IMF WORKING PAPER

WP/87/11

INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

External Shocks and the Process of Fiscal Adjustment in a Small Open Developing Economy */

Prepared by Ke-young Chu

Authorized for Distribution by Mario I. Blejer

March 2, 1987

Abstract

Fiscal policy responses to external shocks are analyzed in an institutional setting that typically characterizes a small open developing economy. In such an economy, taxation of external trade is a major source of government revenue, and external shocks have direct impacts on the fiscal sector. The paper discusses the roles of anticipation and policy rules in the fiscal adjustment process. The paper also discusses the implications of two possible policy rules--stabilizing government expenditure and stabilizing the fiscal balance.

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*/ This paper has been prepared to provide the analytical framework for a forthcoming empirical study by the author on external shocks and fiscal adjustment in developing countries. The author is grateful to Messrs. V. Tanzi, M. I. Blejer, T. Morrison, N. Rossi, M. Wattleworth, and Ms. E. Diehl for helpful comments.

Contents

I. Introduction

In recent years, the fiscal balances of developing countries not only have deteriorated in general, but also have fluctuated widely. Central government deficits of developing countries on average increased from 2.4 percent of gross domestic product (GDP) during 1977-80 to 4.5 percent during 1981-84. At the same time, the average deficit fluctuated sharply between 1.3 percent of GDP in 1980 and 5.4 percent in 1983. 1/

A comparison of fiscal balances in recent years with those in the 1960s gives a longer-term picture of growing deficits and their fluctuations. The central government fiscal deficits of 18 developing countries for which relevant long-term statistical data are readily available increased from 2.8 percent of GDP during 1962-71 to 5.9 percent during 1972-82. At the same time, the fluctuations of the deficits, as measured by the standard errors of the regressions of individual countries' deficits on time trend, almost doubled on average from 1.4 during the former period to 2.5 during the latter.

Another notable feature of recent fiscal developments in developing countries is an increase in the cross-country dispersion of fiscal balances and their fluctuations. For the 18 developing countries, the cross-country standard deviation of the average central government deficits in percent of GDP increased from 1.9 during 1962-71 to 4.0 during 1972-82. Fiscal policy responses of these countries to external shocks apparently were diverse, and the success achieved was not uniform.

The problems posed by growing deficits are obvious. A growing deficit not only implies accelerated increases in internal or external government debts, but also, in developing countries, generally indicates growing pressure on the monetary and external sectors of the economy. A widely fluctuating deficit is a cause of concern because it reflects large variations in revenues, expenditures, or both. It could also cause an increasing deficit, as discussed later in this paper. While large changes in the deficit could reflect, at least partly, the government's attempts to stabilize aggregate demand and employment, the external consequences of such a policy should be considered.

What are the key factors underlying these tendencies toward growing and more widely fluctuating deficits and their diversity in developing countries? Domestic policy objectives--particularly fiscal policy objectives--are obviously an important factor underlying fiscal developments. A major feature of the fiscal sector in many developing countries is the dependence of fiscal revenues and, thus, fiscal

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1/ World Economic Outlook, "A Survey by the Staff of the International Monetary Fund," International Monetary Fund (Washington), April 1985, Table 18, p. 224.

balances on external trade. 1/ Therefore, the external environment can also be an important factor in fiscal developments, particularly in highly open developing economies. In addition, diverse institutional settings and constraints give rise to diverse fiscal performances.

The impact of fluctuating external trade on the fiscal developments in developing countries is highlighted by the experiences during the two recent world trade cycles. For 18 developing countries for which relevant long-term statistical data are readily available, total central government revenues on average increased from 18.1 percent of GDP in 1973 to 19.9 percent in 1975. The 1975 world recession and the consequential compression of trade reduced their revenues to 18.6 percent of GDP in 1976. The increase in revenues was accompanied by an even larger increase in expenditure, but the decline in revenue by a much smaller, and slower, decline in expenditure. Thus, for the 18 countries, total expenditures on average increased from 22.9 percent of GDP in 1973 to 25.8 percent in 1975, but declined to 25.6 percent in 1976 and 25.2 percent in 1977, resulting in an increase in overall deficits from 4.8 percent of GDP in 1973 to 7 percent in 1976.

Although data are not available to examine its entire phases, experiences were similar during the most recent trade cycle. For the 18 countries, total revenues on average increased from 18.6 percent of GDP in 1976 to 22 percent in 1981, whereas total expenditures increased from 25.2 percent to 30.3 percent. In 1982, the last year through which consistent data are readily available for all the sample countries, revenues declined to 21.7 percent of GDP, whereas expenditures continued to increase to 31.2 percent.

In this paper, an attempt is made to provide a framework to analyze the interactions between fiscal policy and the external environment in open developing economies. The focus of analysis will be on the short-term fluctuations in fiscal balances and their interaction with the external sector. For a growing economy, the analysis will focus on the fluctuations of the fiscal variables around their long-term trends. It will be shown, however, that long-term fiscal developments may not necessarily be unrelated with short-run fluctuations.

In this paper, fiscal policy is viewed as the government's effort to attain conflicting policy objectives in an optimal manner. The optimization process is illustrated on the basis of a simple model. The aim is narrow--to provide a simple analytical framework for understanding one particular way in which fiscal policy could interact with external developments in a developing economy and to highlight one manner in which policy objectives and institutional arrangements could constrain fiscal adjustment. The paper, therefore, does not deal

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1/ See Tanzi (1982, 1986) for analysis of the sources of external shocks and fiscal responses in developing countries in recent years. External shocks could also result from changes in foreign grants, the availability of financing, and the conditions of financing.

explicitly with many critical issues, such as growth, underemployment of resources, and inflation. It should also be noted that optimality is defined in a very specific manner.

The remaining part of the paper is organized as follows. In Section II, the analytical framework is outlined. In Sections III and IV, how fiscal developments could be viewed as a result of an optimization process is discussed. In Section IV, implications of the model for analyzing fiscal developments and policy are discussed. The final section summarizes the analysis and presents conclusions.

II. Analytical Framework

1. The model

The economy produces two composite goods--a home good and an exportable good--with given resources, and imports another good which is an imperfect substitute for the home good. The allocation of the existing resources between production of the home good and production of the exportable good depends on the real exchange rate, which is defined as the ratio of nominal exchange rate to the price of the home good, with foreign prices assumed to be fixed. The time framework underlying the functional relationship is long enough to allow for reallocation of the existing resources between the two productive sectors. Therefore, supply of the home good is a negative function of the real exchange rate, and supply of the exportable good a positive function. The economy exports the entire exportable good it produces. To reflect the imperfect substitutability between the home good and the imported good, demand for the home good is specified as a positive, and demand for the imported good as a negative, function of the real exchange rate. To simplify exposition, the model is specified as a linear system.

