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To: Members of the Executive Board

From: The Secretary

Subject: Issues in the Design of Growth Exercises

Attached for consideration by the Executive Directors is a paper on issues in the design of growth exercises. This paper, together with the paper on financial programming and growth exercises (SM/87/268, 11/17/87), has been scheduled for discussion on Wednesday, December 16, 1987.

Mr. Hernández-Cata (ext. 4531) is available to answer technical or factual questions relating to this paper prior to the Board discussion.

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INTERNATIONAL MONETARY FUND

Issues in the Design of Growth Exercises

Prepared by the Research Department

Approved by Jacob A. Frenkel

November 16, 1987

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I. Introduction

During the past year and a half, the Executive Board has had a number of discussions on the general issue of the design of Fund-supported adjustment programs. 1/ An important theme in those discussions has been the need to better integrate growth-oriented policies into the design of programs, and to extend the theoretical framework underlying programs so that it incorporates more specifically economic growth in a medium-term context. In its recent report on "The Role of the IMF in Adjustment with Growth," the Intergovernmental Group of Twenty-Four on International Monetary Affairs (G-24) has elaborated this theme by presenting the following specific proposal on the design of Fund-supported adjustment programs:

> "In order to provide Fund programs with a growth perspective, it is proposed that a set of 'growth exercises' be performed prior to the 'financial exercises.' From these exercises, the amount of external finance necessary to support a growth-oriented adjustment program could be determined. The financial exercises should be built upon these estimates of necessary external finance."

The present paper, along with the accompanying background paper on "Financial Programming and Growth Exercises," represents part of a broad and continuing staff study of the design of growth-oriented adjustment programs. The objective of this paper is to discuss some of the main analytical and empirical issues that arise in the design of growth exercises. These exercises are viewed as attempts to relate, within a quantifiable framework, objectives for the growth of national income over the medium term to key macroeconomic variables, including in particular policy variables. The central focus of the paper is on the roles of capital accumulation, saving, and total factor productivity in the process of economic growth. Attention is also devoted to extending the framework for growth exercises outlined in the recent G-24 Report to deal explicitly with the cost of borrowing from abroad. The paper adopts a supply-side perspective and concentrates on the link between economic policies--especially fiscal and structural policies--and the growth of productive capacity through the effect of those policies on domestic saving and productivity. It does not deal with the problem of inflation nor with the influence of monetary growth and other demand variables in the determination of output. The latter task is taken up in the accompanying background paper where an attempt is made to merge growth exercises into a traditional financial programming framework.

1/ See "Issues for Seminar on Design of Fund Programs" (SM/86/31, 2/19/86) and "Chairman's Concluding Remarks" (Buff 86/44, 3/3/86); "Theoretical Aspects of the Design of Fund-Supported Adjustment Programs" (SM/86/162, 7/2/86) and "Chairman's Concluding Remarks" (Buff 86/205, 10/28/86).

imprecise. As was mentioned in Section I, attempts to quantify the impact of structural measures on total factor productivity would face even greater difficulties, because this variable cannot be measured directly and its estimates are subject to a wide margin of error. To be sure, the task of measuring the effect of tax and spending variables on government saving appears to be comparatively easier. In those circumstances, accepting a relaxation of fiscal targets in exchange for the adoption of structural measures would mean accepting a higher degree of uncertainty in the achievement of specific growth targets.

It should also be noted that uncertainty about the relation between economic policies and objectives introduces the need for "redundancy" in the use of policy measures. Indeed, as was shown by Brainard (1969), Tinbergen's principle of equality between the number of instruments and the number of targets breaks down in the presence of uncertainty. For example, in order to reduce the degree of uncertainty attached to a given growth target for potential GNP, it may be desirable to direct both fiscal and structural measures to the achievement of that target. In that sense there would seem to be complementarity (rather than substitutability) between structural and fiscal policies.

2. Lags in the effect of structural policies

The beneficial impact of structural measures on the growth of productive capacity usually involves delays of two kinds. First, many structural policies take time to be put in place, especially when institutional changes are required. This is likely to be the case, for example, when changes in financial or labor legislation are required, or when improvements are sought in the provision of public goods, such as education and health. Second, in many cases there will be a delay between the implementation of structural policies and their impact on macroeconomic variables.

A variety of empirical staff studies of developing countries suggests that lags of the second kind often extend over several years. 1/ More specifically, these results suggest that it may take somewhere between two and four years for one half of the full effect of certain structural measures on the relevant macroeconomic variable to come through. In the case of trade liberalization, studies based on the experience of Argentina, Chile and Uruguay suggest that it can take from one to two years for tariff reductions to affect the price of imported goods, and an additional two to three years for the change in the relative price of importables to influence the supply of tradable goods. The response of agricultural production following measures to increase producer prices for commodities appears to take between two and four years, depending on the type of crop. Policies to increase private saving by raising domestic interest rates seem to involve lags of one to two years and the effect of investment incentives on the rate of capital formation generally is estimated to take at least two years to come through.

