax revenue to current expenditures ratio by comparing two cross-section regressions for the 48 countries in the sample, before and after the 1979 shocks. The cross-section linear equations that have been estimated below bear little resemblance to the formal abstract model analyzed in Section II; however, the analytical results of that model do provide some help in formulating the relevant questions and in interpreting the results.

2. Specification and estimation of the empirical model

The tax revenue collected in each country can be expressed as a weighted average of the tax bases available to that country. Scaling each variable to public consumption, denoting by β_j the j^{th} tax base as a fraction of G, and by τ_j the tax rate applied to that base, we have:

$$T_t/G_t = \sum_{j=1}^{J} \tau_j \beta_j \qquad (17)$$

To simplify notation, let a ^ symbol over a variable denote the stream of present values of that same variable, scaled to public consumption

1/ The sample was chosen on the basis of data availability and comparability. Data sources are: International Monetary Fund, Government Finance Statistics Yearbook and International Financial Statistics; and IBRD, World Tables. Data concern central governments only.

2/ For most countries in the sample, data were available only up to 1981.

and discounted to the present by $\rho = \frac{1+g}{1+r}$, where g is the rate of growth of public consumption and r is the real interest rate, with $r > g$. That is, for any variable X, $\hat{X}_t = \sum_{k=0}^{\infty} \rho^k \frac{X_{t+k}}{G_{t+k}}$. Then, the intertemporal budget constraint in present values terms (equation (7) in Section II) can be written as:

$$\hat{T}_t = D_t/G_t + \hat{I}^g_t - \hat{NT}_t - \hat{R}_t + \frac{(1+r)}{(r-g)} \qquad (18)$$

where: NT = nontax revenue; R = other sources of revenue (such as grants or money seignorage); and where the last term on the right-hand side of (18) follows from $\sum_{k=0}^{\infty} \rho^k = \frac{1}{1-\rho} = \frac{1+r}{r-g}$. Equation (18) defines the total tax revenues, as a fraction of current public expenditures, that need to be raised over time in order to be able to service the stock of debt outstanding in period t, given the time path of all the relevant fiscal variables.

In order to estimate the model by means of a single linear equation, the following assumptions have been made: first, tax rates are changed subsequent to the realization of unforeseen permanent shocks only, and are otherwise expected to remain constant. 1/ This assumption, together with equation (17), allows us to write the present value of the stream of future tax revenues scaled to G as the weighted average of the discounted stream of all tax bases, also scaled to G:

$$\hat{T}_t = \sum_{j=1}^{J} \tau_j \hat{\beta}_{jt}, \qquad (19)$$

where

$$\hat{\beta}_{jt} = \sum_{k=1}^{\infty} \rho^k \beta_{jt+k}/G_{t+k}$$

Second, the tax rate applied to each tax base can be expressed as a linear function of T/β_j (i.e., of the total tax revenue to be raised over time, $\hat{T}$, as a fraction of the present value of the tax base itself, β_j):

$$\tau_j = \delta_j + \alpha_j \hat{T}/\hat{\beta}_j \qquad (20)$$

1/ This assumption is consistent with the theoretical results of Section II under the hypothesis that temporary deviations of G_t from $\bar{G}$ are not costly.

This assumption does not seem to be particularly restrictive, given that δ_j and α_j are allowed to differ for different j's. However, it is impossible to relate this assumption to the theoretical results of Section II.

From equations (18), (19), and (20), by means of simple substitutions, we obtain:

$$\hat{T}_t = \sum_{j=1}^{J} \delta_j \hat{\beta}_j + k[D_t/G_t + \hat{I}^g_t - N\hat{T}_t - \hat{R}_t + \frac{(1+r)}{(r-g)}] \tag{21}$$

where $k = \sum_{j=1}^{J} \alpha_j$. Equation (21) states that the tax revenue collected (as a fraction of current expenditures net of interest payments) is a linear function of the taxable capacity of the country, as measured by the term $\sum_{j=1}^{J} \delta_j \hat{\beta}_{jt}$, and of the total revenues needed to satisfy the intertemporal wealth constraint, as measured by the terms inside the brackets.