It is assumed that the price of the home good is fully flexible and that the home good market clears. The government relies on taxation of international trade for its revenue and spends on both the home good and the imported good. The external capital account is not introduced in the model. 1/

The external shock is defined initially as a change in export quantity and is specified as an additive term in the supply function of the exportable. With the export price assumed to be constant, such a

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1/ The model is an extended version of the stylized two-good model used by Rodriguez (1978) to analyze the devaluation-inflation spiral. Unlike in Rodriguez's analysis, however, the model is used in this paper to illustrate the use of the fiscal and exchange rate policies for the stabilization of the fiscal and external balances.

shock implies a change in the value of exports. 1/ Implications of a change in the terms of trade will be discussed in Section IV.

On this basis, the home good market is specified as follows:

Supply $HS = a_o - a_1 e$ (2.1)

Demand $HD = b_o + b_1 e + b_2 m + g$ (2.2)

Equilibrium condition $HS = HD$ (2.3)

where:

e = E/PH, real exchange rate (an increase means a real depreciation of the home currency),

E = nominal exchange rate, i.e., the amount of the home currency exchanged for one unit of the foreign currency,

PH = price of the home good, 2/

m = M/PH, real balances,

M = money supply,

g = real government expenditure on the home good, and

a_o, a_1, b_o, b_1, b_2 = coefficients, with a_1, b_1, $b_2 > 0$.

As indicated in equation (2.3), the home good market is assumed to clear. This assumption implies the following relationship between the real exchange rate and real balances:

$$e = (a_o - b_o)/(a_1 + b_1) - (b_2/(a_1 + b_1))m - (1/(a_1 + b_1))g, \text{ or} \quad (2.4)$$

$$m = (a_o - b_o)/b_2 - ((a_1 + b_1)/b_2)e - (1/b_2)g \quad (2.5)$$

Equations (2.4) and (2.5) imply that for the home good market to clear, a higher level of real government expenditure on the home good requires either a real appreciation of the domestic currency (to increase supply

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1/ A terms of trade shock resulting from a change in the export price can be represented by an additive term in the export supply equation in the model discussed in this paper, although such a shock would also result in a change in the relative price of the home good vis-à-vis the exportable goods (see Section IV). A shock represented by an additive term is a useful first step to an analysis of terms of trade shocks.

2/ With the entire exportable good assumed to be exported and the price of the imported good assumed to be fixed, the price of the home good is the domestic price level.

of the home good), or a decrease in real balances (to reduce private demand for the home good), or both.

The trade balance of the economy is defined by the following equations:

Trade balance	$TB = TS - TD - z$	(2.6)
Supply of the exportable good	$TS = c_o + c_1 e + s$	(2.7)
Private demand for the imported good	$TD = d_o - d_1 e + d_2 m$	(2.8)

where:

z = real government expenditure on the imported good,

s = external shock,

c_0, c_1, d_0, d_1, d_2 = coefficients, with c_1, d_1, and $d_2 > 0$.

In the absence of capital transactions, the change in external reserves, ($\dot{r}$), or the external balance, is defined by:

$$\dot{r} = TB. \qquad (2.9)$$

The fiscal sector of a small open economy relying heavily on the taxation of international transactions and related incomes and economic activities may be described by the following equations: 1/

Deficit	$d = G - T,$	(2.10)
Revenue	$T = t(TS + TD),$	(2.11)
Expenditure	$G = g + z,$	(2.12)

where t = tax rate, assumed to be equal for both exports and imports. The change in government debt ($\dot{n}$) may be defined as:

$$\dot{n} = d \qquad (2.13)$$

1/ The fiscal deficit is measured in the foreign currency in which the trade balance is measured. If the fiscal deficit is measured in the domestic currency, TS, TD, and gg would have to be multiplied by e in equations (2.4) and (2.12). Thus, a real devaluation of the domestic currency would affect the fiscal deficit not only through the price effect, but also through the valuation effect. By measuring the fiscal balance in the foreign currency, this latter valuation effect of devaluation on the fiscal deficit is disregarded in this analysis.

2. Fiscal policy as a result of optimization

The formulation and execution of fiscal policy may be viewed as an optimization problem in a broad sense. Before the optimization process is illustrated in the next section on the basis of the model introduced in the preceding subsection, it would be useful to discuss how the formulation and execution of fiscal policy could be viewed as an optimization process in a real-world setting. The government has a number of policy objectives, policy instruments, and constraints in implementing policies.

Policy objectives could be conflicting. For example, a reduction in government expenditure on imported goods (government imports) will mitigate the adverse impact of a negative external shock on both the fiscal and external balances, but the mitigation of these adverse impacts conflicts with another obvious policy objective--maintenance of such expenditure at a target level. This latter objective would be particularly crucial if such expenditure were vital for preserving the living standards of the poor or promoting economic growth (which would entail the importation of essential items such as food, fuel, or investment goods). In another example, government policy to finance the fiscal or external deficit by borrowing--rather than to adjust--may conflict with another obvious objective to contain its debt at a sustainable level.

The government has a limited number of policy instruments and various constraints. In the fiscal sector, the government controls tax rates and expenditures on goods and services. In the external sector, the government controls the official exchange rate and has means to control some components of imports. These policy instruments, however, are not equally effective for all circumstances. Tax rates may be policy instruments, but tax revenue is not; this is true particularly for economies relying heavily on the taxation of international trade. Tax laws are relatively easy to change, but the implementation of new tax laws may be much more different. 1/ Many developing countries therefore find it easier to adjust expenditure rather than revenue. Some expenditures are also more difficult to change than others; it would be more costly to change planned expenditure on the completion of a partly constructed highway than planned expenditure on transportation equipment, whereas attempts to reduce some expenditures could meet stronger political resistance than efforts to lower others.

Among the external policy instruments, exchange rate changes may take longer to influence exports than imports. In many developing countries, the exchange rate may not be an effective instrument to control even imports in the short run because the domestic economy does not produce any substitutes. 2/ Import restrictions, although they could be prompt in alleviating the effect of a negative external shock on the external balance, have far-reaching allocative and distributional consequences.

1/ See Tanzi (1986), p. 90.
2/ See Crockett (1981).

The constraints include not only technical, behavioral, and institutional relationships, but also, very importantly, the government's limited ability to predict, and even to recognize, external shocks. Furthermore, it takes time for the government, once it has recognized the shock, to formulate and execute policies because this last process is not only a technical and administrative process, but also a political process in which a difficult social consensus has to be formed. A considerable amount of time, therefore, has to be allocated between the time at which the shock occurs and the time at which the intended effects of policies materialize. This lag requires that policies should be formulated and executed on the basis of an imperfect recognition of shocks, and the limited ability of the government to predict the shocks becomes a critical constraint. 1/

In the following analysis, fiscal responses to external shocks suggested by the optimization process are described for alternative mixes of policy objectives and instruments. At first, external shocks are assumed to result from changes in export quantity and to be fully anticipated; the implications of unanticipated shocks and changes in the terms of trade will be analyzed later.