1/ See Bond (1983), Khan and Zahler (1983) and MacDonald (1983).

Altogether, the results of the empirical studies cited above suggest that the effects of many structural policies on output involve delays that are considerably longer than those usually associated with demand management policies, suggesting that there is little scope for policy substitution over the short-term. However, this conclusion needs to be qualified in two important respects. First, the long lags found in these empirical studies may reflect to some extent private individuals' expectations about the durability of structural measures. The higher the probability assigned by individuals to a policy reversal, the more their response is likely to be delayed, as the credibility of policy will have to pass the test of time. Conversely, the response to a policy that is generally expected to remain in place should be relatively fast and, specifically, faster than would have been expected on the basis of historical relationships.

The second qualification refers to situations where private initiative has been stifled, work effort discouraged, and the operation of markets has been severely constrained (or even suppressed) by legal or regulatory barriers. It would seem that, in such circumstances, liberalization can produce results that are not only substantial but also quite rapid. By way of illustration, the measures adopted by the government of the People's Republic of China in the period since 1979 to encourage private ownership of small plots by farmers, to allow private sales of certain consumer goods in urban centers and to legalize free markets in certain areas appear to have encouraged a strong and rapid increase in economic activity. 1/

Another point to be made about structural policies is that often they lead to a once-and-for-all adjustment in the level of output. This would be the case, for example, of measures to liberalize the trade system or to remove price distortions. In many cases, the adjustment in the level of output will be distributed over a period of time, as was noted above, so that these policies will affect the measured rate of growth of output for several years. But they will not have significant effects on the growth rate of the economy after the completion of this adjustment period. 2/ In this respect, the effects of a change in fiscal policy would be qualitatively similar. For example, the initial effect of a rise in government saving relative to GNP would be to increase the rate of capital formation and hence the rate of growth of output. Over time, however, capital deepening would lower the marginal product of capital, slowing investment and output growth. In the new steady state equilibrium, the rate of growth of potential GNP would again be determined by the growth rates of the labor force and total factor productivity. In conclusion, structural and fiscal policies

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1/ For a description of these measures see SM/86/260, especially Appendix Table I.

2/ It should be noted, however, that some structural measures could have more lasting effects, for example, if the benefits derived from measures to improve the educational system are embodied into a growing labor force.

should not be expected to raise the growth rate of the economy indefinitely. The main point is that these policies will permanently raise the level of potential GNP, thus increasing the base on which future growth will build.

3. Interrelations between fiscal and structural policies

As was noted above in section IV, measures to stimulate private saving and to reduce the cost of capital to firms often involve a loss of government revenue that must be kept in mind given the objective of raising total domestic saving to encourage investment and growth. Other structural measures, such as those aimed at improving education, cutting personal taxes to encourage work effort, or reducing taxes on international trade also may have significant costs in terms of fiscal revenue. But generalizations are difficult in this area: some measures will have little effect on revenue, and some might even help to improve the fiscal position, such as the elimination of subsidies. Structural policies thus would need to be evaluated on a case by case basis, with due regard for their fiscal implications as well as their expected impact on efficiency.

It is now well recognized that fiscal measures can have far-reaching effects on efficiency and on incentives to work, save and invest. Yet, attempts to reduce the fiscal deficit often include specific revenue measures such as export duties, import restrictions, payroll taxes and taxes on interest income, that are detrimental to export performance, saving, employment and growth. There is no doubt that the impact on growth of a change in fiscal policy will depend on the "quality" of the fiscal measures adopted. This point has been emphasized by Tanzi (1987) who has suggested that Fund stabilization programs should "systematically deal with microeconomic issues of public finance in addition to other structural policies." He also discussed some of the problems raised by this proposal. For example, the design and implementation of specific fiscal measures would require considerable and specialized staff resources, and might be seen as involving interference by the Fund in areas that are politically sensitive because they are likely to affect the interests of specific groups.

VI. Conclusion

The analytical framework presented in this paper has focused on the growth of productive capacity over the medium-term. While the considerations mentioned in this framework generally have played an important role in Fund-supported programs, a more systematic use of growth exercises could be a useful ingredient in the design of such programs and, more generally, in the Fund's analysis of economic prospects and policy requirements in member countries. The framework discussed in this paper (and formalized in the Appendix) provides one illustration of how quantitative growth exercises might be conducted.