The last step is to relate the expected stream of future present values of each variable to current observations of the same variable. This involves assuming that each variable is expected to grow exponentially at some constant rate. If X is the variable in question, γ_X is its expected rate of growth, and X_0 is the current observation of X, then:

$$\hat{X} = X_0 \sum_{k=0}^{\infty} \rho^t \frac{(1+\gamma)^t}{(1+g)^t} = X_0 \frac{1+r}{r-\gamma_X} \tag{22}$$

Assuming for simplicity that each tax base is expected to grow at the same constant rate of growth, $\bar{\gamma}$ (where $\bar{\gamma}$ is also the rate of growth of real output), equation (21) can be expressed in terms of observable variables (denoted with a $_0$ subscript): 1/

$$T_0/G_0 = k\frac{(r-\bar{\gamma})}{r-g} + \sum_{j=0}^{J} \delta_j \beta_0 + k\frac{(r-\bar{\gamma})}{1-r} D_0/G_0 + k\frac{(r-\bar{\gamma})}{r-\gamma_I} I_0^g$$
$$- k\frac{(r-\bar{\gamma})}{r-\gamma_N} NT_0 - k\frac{(r-\bar{\gamma})}{r-\gamma_R} R_0 \tag{23}$$

1/ In deriving (23) from (22), the fact that $\bar{\gamma}_T = \bar{\gamma}$ has been used.

By making the final assumption that the coefficients δ_j, k, γ, and r are equal across countries, equation (23) can be estimated by means of a cross-section regression.

The results of the estimates for the 1974-79 and 1980-82 subperiods are reported in Table 1. Each variable is measured as a simple average of the ratio between the variable in question and public consumption during the relevant subperiod, 1/ except for the debt variable, which is measured at the beginning of the subperiod. All the fiscal variables refer to central government only, except for the debt figure, which is total external debt of the country. (Since private external debt is frequently guaranteed by the government, it is likely to be a more relevant variable for the fiscal authorities than other, smaller debt aggregates.) 2/ Tax revenue figures include social security contributions; however, for some countries this inclusion could be a source of errors in variables.

The taxable capacity of each country, $\sum_{j=1}^{J} \delta_j \hat{\beta}_{jt}$, is not directly observable. Following the early literature on international tax comparisons, 3/ it has been proxied by three variables: output of the mining sector, N, imports, M, and output of the agricultural sector, A. The first two variables measure the two largest tax bases available to a developing country and they thus provide an indication of the country's "ability to collect taxes;" their estimated coefficients are always significant and with the expected sign. 4/ The output of the agricultural sector proxies for the stage of development, which presumably affects the citizens' "willingness to pay taxes;" its estimated coefficient has the negative sign, as expected, but is significant only in the 1980-82 subperiod. 5/

1/ For most countries, data go up to 1981 only.

2/ When total external debt of the country is replaced by public debt of the central government, the overall fit deteriorates for the 1980-82 subperiod, and improves slightly for the 1974-79 subperiod. The estimated coefficients of the other variables remain substantially unaffected, and the debt coefficient remains negative and significant.

3/ For instance, see Tait, Gratz, and Eichengreen (1978), and Tabellini (1985).

4/ When exports were added to the regression, either alone, or summed to imports, or in per capita terms, the results deteriorated for both periods; one possible reason for this result is the high correlation between exports and output of the mining sector.

5/ When GDP per capita was used instead, the 1974-79 equation performed better, and the 1980-82 equation deteriorated; however, the remaining coefficients remained substantially unaffected.