III. External Shocks and Fiscal Policy

1. Anticipated shocks

a. Optimization

Fiscal policy is formulated in the model by minimizing a quadratic loss function that has two sets of terms: (1) the deviations of government debt and external reserves from their respective targets, and (2) changes in real government expenditure on certain goods and the real exchange rate. The costs associated with changing real government expenditure and the real exchange rate are important obstacles to fast adjustment. Such costs have been assumed in many theoretical and empirical analyses. 2/ Initially, real government expenditure on the

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1/ See Smith and Teigen (1965), pp. 29-32, for a discussion of lags associated with macroeconomic policies in general.

2/ The cost arising from adjusting real government expenditure could result from changing interrelated expenditure plans for successive plan periods. The cost arising from adjusting the real exchange rate results from the fact that it is an importanc price. The specification of the loss function reflects the fact that the analysis focuses on the interactions between the fiscal and the external sectors. The loss function could be expanded to cover a wider range of macroeconomic policy objectives such as the stability of aggregate demand, prices, and employment (see Chow (1975)). The methodology has also been used to analyze the various aspects of the adjustment process in developed and developing countries (see Artus (1974), Heller (1974), Hemphill (1974), and Chu, Hwa, and Krishnamurty (1982)).

home good is a policy instrument, while real government expenditure on the imported good (real government imports) is always maintained at the target level. The implications of using real government imports as an instrument will be examined later.

The decomposition of government expenditure into a part that is a target and the remaining part that is an instrument is admittedly a simple approach. However, any government has at any time some expenditure that is not subject to adjustment, such as some components of military spending and entitlement programs. 1/ In general, fiscal rigidity will be an increasing function of the proportion of the expenditure (and revenue) that is not subject to adjustment in response to changes in circumstances.

With government expenditure on the home good and the real exchange rate as instruments, the problem may be formulated as follows:

$$\text{Min } L = \alpha_1(n - \bar{n})^2 + \alpha_2\dot{g}^2 + \beta_1(r - \bar{r})^2 + \beta_2\dot{e}^2 \qquad (3.1)$$

$$\text{Subject to: } n - \bar{n} = -v_o + v_1 g + \bar{z} - v_2 e - v_3 s \qquad (3.2)$$

$$r - \bar{r} = h_o + h_1 g - \bar{z} + h_2 e + s \qquad (3.3)$$

with respect to g and e, where L = social cost to be minimized; barred and dotted variables = respectively, targets and time derivatives; s = anticipated external shock; and

v_o, v_1, v_2, v_3, h_o, h_1, h_2 = technical and behavioral parameters,

α_1, α_2, β_1, β_2 = policy parameters: relative importance attached by the government to the respective arguments in the loss function; ≥ 0.

The specification of the loss function reflects the simplicity of the economy being considered. For example, since the external account of the economy consists of only the trade account, the economy's external reserves change only as a result of the trade imbalance. It should also be noted that the loss is specified to be symmetric with changes in g and e. One might argue that the relationship should be asymmetric, and this issue has important implications for the relationhip between the fluctuation of the fiscal balance and the long-run increase in the fiscal deficit, which will be discussed later in the paper.

Equation (3.2) is derived from a fiscal balance identity and a number of technical, behavioral, and institutional relationships. Equation (3.3) is derived from an external balance identity and a number

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1/ A similar distinction could also be made for the revenue side; tax reductions might be more difficult in an election year than in other years.

of technical and behavioral relationships. Equation (3.4) defines the government's fiscal balance as a function of real government expenditures (g, z), the real exchange rate (e), and external shock (s), on the assumption that the home good market is cleared. On the assumption of an initial equilibrium, 1/ it is derived by substituting equation (2.5) for m in equation (2.8), and equations (2.7) and (2.8) for TS and TD in equations (2.10)-(2.12):

$$\begin{aligned} \dot{n} = n - \bar{n} &= -v_o + v_1 g + \bar{z} - v_2 e - v_3 s \\ v_o &= t(c_o + d_o + d_2(a_o - b_o)/b_2) \\ v_1 &= 1 + t(d_2/b_2) \\ v_2 &= t(c_1 - d_1 - d_2(a_1 + b_1)/b_2) \\ v_3 &= t. \end{aligned} \qquad (3.4)$$

Equation (3.5) defines the external balance as a function of real government expenditures, the real exchange rate, and external shock on the assumption that the home good market is cleared. On the assumption of an initial equilibrium, it is derived by substituting equation (2.5) for m in equation (2.8), and equations (2.7) and (2.8) for TS and TD in equations (2.6) and (2.9):

$$\begin{aligned} \dot{r} = r - \bar{r} &= h_o + h_1 g - \bar{z} + h_2 e + s \\ h_o &= c_o - d_o - d_2(a_o - b_o)/b_2 \\ h_1 &= d_2/b_2 \\ h_2 &= c_1 + d_1 + d_2(a_1 + b_1)/b_2 \end{aligned} \qquad (3.5)$$

The coefficients v_1, v_2, and v_3 measure the effects of g, e, and s on $\dot{n}$; the coefficients h_1, h_2, and $h_3(=1)$, their effects on $\dot{r}$. The coefficients v_1 and h_1 indicate the effects of a change in real government spending on the home good on the fiscal balance and the external balance, respectively.

The coefficient v_2 is the net effect of a change in the real exchange rate ($\dot{e}$) on the government deficit ($\dot{n}$), resulting from a positive effect on revenue from the taxation of exports partly offset by a negative effect on revenue from the taxation of imports induced by the change in the exchange rate. The coefficient h_2 is the sum of the mutually augmenting effects of a change in the real exchange rate ($\dot{e}$) on the external balance ($\dot{r}$) resulting from changes in exports and imports. Normally, v_2 should be smaller than h_2 and its sign and the

1/ Or an initial imbalance ($n_{-1}-\bar{n}$) may be considered to be a part of the constant term (v_o).

magnitude should be a function of technology, taste, and time. As indicated earlier, the model is based on a time framework long enough for the reallocation of resources between productive sectors, and the coefficient v_2 is assumed to be relatively small, but positive. The coefficients v_1, v_2, and v_3, reflecting the impacts on the fiscal balance, are (increasing) functions of the tax rate, whereas the coefficients h_1, h_2, and h_3, reflecting the impacts on external balance, are independent of the tax rate.