To be sure, the framework will need to be broadened in many cases to deal with important issues such as inflation, exchange rate depreciation and the implications for aggregate supply of various forms of nominal or real wage rigidity and the dependence on imported inputs.

Even in the relatively simple framework presented in this paper, the requirements for growth exercises in terms of data and statistical estimates of key parameters would seem to be quite demanding. Indeed, it is likely that for many countries, the required information will not be available and the conduct of growth exercises will need to rely on rough estimates and a considerable degree of judgement. This problem is not, of course, limited to growth exercises. Financial programming also must confront a considerable degree of uncertainty about the structure of key economic relationships, such as the demand for money. However, the data requirements for growth exercises may be somewhat more difficult to meet since information on certain key variables such as the capital stock and the labor force is less readily available, and at less timely and frequent intervals, than monetary surveys or balance of payments data.

The framework for growth exercises must be sufficiently broad to evaluate the contributions of both productivity growth and capital formation to the growth of output. Moreover, in relating investment requirements to growth objectives, such exercises must distinguish between national income and domestic product and take into account the implications of external debt servicing and debt accumulation. In such a framework, the appropriate level of foreign borrowing is likely to be circumscribed, given the cost of borrowing abroad and the rate of return on domestic investment, and growth oriented policies will need to focus on raising domestic saving and improving the performance of productivity.

In pursuing growth objectives, the authorities would be expected to rely on two broad categories of instruments: fiscal policies (to raise domestic saving and investment while contributing to adjustment in the current account of the balance of payments); and structural policies (to increase total factor productivity, and to remove distortions that discourage private saving and favor an inefficient pattern of private investment). Government policies also can have important effects on economic growth through their influence on the level and the efficiency of public investment. Fiscal measures and structural policies thus appear to provide alternative ways to achieve growth objectives. However, an examination of the differences regarding lags in the effects of various policies, of the interrelations between fiscal and structural measures, and of the consequences of uncertainty about the effects of policy instruments, suggests that fiscal and structural policies generally should be viewed as complementary rather than substitutable.

APPENDIX

1. Relation between the growth of real GNP, domestic saving and external borrowing

For simplicity, the model presented in this section assumes that prices remain constant and that domestic output depends only on the capital stock. As shown below in Section 2, the model can be extended to incorporate a production function involving both capital and labor by expressing key variables in per capita terms without altering the main conclusions. 1/ Potential domestic product (Q) is given by the production function:

$$Q = F(K) \tag{1}$$

and potential national product (Y) is the difference between potential domestic product and interest payments on the external debt:

$$Y = Q - rD \tag{2}$$

Where D is the net stock of external debt 2/ and r is the world market interest rate. Combining equations (1) and (2), differentiating with respect to time and assuming no change in the interest rate yields the expression:

$$\dot{Y} = F_K\dot{K} - r\dot{D} \tag{3}$$

where $\dot{K}$ is the rate of capital formation (including both private and government capital), F_K is the marginal productivity of capital, and dots indicate time derivatives.

Saving is defined to include domestic saving (S_d) and foreign saving (S_f), and domestic investment is equal to the change in the capital stock. In equilibrium, domestic investment must be financed by domestic or by foreign saving, thus, assuming there is no depreciation:

$$\dot{K} = I = S_d + S_f \tag{4}$$

Combining (3) and (4):

$$\dot{Y} = F_K S_d + (F_K - r)S_f \tag{5}$$

1/ In some respects the model presented in this Appendix is similar to the discrete-time model developed by Ortiz and Serra-Puche (1986).

2/ More generally, D could be defined as the country's net external liability position, i.e. its external debt minus its claims on foreigners (including official international reserves). Differences in the interest rates corresponding to the various components of the net external liability position would need to be taken into consideration.

where $\dot{Y}$ is the change in potential GNP,

S_d is domestic saving (private and public),

S_f is the inflow of foreign saving (assumed to be equal the net change in the external debt),

r is the cost of capital, assumed to be equal to the world interest rate, and

$F_K = \frac{\partial Q}{\partial K}$ is the marginal product of capital.