Table 1. Regression Results with Variables Scaled to Current Public Expenditures Net of Interest Payments: 48 Non-oil Developing Countries 1/

(i) 1974-79

$$T/G = \underset{(10.53)}{111.743} + \underset{(3.06)}{0.1551}\ N/G + \underset{(3.79)}{0.0866}\ M/G$$

$$- \underset{(-1.62)}{0.0210}\ A/G - \underset{(-2.72)}{0.0584}\ D/G - \underset{(-3.49)}{0.6380}\ GR/G$$

$$- \underset{(-2.87)}{0.4370}\ NT/G + \underset{(5.25)}{0.6292}\ I^g/G - \underset{(-4.07)}{1.3435}\ (I^g+G)/Q$$

$F(8, 39) = 20.05$ $\qquad \bar{R}^2 = 0.76$

(ii) 1980-82

$$T/G = \underset{(10.92)}{99.8745} + \underset{(4.39)}{0.2553}\ N/G + \underset{(2.91)}{0.0735}\ M/G$$

$$- \underset{(-3.07)}{0.0165}\ A/G - \underset{(-3.11)}{0.0438}\ D/G - \underset{(-4.79)}{0.8880}\ GR/G$$

$$- \underset{(-0.83)}{0.1590}\ NT/G + \underset{(5.25)}{0.5291}\ I^g/G - \underset{(-3.18)}{0.9686}\ (I^g+G)/Q$$

$F(8, 39) = 18.57$ $\qquad \bar{R}^2 = 0.75$

Sources: IMF, Government Finance Statistics Yearbook, and International Financial Statistics; IBRD, World Tables.

1/ Numbers in parentheses are t-statistics. Notations used are as follows:

- N = output of the mining sector (at factor cost);
- M = imports;
- A = output of the agricultural sector (at factor cost);
- GR = grants;
- NT = nontax revenue (central government);
- D = total external debt outstanding;
- I^g = capital expenditures (central government);
- G = current expenditures net of interest payments (central government);
- Q = GDP (at factor cost); and
- T = tax revenue, including social security contributions (central government).

All variables are in nominal terms. The ratios have all been averaged over the relevant subperiods, except for D/G which refers to the first year of each subperiod (1974 and 1980, respectively). No adjustment has been made for the fact that fiscal variables refer to the fiscal year and all other variables refer to the calendar year.

In order to allow for the possibility that the revenue composition between tax and nontax sources may be different for countries with public sectors of different sizes, the share of central government expenditures net of interest payments over GDP, $(G + I^g)/Q$, was added as an explanatory variable. It turns out to be highly significant in both subperiods and contributes to a substantial improvement in the overall fit. The negative sign of its estimated coefficient, and its high and positive simple correlation coefficient with the ratio of nontax revenues to GDP, indicate that countries with larger shares of central government expenditures in GDP tend to raise relatively more revenues from nontax sources and relatively less by means of taxes. There is no good a priori reason for this finding. 1/

The remaining explanatory variables are those that enter the government net wealth constraint--cf., equations (18) and (19). They are all averages of the yearly ratios for the relevant subperiods, except for D/G, which refers to the first year of each subperiod (1974 and 1980, respectively). The estimated coefficients of grants, GR/G, and of the expenditure composition, $I^g/_G$, are always significant and with the expected sign. Nontax revenue, NT/G, has a negative estimated coefficient, as expected, which however is significant only in the first subperiod. When revenue from money creation 2/ was added as a further explanatory variable, it turned out to be insignificant.

The estimated coefficient of outstanding debt at the beginning of the period, D/G, always has the wrong (negative) sign and is always significant. This unexpected result can be interpreted in either of two ways: (a) a number of developing countries have violated the intertemporal budget constraint, and their external debt is growing on average and in real terms at a rate in excess of the real rate of interest; that is, equation (6) of Section II does not hold. Indeed, when a dummy variable identifying those countries that had undergone debt rescheduling between 1978 and 1983 is added to the coefficient of external debt, it has a negative sign, which for the 1980-82 subperiod, is almost significant at the 95 percent level (its t-statistic is -1.92); the estimated coefficient for all other countries remains negative, but it drops substantially in absolute value; and (b) the time period considered is too short, and the stock of debt outstanding at the beginning of each subperiod is proxying for such things as the country rate of time pref-

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1/ One possibility is that the negative coefficient on $(G+I^g)/Q$ indicates a simultaneous equation bias problem--recall that G is also used to scale all other variables, including the endogenous variable. See p. 18 below.