b. Factors affecting optimal policy

The minimization of the objective function (equation (3.1)) with respect to the two policy instruments (g and e), subject to equations (3.2) and (3.3), yield the following first-order conditions which define the optimal paths of the policy instruments as functions of the technnical, behavioral, institutional, and policy parameters (v_1, v_2, h_1, h_2, α_1, α_2, β_1, β_2) and the fiscal and the external imbalances ($b - \bar{b}$, $r - \bar{r}$) assessed at the optimal values of the policy instruments and the anticipated external shock at any given time:

$$\begin{bmatrix} \dot{g} \\ \dot{e} \end{bmatrix} = \begin{bmatrix} -(\alpha_1/\alpha_2)v_1 & -(\beta_1/\alpha_2)h_1 \\ (\alpha_1/\beta_2)v_2 & -(\beta_1/\beta_2)h_2 \end{bmatrix} \begin{bmatrix} n - \bar{n} \\ r - \bar{r} \end{bmatrix} \qquad (3.6)$$

$$(3.7)$$

The adjustment process described by the system of equations (3.6) and (3.7) has a number of features:

First, the role of the policy parameters in the determination of the adjustment process is noted. A large α_1 (weight for $n - \bar{n}$ in the loss function) relative to β_1 (weight for $r - \bar{r}$) implies that relatively fast policy responses to a fiscal imbalance are optimal, whereas a large β_1 relative to α_1 implies that relatively fast policy responses to an external imbalance are optimal. A large α_2 implies fiscal rigidity, whereas a large β_2 implies exchange rate rigidity. No cost associated with $\dot{g}$ or $\dot{e}$ ($\alpha_2 = \beta_2 = 0$) implies instantaneous adjustment to the fiscal or external equilibria.

Second, a higher tax rate, other things being equal, makes relatively faster policy responses to the fiscal imbalances optimal; a lower tax rate makes relatively faster responses to external imbalances optimal. This feature of responses is seen from the fact that both v_1 and v_2 are increasing functions of the tax rate t. A higher tax rate would imply that larger changes in g and e for a given $(n - \bar{n})$ would be optimal. This result reflects the fact that a higher tax rate enhances the effectiveness of the policy instruments for the reduction

of the fiscal imbalance relative to their effectiveness for the reduction in the external imbalance in reducing social cost.

Third, the signs of the diagonal elements of the matrix in the system of equations (3.6) and (3.7) are obviously negative. The upper right off-diagonal element is negative by assumption. This negative relationship between the optimal change in real government expenditure on the home good ($\dot{g}$) and the external balance ($r - \bar{r}$) reflects the fact that, given the target government import, the reduction in the external deficit requires a decrease in real balances to reduce private demand for the imported good, and this reduction is achieved by an increase in real government expenditure on the home good, which will reduce real balances by raising the price of the home good. 1/ The positive relationship between the optimal devaluation ($\dot{e}$) of the home currency and the fiscal imbalance ($b - \bar{b}$), indicated by the lower left off-diagonal element of the matrix, reflects the fact that the reduction in the fiscal deficit requires an increase in exports, which is assumed to be a dominant tax base, and therefore a real devaluation.

Finally, the dependence of the optimal adjustment path on the anticipated shock should be noted. In equations (3.6) and (3.7), both the fiscal and external imbalances ($n - \bar{n}$, $r - \bar{r}$) are functions of the anticipated shock. 2/

c. Comparative statics

The first-order conditions described in equations (3.6) and (3.7) yield the steady-state solutions of the model. Because the matrix in the system of the two equations is nonsingular, the steady-state solutions are obtained uniquely when $\dot{g} = \dot{e} = 0$, which imply $n - \bar{n} = r - \bar{r} = 0$. In the steady state, the problem becomes a two-target, two-instrument problem; therefore, the targets (fiscal and external equilibria) are fully achieved. The equilibrium values of real government expenditure on the home good (g) and real exchange rate (e) are determined jointly by the two equations:

1/ This process could be described as a crowding-out process. In practice, the same goal could be achieved by a contractionary monetary policy.

2/ With government imports (z) and the real exchange rate (e) as instruments, using the notation introduced in equations (3.1)-(3.3), the minimization problem becomes:

$$\text{Min } L = \alpha_1(n - \bar{n})^2 + \alpha_2\dot{z} + \beta_1(r - \bar{r})^2 + \beta_2\dot{e}, \text{ subject to} \qquad \text{(i)}$$

$$\dot{n} = n - \bar{n} = -v_o + v_1\bar{g} + z - v_2e - v_3s \text{ and} \qquad \text{(ii)}$$

$$\dot{r} = r - \bar{r} = h_o + h_1\bar{g} - z + h_2e + s \qquad \text{(iii)}$$

where, again, bars denote targets.

$$n - \bar{n} = 0, \text{ and} \tag{3.8}$$

$$r - \bar{r} = 0, \tag{3.9}$$

the former defining the fiscal equilibrium and the latter the external equilibrium (Chart 1). The equation may be written more explicitly as:

$$e = (v_1/v_2)g + (1/v_2)\bar{z} - (v_3/v_2)s - v_o/v_2 \tag{3.10}$$

$$e = -(h_1/h_2)g + (1/h_2)\bar{z} - (1/h_2)s - h_o/h_2 \tag{3.11}$$

Equation (3.10) is the locus of g-e coordinates that balance the budget; equation (3.11) is the locus of g-e coordinates that balance the external account. The former, called the budget line, is positively sloped; the latter, called the BOP line, negatively sloped.

An expansionary fiscal policy instituted in the form of an increase in target real government imports ($\Delta\bar{z} > 0$) will cause shifts of both the budget line and the BOP line upward. This implies a real depreciation ($\Delta e > 0$) of the home currency; real government expenditure on the home good would have to decrease under normal circumstances ($\Delta g < 0$).

The following algebraic solutions, expressed in discrete forms, show these results more explicitly:

$$\Delta e = ((h_1 + v_1)/(h_1v_2 + h_2v_1))\Delta\bar{z} \tag{3.12}$$

$$\Delta g = -((h_2 - v_2)/(h_1v_2 + h_2v_1))\Delta\bar{z} \tag{3.13}$$

As discussed in Section II, h_2, the impact of a real depreciation of the home currency on the external balance should be larger than v_2, the impact of a real depreciation on the fiscal balance. Therefore, real government expenditure on the home good should be reduced when government imports increase.

The impacts of an external shock can also be analyzed similarly. A negative external shock ($\Delta s < 0$) would cause shifts of both the budget

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2/ (Cont'd from p. 11)

The first-order conditions are:

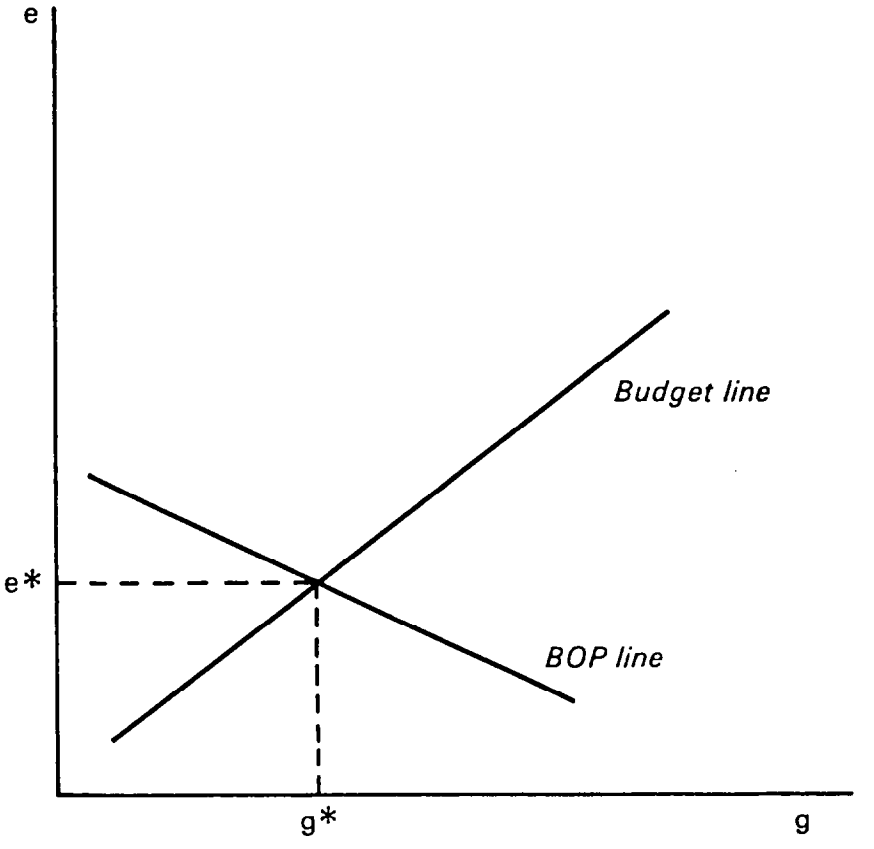
$$\begin{bmatrix} \dot{z} \\ \dot{e} \end{bmatrix} = \begin{bmatrix} -(\alpha_1/\alpha_2) & (\beta_1/\alpha_2) \\ (\alpha_1/\beta_2)v_2 & -(\beta_1/\beta_2)h_2 \end{bmatrix} \begin{bmatrix} n - \bar{n} \\ r - \bar{r} \end{bmatrix} \tag{iv}$$

(v)

The first-order conditions in equations (iv) and (v) suggest that the relationship between the optimal change ($\dot{z}$) in government imports and the external balance ($r - \bar{r}$) should be positive. This result reflects the fact that a reduction in government imports improves the external balance.

CHART 1

STEADY-STATE SOLUTION



line and the BOP line. The real exchange rate should depreciate ($\Delta e > 0$), and real government expenditure on the home good should be reduced under normal circumstances ($\Delta g < 0$). These results can be shown more explicitly as follows:

$$\Delta e = -((h_1 v_3 + v_1)/(h_1 v_2 + h_2 v_1))\Delta s \qquad (3.14)$$

$$\Delta g = ((v_3 h_2 - v_2)/(h_1 v_2 + h_2 v_1))\Delta s \qquad (3.15)$$

In equation (3.15), $v_3 = t$, $h_2 = c_1 + d_1 + d_2 (a_1 + b_1)/b_2$, and $v_2 = t(c_1 - d_1 - d_2 (a_1 + b_1)/b_2)$. Therefore, $v_3 h_2 - v_2$ may be written as $t((c_1 + d_1 + d_2(a_1 + b_1)/b_2) - (c_1 - d_1 - d_2(a_1 + b_1)/b_2))$, which should be positive under normal circumstances.

d. Dynamics

The first-order conditions also suggest the dynamic properties of the adjustment paths. Consider two situations: (i) a negative external shock creates deficits in both fiscal and external balances. In Chart 2, this situation may be represented by an e-g coordinate in the area bounded by the two inequalities: $n - \bar{n} > 0$, $r - \bar{r} < 0$. The first-order conditions, equations (3.6) and (3.7), suggest that the real exchange rate should depreciate ($\dot{e} > 0$); the adjustment of g should be, however, positive if $a = -(\alpha_1/\alpha_2)v_1(n - \bar{n}) - (\beta_1/\alpha_2)h_1(r - \bar{r}) > 0$, but negative if $a < 0$. The condition $a > 0$ is satisfied in the area constrained by the BB line as the upper bound. That is, a negative external shock should be responded to by increasing real government expenditure on the home good if either the initial external imbalance is larger than the fiscal imbalance, or the government attaches greater importance to the external equilibrium than the fiscal equilibrium, or both. In this case, an increase in real government expenditure on the home good will reduce the demand for the imported good by reducing real balances, thus improving the external balance. In the area constrained by the BB line as a lower bound, real government expenditure on the home good should be decreased. In this case, the contractionary fiscal policy stance would be optimal because the size of the fiscal imbalance is relatively large, or the government attaches greater importance to the fiscal equilibrium than to the external equilibrium, or both. (ii) A positive shock would trigger an adjustment path in an opposite direction. The system is seen to be stable, with the possibility of overshooting in the movement of real government expenditure on the home good.

2. Unanticipated shocks

The government must revise policies for a number of reasons: errors in the anticipation of shocks, errors in the estimation of the impact of policies, or changes in targets. In this paper, the focus is

on errors in the anticipation of shocks. As indicated earlier, a major constraint the government faces in responding to such errors is the limited time it has for dealing with them. As time becomes more scarce, the number of available policy instruments could be drastically reduced, and their effect diminished. For example, having formulated the budget for a two-year plan period on the basis of anticipated external shocks, the government may find itself experiencing a sharp decline in exports, economic activity deriving from the exports, and a consequential reduction in the tax base, with only less than a year left for the plan period. How should fiscal policy respond to such an unanticipated negative shock? In such circumstances, the short-run effectiveness might be the most important criterion on the basis of which policy instruments are selected.