2/ Defined as $\frac{\Delta Y}{Y} \cdot \frac{m}{Y}$, where Y is nominal income, m is the stock of monetary base outstanding, and Δ is the difference operator (cf., Auernheimer (1974)).

erence, or the ease with which countries had access to international capital markets and were thus able (or willing) to delay and reduce their adjustment. Both interpretations are likely to contain some element of truth.

In addition, the estimated equations possibly suffer from a simultaneous equation bias. Even accepting the hypothesis that grants, nontax revenues, and debt outstanding at the beginning of each period are exogenous, it is likely that the expenditure composition variable and the share of public expenditures in GDP are correlated with the residuals of the equations being estimated. In developing countries capital expenditures generally consist of infrastructure and other investments that do not provide the government with a stream of future cash flows; hence, they have to be paid for by raising revenues from other (tax or nontax) sources. It is likely, therefore, that tax revenue, current expenditures, and capital expenditures of governments are all simultaneously determined. 1/ Moreover, it is possible that the total size of the public sector is simultaneously determined, among other things, by the composition of revenues raised and the size of tax revenues relative to current public expenditures. There is no solution to this problem, short of finding some good instrumental variables for $I^g/_G$ and $(G+I^g)/Q$.

Several dummies for country groupings were tried: for geographic location, for structural features of the economy, and, as mentioned above, for countries that underwent debt rescheduling. All dummies were tried on the intercept only, except for the dummy on debt rescheduling, which was tried both on the intercept and on the coefficient of external debt (see p. 17 above). Countries were grouped according to certain structural features of their economies as follows: (a) those countries whose oil and lubricant imports were above 20 percent of total imports in 1980; (b) those which experienced a terms of trade deterioration of more than 20 percent between 1979 and 1982; and (c) newly industrialized countries (defined as those countries with GDP per capita above $1,700 in 1981, and with a share of manufacturing output over GDP above 20 percent, also in 1981--cf., Balassa (1981 a)).

When the dummies for geographic location were tried on the intercept, their individual coefficients turned out to be insignificant, and an F-test at the 95 percent confidence interval could not reject the hypothesis that all their coefficients were equal to zero for both sub-

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1/ This is indeed a result of the theoretical model analyzed in Section II for the case in which the government cannot freely choose public consumption. If public consumption is a perfectly flexible policy instrument, the model predicts that capital expenditures of the Government will be determined exclusively by the optimal capital stock, and can thus be considered as exogenous with respect to the equation being estimated.

periods. The same results emerged when the dummies for debt rescheduling and for the three structural features of the economy were tried on the intercept, again for both subperiods. Thus, the only relevant country grouping is of those countries that underwent debt restructuring between 1978 and 1983 and those that did not; moreover, this grouping affects the coefficient of total external debt, for the 1980-82 regression, but not the intercept.

The classification of central government expenditures between current and capital expenditures is known to be highly unreliable and heterogenous across countries, and this could cause serious errors in variables. To overcome this problem, the model was re-estimated by scaling all variables to total public expenditures, net of interest payments. The regression results are reported in Table 2. (The capital expenditure variable turned out to have an insignificant estimated coefficient and was dropped from the set of explanatory variables.) They are somewhat worse according to statistical criteria than the results reported in Table 1.

3. Interpretation of the results

We can now return to the question raised in the beginning of Section III: Why did the average of tax revenue to current public expenditure ratio drop in developing countries subsequent to the 1979 shocks? And how was the drop distributed among the 48 countries in the sample?

Table 3 displays the actual drop in the ratio between 1974-79 and 1980-82 in each of the 48 developing countries in the sample, together with the difference in the predicted values from the regressions reported in Table 1. The change in the actual ratios has the same sign as the change in the predicted ratio for all but eight countries in the sample. 1/ Moreover, the correlation coefficient between the two changes is 0.75. Thus, on average, a comparison of the predicted values for the two subperiods (specifically, a comparison of the estimated coefficients and of the explanatory variables in the regression) can account for over one half of the actual change in the ratio in individual countries. The remaining part of the change is reflected in the residuals of the regressions and in the change in the distribution of these residuals across the sample. 2/

1/ They are: Kenya, Zaire, Fiji, India, Pakistan, Sri Lanka, Argentina, and Chile.

2/ Since the predicted values are based on the regressions of Table 1, where no dummy variable for country groupings is included, it is implicitly assumed that all countries have the same coefficients. This assumption could be easily dropped by comparing the actual and the predicted values from a regression with appropriate dummies.

Table 2. Regression Results with Variables Scaled to Total Public Expenditures Net of Interest Payments: 48 Non-oil Developing Countries 1/

(i) 1974-79

$$T/TG = \underset{(13.51)}{93.347} + \underset{(2.15)}{0.108}\ N/TG + \underset{(3.77)}{0.08418}\ M/TG$$

$$- \underset{(-0.87)}{0.009838}\ A/TG - \underset{(-3.68)}{0.6542}\ GR/TG - \underset{(-2.74)}{0.4482}\ NT/TG$$

$$- \underset{(-2.85)}{0.0655}\ D/TG - \underset{(-3.86)}{0.7679}\ TG/Q$$

$F(7, 40) = 17.33$ $\qquad$ $\bar{R}^2 = 0.71$

(ii) 1980-82

$$T/TG = \underset{(9.94)}{78.444} + \underset{(2.70)}{0.1676}\ N/TG$$

$$+ \underset{(2.36)}{0.06327}\ M/TG - \underset{(-2.78)}{0.0128}\ A/TG - \underset{(-5.08)}{1.0334}\ GR/TG$$

$$- \underset{(-0.54)}{0.1091}\ NT/TG - \underset{(-1.03)}{0.0281}\ D/TG - \underset{(-1.96)}{0.3910}\ TG/Q$$

$F(7, 40) = 10.29$ $\qquad$ $\bar{R}^2 = 0.58$

Sources: Same as Table 1.

1/ The numbers in parentheses are t-statistics.

$TG = G + I^g$ = total expenditures net of interest payments; and
D = total external debt of the country.

The remaining variables are defined in Table 1.

Table 3. Actual and Predicted Changes in the Tax Revenue to Current Public Expenditure Ratio: 1974-79 to 1980-82

Country	Actual Change	Predicted Change 1/
Malta	26.81	30.66
Philippines*	22.47	24.65
Mexico*	14.95	10.08
Peru*	14.74	10.81
Cyprus	14.63	6.49
Malaysia	14.18	15.05
Tanzania	12.01	-28.62
Panama	9.31	0.09
Jordan	8.83	7.50
Pakistan	7.11	-15.33
Zaire*	6.46	-1.41
Botswana	5.30	10.91
Papua New Guinea	4.73	9.06
Cameroon	4.22	3.37
Trinidad and Tobago	2.53	3.39
Argentina*	1.69	-6.91
Kenya	1.24	-7.38
Tunisia	0.76	10.23
Burma	0.72	0.05
Fiji	0.13	-7.00
Barbados	-0.02	-2.69
Malawi*	-0.02	-15.65
Ghana	-0.30	-13.49
Rwanda	-0.40	-1.67
Mauritius	-1.03	-4.61
Paraguay	-2.43	-1.66
Morocco*	-3.25	-10.91
Chile*	-4.15	11.14
Korea	-4.51	-3.34
Turkey*	-4.91	-2.35
India	-5.39	3.09
Sri Lanka	-5.62	11.57
Costa Rica*	-10.27	-9.73
Yemen Arab Republic	-12.07	-2.17
Thailand	-12.20	-9.80
Syrian Arab Republic	-15.00	-9.44
Brazil*	-15.34	-3.23
Sudan*	-18.92	-12.68
Zambia*	-19.95	-14.65
Nicaragua*	-21.41	-41.86
Senegal*	-22.74	-16.80
Swaziland	-23.12	-23.84
Bolivia*	-28.76	-32.56
Liberia*	-30.16	-39.73
Sierra Leone*	-34.32	-15.21
Uganda	-45.71	-34.67
Dominican Republic*	-47.77	-20.54
El Salvador	-51.43	-26.63