Suppose the government uses its expenditure (g) on the home good and the real exchange rate (e) as instruments to minimize the loss function defined by equation (3.1) on the basis of an anticipated external shock. This step will be called the first-step optimization. Suppose, upon facing a major deviation of the actual shock from the anticipated shock, the government decides to use its expenditure (g) on the home good and, notwithstanding the allocative inefficiency, restrictions of private import (TD) as instruments to achieve the original fiscal and external targets, while maintaining the real exchange rate (e) at the originally planned level. This step could be called the second-step optimization. Formally, the following minimization problem may be formulated:

$$\text{Min LL} = \gamma_1 dn^2 + \gamma_2 dg^2 + \delta_1 dTD^2 + \delta_2 dr^2 \tag{3.16}$$

$$\text{Subject to} \quad dn = v_1 dg - v_3 ds, \text{ and} \tag{3.17}$$

$$dr = ds - dTD \tag{3.18}$$

where:

$dn = n - n^*$, $dg = g - g^*$, $dTD = TD - TD^*$, $dr = r - r^*$, $ds = s - s^*$,

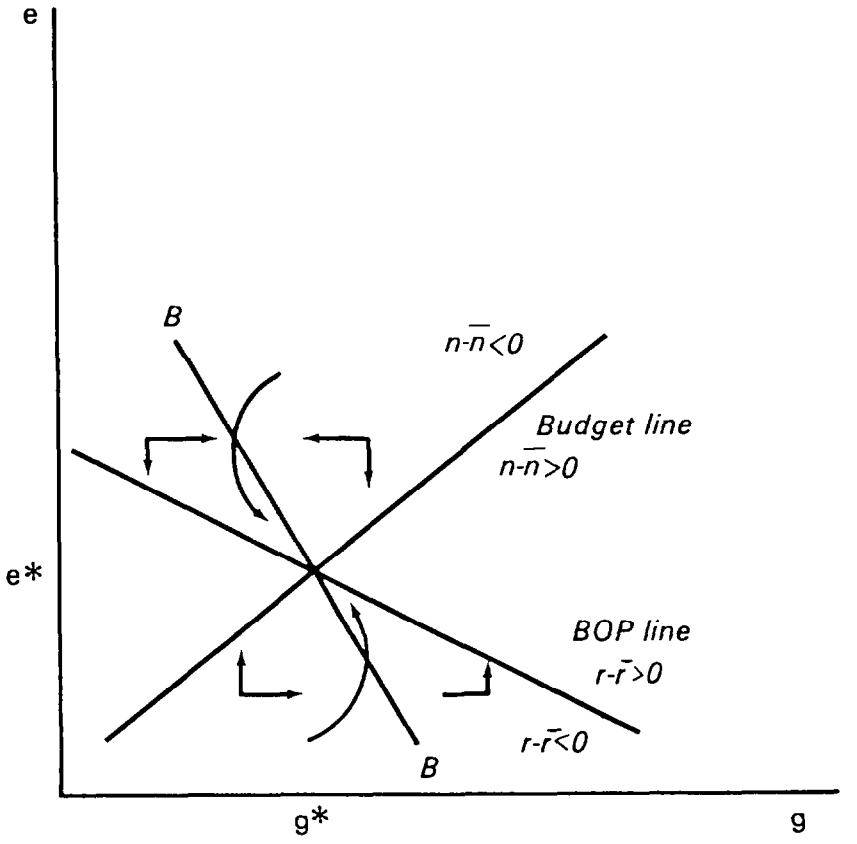
n^*, g^*, TD^*, r^* = optimal values of n, g, TD, r derived from the first-step optimization, and s^* = anticipated shock;

γ_1, γ_2, δ_1, δ_2 = policy parameters; ≥ 0.

The policy parameters reflect the weights attached by the government to the terms in the right-hand side of the objective function. In addition, the parameters γ_2 and δ_1 also reflect the technical feasibility of changing the two instruments g and TD; i.e., γ_2 and δ_1 will be relatively large not only if the government attaches great importance to maintaining the levels of g and TD at the originally planned levels, but also if it is technically difficult to deviate from the originally

CHART 2

DYNAMIC PROPERTIES OF THE MODEL



planned levels because of the limited time the government has for revising the original plans.

The first-order conditions, which may be written as:

$$dg = (\gamma_1 v_1 v_3)/(\gamma_1 v_1^2 + \gamma_2)ds, \tag{3.19}$$

$$dTD = \delta_2/(\delta_1 + \delta_2)ds, \tag{3.20}$$

imply the following relationships between the government debt, external reserves, and the shock:

$$dn = -(\gamma_2 v_3)/(\gamma_1 v_1^2 + \gamma_2)ds \tag{3.19}'$$

$$dr = \delta_1/(\delta_1 + \delta_2)ds \tag{3.20}'$$

Several features of the solutions described in equations (3.19)-(3.20)' should be noted. With the real exchange rate ruled out as a policy instrument, fiscal and external policies become separate exercises in this second-step minimization problem, involving no reallocation of resources. The government has to determine to what extent the fiscal imbalance caused by the unanticipated shock should be financed and to what extent it should be absorbed by adjustment. The size of γ_1 relative to γ_2 determines the desired (and feasible) extent of adjustment; a large γ_2 relative to γ_1 implies large adjustment relative to financing. Similarly, the government has to decide the desired (and feasible) extent of financing the external deficit; a large δ_2 relative to δ_2 implies large adjustment relative to financing.

IV. Terms of Trade Shocks and Fiscal Policy

The analysis has dealt with the implications of quantity shocks. How would the conclusions be affected for terms of trade shocks? Suppose the world price of the exportable good declines. How would the steady-state equilibrium and the dynamic adjustment path be affected? To analyze these implications, the export price should be explicitly introduced in the model. In this case, equations (2.1) and (2.7) will have the following forms:

$$HS = a_o - P_x a_1 e \tag{2.1}'$$

$$TS = c_o + P_x c_1 e \tag{2.7}'$$

The value of exports will be defined by:

$$P_x TS = P_x c_o + P_x^2 c_1 e$$

and some of the coefficients will be changed as follows:

$$v_o = t(P_x c_o + d_o + d_2(a_o - b_o)/b_2)$$

$$v_2 = t(P_x^2 c_1 - d_1 - d_2(a_1 P_x + b_1)/b_2))$$

$$v_3 = P_x t$$

$$h_o = P_x c_o - d_o - d_2(a_o - b_o)/b_2$$

$$h_2 = P_x^2 c_1 + d_1 + d_2(a_1 P_x + b_1)/b_2$$

For a small economy, the optimization is based on the export price as given. The first-order conditions of the first-step optimization will have the following forms:

$$\begin{bmatrix} \dot{g} \\ \dot{e} \end{bmatrix} = \begin{bmatrix} -(\alpha_1/\alpha_2)v_1 & -(\beta_1/\alpha_2)h_1 \\ (\alpha_1/\beta_2)v_2(P_x) & -(\beta_1/\beta_2)h_2(P_x) \end{bmatrix} \begin{bmatrix} (n - \bar{n}) \\ (r - \bar{r}) \end{bmatrix} \qquad (3.6)' \quad (3.7)'$$

The expressions $v_2(P_x)$ and $h_2(P_x)$ remind the reader that v_2 and h_2 are now functions of P_x. The fiscal response remains the same as for the quantity shock, but the adjustment of the exchange rate is affected. On the assumption that v_2 is an increasing function of P_x 1/ (h_2 is an increasing function of P_x), the optimal size of the adjustment of the exchange rate for given fiscal and external imbalances decreases as the export price decreases. At the same time, a decrease in export price will increase the fiscal and the external imbalances. Therefore, the size of the fiscal adjustment (g) would increase. The size of the exchange rate adjustment (e) will depend on two offsetting effects of the fall in the export price: one on the coefficients v_2 and h_2 and the other on the sizes of the imbalances.