Sources: International Monetary Fund, Government Finance Statistics Yearbook (for actual change), and regressions given in Table 1 (for predicted change).

Note: Countries marked with an asterisk (*) underwent debt restructuring between 1978 and 1983. See International Capital Markets--Development and Prospects, IMF Occasional Paper No. 31 (1984).

1/ Predictions are based on the regressions reported in Table 1.

If the countries had undergone some adjustment in their tax rates, this should be reflected in an increase in the δ_j and α_j coefficients of equations (20) and (23). Assuming that the linear relationship between the observed variables and their present value remained the same over the two subperiods, the change in δ_j can be inferred by comparing the estimated coefficients of M/G and N/G in the regression. The coefficient of N/G has actually increased (from 0.155 to 0.255); but the coefficient of M/G has dropped (from 0.086 to 0.073). Moreover, for the sample as a whole, N/G has remained approximately constant, whereas M/G has dropped from a sample average of almost 200 percent to a sample average of 188 percent. Thus, on average, developing countries seem to have reduced the tax revenue extracted from imports and increased the tax revenue raised from the mining sector. Taken at face value, the reduction of the estimated coefficient of imports (i.e., the reduction of the sample average tax rate on imports) seems to suggest that the import substitution policies of the countries in the sample, if undertaken, may have been in the form of quantity controls rather than higher tariffs.

The negative estimated coefficient of A/G dropped in absolute value, which can mean that countries with a larger share of agricultural output in GDP underwent more adjustment (or less deterioration in the tax to current expenditures ratio) than the other countries in the sample. Notice, however, that the sample mean of A/G increased from 206 percent to 219 percent.

The intercept dropped by a large amount, from 111.74 to 99.87. Referring to equation (23), this drop can be explained by any one of the following factors: (a) the k coefficient was reduced; this would indicate that, for the sample of countries as a whole, tax rates became less responsive to the total amount of revenues that needed to be raised (recall that $k = \sum_{j=1}^{J} \alpha_j$, with the α_j entering in equation (20)); (b) the expected future growth of public consumption, $\bar{g}$, decreased; (c) the expected future growth of output, $\bar{\gamma}$, increased; and (d) the real interest rate increased, and $\bar{g} > \bar{\gamma}$ (i.e., public consumption is expected to grow faster than real output). The third factor (c) is clearly implausible: if anything, expected output growth of most developing countries should have fallen after 1979. The fourth factor, (d) is also not convincing: even though $\bar{r}$ did increase since 1979, it is by no means clear that $\bar{g} > \bar{\gamma}$. The first two factors are, therefore, the most plausible explanations of what caused the drop in the intercept. Notice that the results of the experiments with the dummy variables, reported in subsection 2 of Section III above, indicate that this phenomenon is equally widespread throughout the sample, irrespective of the geographic location or of the economic structure of individual countries.

Further evidence of a fall in k emerges from a comparison of the remaining estimated coefficients in Table 1: only the estimated coefficient of the grants variable increases in the second subperiod, and all other coefficients decrease, some by large amounts. Thus, unless the rates of growth of all these variables are expected to fall, the results seem to indicate that the tax revenues of the countries in the sample became less responsive to the overall size of the revenues needed to satisfy the international budget constraint. Exactly the same qualitative results emerge from a comparison of the estimated coefficients of the regressions reported in Table 2, with the exception of the coefficient for the output of the agricultural sector.

IV. Conclusions

The theoretical model described in Section II suggests that non-oil developing countries should have reacted to the 1979 shocks by increasing their tax rates, cutting their current public expenditures, and possibly increasing their capital public expenditures. Moreover, according to the model, the adjustment should have been harsher the larger a country's stock of external debt outstanding.

A preliminary look at the data in Section III indicates that the response of the 48 non-oil developing countries included in our sample diverged significantly from that posited by the model. On average, the ratio of their tax revenues to current public expenditures, net of interest payments, dropped significantly in the two or three years subsequent to 1979, and so did the ratio of capital expenditures to current government expenditures. The sample variance, however, was very large. Seventeen countries in the sample were actually able to increase their tax revenue to current public expenditure ratio.

In order to gain a better understanding of what is responsible for the apparently anomalous behavior of these ratios, a cross-section regression of the tax revenue to current public expenditure ratio against a number of explanatory variables was estimated before and after the 1979 shock. If selected developing countries had undertaken some adjustment in their tax policy or in their current public expenditures, the coefficients of this regression would have changed in a manner predicted by Section II.

The regression results indicate that, on average, after 1979: (i) the tax revenue extracted from the mining sector increased; (ii) the tax revenue extracted from imports decreased, presumably due to a drop in the volume of imports; (iii) tax revenues have become less responsive to the overall size of the budget to be financed; and (iv) both before and after 1979, the tax revenue to current public expenditure ratio was inversely related to the size of external debt outstanding at the beginning of the periods considered in the study (1974-79 and 1980-82, respectively); this relationship is significantly more negative for those countries that underwent debt restructuring between 1978 and 1983.

Results (ii)-(iv), particularly (iii) and (iv), contradict the predictions of the theoretical model of Section II and identify some of the causes of the anomalous behavior of the tax revenue to current public expenditure ratio for the sample as a whole. If the hypotheses implicit and explicit in the theoretical model and in the econometric analysis are correct, and if the reported results do not depend crucially on their being based only on the few years subsequent to 1979 for which data were available, the following two conclusions can be drawn:

1. With only a few exceptions, the developing countries in this sample generally adjusted their fiscal policies too little or too late (or not at all) to the 1979 shocks. As a result these countries may have to undertake a much harsher and prolonged adjustment in the foreseeable future than would have been necessary had they reacted more promptly.

2. The lack (or delay) of fiscal adjustment may be responsible for the difficulties experienced by some of the developing countries in servicing their external debt. In this respect, it is worth noting that of the 19 countries included in this sample that underwent debt restructuring between 1978 and 1983, all except five experienced a drop in the actual tax to current expenditures ratio, 1/ and all except three experienced a drop in the predicted tax revenue to current public expenditure ratio after 1979. 2/

These conclusions concern the fiscal policies of the countries in the sample exclusively; adjustment to adverse exogenous shocks can (and should) take other forms as well, such as import substitution and production switching policies. This paper has not discussed whether and how quickly the nonfiscal adjustments were implemented by the countries in the sample. Moreover, the behavior of the private sector has not been discussed. It is possible that the evidence of overconsumption that has emerged from the central government data would not be supported by data for larger measures of the public sector, or for the economy as a whole. 3/

1/ They are Zaire, the Philippines, Argentina, Mexico, and Peru.

2/ They are the Philippines, Mexico, and Peru.

3/ Zaidi (1984) recently reached this conclusion for a sample of 20 non-oil developing countries, on the basis of national data on savings and investment.

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