How would the steady-state equilibrium be affected? The budget line and the BOP line may be written as:

$$e = (1/v_2(P_x))(v_1 g + \bar{z} - v_o(P_x)) \qquad (3.10)'$$

$$e = -(h_1/h_2(P_x))(h_1 g + \bar{z} - h_o(P_x)) \qquad (3.11)'$$

A deterioration in the terms of trade resulting from a fall in the export price would cause upward shifts in the budget line and the BOP line; at the same time, both lines will become steeper, suggesting that the required real depreciation should be an increasing function of the extent to which the export price falls.

1/ This assumption implies that $2P_x c_1 - d_2(a_1/b_2)$ is positive. This condition will be satisfied if export supply is price elastic.

V. Implications of the Model for Analysis of Fiscal Developments and Policy

The analysis in the preceding sections suggests how target government imports and the anticipated and unanticipated components of the external shock affect government expenditure and fiscal balance through the optimization process. To elaborate on this point, the change in government expenditure may be decomposed into the planned component and the deviation from the plan:

Actual change:

$$(g + z) - (g_{-1} + z_{-1})$$

$$= (g^* - g_{-1}) + (\bar{z} - \bar{z}_{-1}) + (g - g^*) \qquad (5.1)$$

(planned) (deviation from plan)

Planned change:

$$(g^* + \bar{z}) - (g_{-1} + \bar{z}_{-1})$$

$$= -(\alpha_1/\alpha_2)v_1(b^* - \bar{b}) - (\beta_1/\alpha_2)h_1(r^* - \bar{r}) + (\bar{z} - \bar{z}_{-1}) \qquad (5.2)$$

(change in g) (change in z)

where * = short-run optimal values of policy instruments resulting from the first-step optimization based on the anticipated shock (s*), and

$$n^* - \bar{n} = - v_o + v_1 g^* + \bar{z} - v_2 e^* - v_3 s^* \qquad (5.3)$$

$$r^* - \bar{r} = - h_o + h_1 g^* - \bar{z} + h_2 e^* + s^* \qquad (5.4)$$

Deviation from plan:

$$(g - g^*) = (\gamma_1 v_1 v_3)/(\gamma_1 v_1^2 + \gamma_2)(s - s^*) \qquad (5.5)$$

Equations (5.1)-(5.5) indicate that the change $((g + z) - (g_{-1} - gg_{-1}))$ in real government expenditure is a function of g^*, e^*, $\bar{z}$, $\bar{z}_{-1}$, s^*, and $s - s^*$. Similarly, the change $(e - e_{-1})$ in the real exchange rate may be expressed as a function of g^*, e^*, z, s^*, and $s - s^*$. These structural form equations suggest the reduced form equation for real government expenditure as a function of g_{-1}, $\bar{z}$, $\bar{z}_{-1}$, s^*, and $s - s^*$, implying the importance of the target government imports and both the anticipated and unanticipated components of the external shock. In addition, the reduced form equation suggests how policy and other parameters determine fiscal responses to these policy and exogenous variables.

1. Implications for analysis of fiscal developments

The analytical framework suggests a number of factors critical for the long-run developments as well as for the short-run fluctuations of the fiscal balance.

First, the long-run deterioration in the fiscal balance is not necessarily an inevitable consequence of a long-run expansion in target expenditure, unless the expansion exceeds a reasonable bound. An increase in the target government imports ($\bar{z}$) would have to induce adjustments in the real exchange rate (e) and expenditure on the home good (g), and the dynamics will keep the adjustment process in motion until sufficient adjustment has been achieved to attain the fiscal equilibrium. This final equilibrium does not necessarily imply, however, that continuous increases in the target expenditure cannot cause persistent negative fiscal imbalances over the years as a result of the short-run rigidity of policy instruments. Weak fiscal discipline will prolong fiscal adjustment.

Second, the fluctuation of target expenditure would generate the fluctuation of the fiscal balance. The fluctuation of government imports would destabilize the fiscal balance unless the policy instruments are totally flexible.

Third, wrong anticipation could be a critical source of fiscal instability. Suppose the government anticipates a positive external shock and plans an expansion in its expenditure on the home good. When the government, in contrast to the original anticipation, recognizes a negative shock, the negative adjustment in the expenditure resulting from the second-step optimization may not necessarily be sufficient because of various constraints discussed earlier. By the time the adjustment is fully made, the external shock may turn positive again, thus aggravating the fiscal instability. Another possibility is the dependence of target government imports on the anticipated external shock. Such dependence will intensify the expansionary fiscal stance during the rising phase of the anticipated external shock.

Fourth, changes in the policy parameter could be a source of fiscal instability. A greater weight assigned by the government to the stability of expenditure would tend to aggravate the fluctuation of the fiscal balance. The fluctuations of the policy parameter themselves could also be a source of greater fiscal instability.

What does this relationship between the fluctuation of shocks and the fluctuation of the fiscal balance imply for the long-run developments in the fiscal balance? It is conceivable that, contrary to the relationship suggested in equation (3.1), the adjustments are asymmetric. It could be politically easy for the government to expand expenditure in response to a positive shock than to reduce it in response to a negative shock. Such an asymmetry would result if the policy parameter (α_2) for the change in government expenditure ($\dot{g}$) in

the loss function (equation (3.1)) assumes a larger value for a decrease ($\dot{g} < 0$) than for an increase ($\dot{g} > 0$). A similar asymmetry would also result if the policy parameter (γ_2) assumes a larger value for a negative deviation of the actual from the planned g ($g - g^* < 0$) than for a positive deviation ($g - g^* > 0$). In such a case, the policy rule discussed in this section will not only result in unstable fiscal balances but also in a tendency for the imbalance to persist. 1/

The analysis suggests that what appears to be the lack of government ability to make fast fiscal adjustment could reflect past wrong forecasts complemented by the economy's technical and institutional characteristics. For example, in equations (3.6) and (3.7), a behavioral and institutional parameter (v_2) affects the speed with which government expenditure would be adjusted for a given set of policy parameters.

Given the technical, behavioral, and institutional setting of the economy, a particular set of policy parameters could yield an adjustment path which would be optimal for the government, but not necessarily for some other participants in developments of the economy, e.g., foreign creditors. The adjustment path which is considered to be optimal for the government could imply a financing need exceeding a level that creditors would be willing to satisfy. This financing constraint implies a need to revise the original adjustment path. The model described in this paper suggests various ways in which the adjustment path could be revised with different implications for the economy during the adjustment process. It also provides a framework to analyze the diverse nature of the adjustment processes taken by different countries.

2. Policy implications

A number of policy issues are raised by the preceding analysis. An important policy is to improve tax administration and to diversify sources of revenue. With a given degree of revenue instability, an important issue is the choice between policy to stabilize expenditure and policy to stabilize fiscal balance. It is obvious that normally these two objectives are not achievable simultaneously in the institutional setting where revenues fluctuate widely as a result of the fluctuation of external circumstances. It is obvious that these two goals have different implications. Nor is it easy to discuss this issue on an aggregate basis. However, one could analyze the implications of these two policy rules.

One extreme strategy for a developing country facing unstable government revenues would be to maintain the maximum flexibility in expenditures to ensure the fiscal equilibrium at any time. In the context of the objective function introduced in Section III, this

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1/ See Heller (1974) for a formulation of the objective function that accounts for the asymmetry. Hemphill (1974) discussed asymmetry in a similar problem.

strategy implies expanding the coverage of the instrument component of expenditure and assigning a small policy parameter associated with the change in expenditure not only by maintaining strong fiscal discipline, but also choosing projects in such a manner that necessary adjustments, whether they are upward or downward, are feasible. Note that this strategy does not necessarily imply that growth of the economy has to be sacrificed because the fiscal adjustment being considered is the adjustment around the long-run trend, which would be an upward trend if the economy is growing.

Another extreme strategy would be to maintain the stability of expenditure around its long-term trend consistent with the objective of maintaining the long-run fiscal equilibrium. In this approach, implying a large coefficient of the change in government expenditure and the setting of the expenditure at the long-run path of revenue, would ensure the stability of expenditure and the long-run fiscal equilibrium, but could generate the fluctuation of the fiscal balance in the short run as revenue fluctuates. 1/

Both of these approaches would be committed to the long-run maintenance of the fiscal equilibrium; the former, however, emphasizes the short-run stabilization of the fiscal balance, whereas the latter emphasizes the short-run stabilization of expenditure. It is obvious that any of these two approaches are not practical in their pure forms. In the first approach, a strong commitment to the policy rule over the entire phases of the revenue cycles is very important. The selection of public projects during the rising phase of the fiscal cycles should be made with the specific objective of ensuring downward adjustments of the scales of such projects. In the second approach, finding the right path of the growth in expenditure would be critical for its success. How would the government resist the political pressure to expand at the time of a booming revenue? How would the government and the public in general form a consensus on the right path of expenditure? Under this policy rule, the importance of the right path of expenditure cannot be overemphasized because it is the critical factor in preventing the medium-term fiscal disequilibrium.

VI. Summary and Conclusions

A small stylized model was used to show the process through which the fiscal balances of developing countries could be destabilized and, through this process, could also deteriorate. The paper emphasizes the dependence of government revenue in these countries on external developments; this dependence results from the institutional setting in which taxation of international transactions and related incomes and activities is a dominant source of revenue.

1/ See Mansfield (1982) for a discussion of alternative policy rules to stabilize aggregate demand.

The fiscal policy was viewed as a result of a two-step optimization in which not only policy parameters, but also the government's anticipation of external developments play a critical role. Wrong anticipation of external developments could aggravate the destabilization process because fiscal responses to external developments are not instantaneous. For example, the full impact of an expansionary fiscal policy implemented at the time the government anticipates a positive external shock may be realized only with a lag, at the time a negative shock begins to materialize. The paper examines the role of the fiscal targets, external developments, the policy parameters, and anticipation in the determination of fiscal balances. It was also noted that the fluctuation of revenue itself could be a cause of a deterioration in the fiscal balance over time because of the asymmetry of the upward and downward fiscal adjustments.

The analysis highlighted two contrasting possible fiscal policy rules. One of the rules would aim at the stability of the fiscal balance. With the unstable revenue facing many developing economies, such a policy rule would imply unstable expenditure. Another rule would aim at the stability of government expenditure. Such a policy rule would imply the unstable fiscal balance. The two policy rules have contrasting implications. For the former policy rule, the rising phase of fiscal cycles with a specific objective of ensuring downward adjustments was emphasized. For the latter policy rule, the difficulty of determining the right path of expenditure was emphasized.

The model such as the one discussed in this paper also suggests a way to analyze the role of an institution like the Fund in the adjustment process. How should Fund-supported financial programming be viewed in the context of the model presented in this paper? Although the role of the Fund in the adjustment process is much wider than can be adequately explained by the model, 1/ it may be useful to analyze some aspects of the role. For example, Fund-supported programs include targets for fiscal and external balances and policy measures to promote flexibility in certain prices, such as the exchange rate. These policies are supported by increased financing from abroad. In the context of the model, such an arrangement could be viewed as a constrained optimization problem with a specific set of policy parameters (which may not necessarily be the government's own in the absence of the financing constraint) and with additional foreign financing. By introducing policy, technical, and behavioral parameters, as well as various targets and constraints into the model in an explicit manner, the model could highlight the exact causes of changes in policy; e.g., the model provides a framework to analyze changes in the policy rule (i.e., changes in policy parameters) and changes in policy (i.e.,

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1/ For example, liberalization of the trade regime and pricing system which often constitute critical parts of such programs cannot be analyzed in the context of the model. Also, the model does not incorporate many variables critical in some programs (e.g., interest rates, wage rates, and producer prices).

changes in policy instruments) that could result from factors other than changes in policy parameters.

The model presented in this paper suggests one possible way to analyze a rather narrow aspect of the fiscal adjustment process. In particular, the relative roles of fiscal discipline and anticipation were analyzed. The model could be extended in a number of directions. First, the objective function could be expanded to incorporate the government's growth objective; the problem could be formulated as a dynamic, rather than static, optimization problem. In such a context, the implications of revenue instability for growth could be analyzed. Second, the revision of the original plan necessitated by an unanticipated shock could be viewed as part of a new plan for a new plan period; this approach would inevitably require a different formulation of the optimization problem and possibly different analytical results. Third, various additional constraints could be more explicitly introduced in the model, such as external financing, together with its ceiling. Fourth, the implications of alternative processes in which the government forms anticipation could be examined. Fifth, focusing on the distinction between anticipated and unanticipated shocks, the analysis did not make a clear distinction between permanent and transitory shocks. It was implicitly assumed that the shocks are sufficiently large to trigger policy responses. The model could be extended to analyze the latter distinction of shocks.

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