Dividing through by Y, and using horizontal bars to indicate ratios to potential GNP, equation (5) becomes an expression relating the rate of growth of potential GNP to the domestic and foreign saving rates and to the international interest rate:

$$\dot{Y}/Y = F_K\bar{S}_d + (F_K - r)\bar{S}_f \qquad (6)$$

Equations (5) and (6) indicate that the growth of potential GNP can be raised by increasing the reliance on foreign saving as long as the marginal product of capital exceeds the world interest rate. 1/ A rise in domestic saving would increase the growth of potential GNP as long as F_k is positive, although, of course, this would involve a reduction in the current level of consumption. It may be noted that if F(K) is a fixed-coefficient production function with constant capital/output ratio 1/b (as in Annex II of the G-24 Report) the optimum level of foreign borrowing occurs when b = r. If $b \neq r$, the interpretation of the model is rather difficult. When $b > r$, the country keeps borrowing and investing until it uses up all of its labor. If $b < r$, the country reduces its stock of foreign debt and its capital stock. Since b is constant, there is no tendency toward equilibrium. When the external debt is reduced to zero, the country shifts to an increasingly large net foreign asset position and the capital stock continues to contract. Eventually, the capital stock will vanish, domestic output will drop to zero, and national income will consist only of interest receipts on the country's external claims.

The model can be extended to incorporate fiscal variables by defining domestic saving as the sum of private saving and government saving:

$$S_d = S_p + \tau Y - G, \qquad (7)$$

1/ Allowing for depreciation, the condition for foreign borrowing to raise national income would be $F_k > r+\delta$, where δ is the rate of depreciation of the capital stock.

where τ is the average income tax rate, and

G is government current expenditure on goods and services.

The simplest way to allow for the growth of productivity (A) is to replace equation (1) by the additive production function:

$$Q = F(K) + A \qquad (1)'$$

Differentiating (1)' and taking equations (2), (4) and (7) into account yields:

$$\dot{Y} = F_K[S_p + \tau Y - G] + (F_K - r)S_f + \dot{A} \qquad (8)$$

Assuming that private savings are a constant fraction (s) of disposable income, and allowing for a degree of debt neutrality, then

$S_p = s(1-\gamma\tau)Y - (1-\gamma)(\tau Y-G)$, where

$1-\gamma$ is the proportion of a change in government saving offset by an opposite change in private saving ($\gamma = 0$ represents the case of full debt neutrality).

Substituting for private saving and dividing through by Y yields:

$$\dot{Y}/Y = F_K[s(1 - \gamma\tau) + \gamma(\tau - \bar{G})] + (F_K - r)\bar{S}_f + \lambda\bar{A} \qquad (9)$$

Where $\bar{G}$ and $\bar{A}$ are government current spending and total factor productivity, respectively, expressed as ratios to potential GNP, and $\lambda = \dot{A}/A$. Equation (9) indicates that the growth of potential GNP in any given period is influenced by: the domestic saving rate--which in turn depends on the private savings rate (s), the tax rate (τ), the ratio of government current spending to GNP (G) and the nonneutrality parameter γ; the cost of capital (r); foreign saving as a ratio to GNP (S_f); and the growth of multifactor productivity (λ).

If the world interest rate is allowed to change, equation (3) becomes $\dot{Y} = F_K\dot{K} - r\dot{D} - \dot{r}D$. The result is to modify equations (8) and (9) by adding the term $-\dot{r}\bar{D}$, indicating that a rise in the world interest rate would reduce the growth of national income in proportion to the country's external debt/GNP ratio.

2. Rising cost of capital

Assume that the rate at which the country can borrow from world financial markets is equal to the international interest rate r^* plus a fraction Φ of the country's debt/GNP ratio, so that $r = r^* + \Phi\bar{D}$.

Assuming a stable debt/GNP ratio and no change in the international interest rate, the change in national income is then given by

$$\dot{Y} = \dot{Q} - \dot{D}(r^* + \Phi\bar{D})$$

Using equation (4) it can be shown that

$$\dot{Y}/Y = F_K S_d + (F_K - r^* - \Phi\bar{D})S_f$$

In this model, the higher the debt/GNP ratio, the higher must be the marginal product of capital in relation to the world interest rate for external borrowing to raise the growth of GNP.

3. Generalization to the two-factor production function

The linear homogeneous production function $Q = F(K, N)A$, where N stands for the labor force, can be written in the intensive form $q = f(k)A$, where lower-case letters denote variables expressed in per capita terms. 1/ Per capita income is given by $y = q - rd$, so that

$$y = f(k)A - rd$$

where y is per capita income,

k is the capital/labor ratio,

A is total factor productivity, and

d is per capita external debt.

Taking time derivatives and using the definition of saving yields:

$$\dot{y} = \frac{\partial Q}{\partial K} s_d + (\frac{\partial Q}{\partial K} - r)s_f + n(rd - \frac{\partial Q}{\partial K} k) + \lambda q$$

where s_d and s_f are per capita domestic and foreign saving, respectively

n is the rate of growth of the labor force, and

$\frac{\partial Q}{\partial K} = Af_k$ is the marginal productivity of capital.

Dividing through by y and using bars to indicate ratios to GNP:

$$\dot{y}/y = \frac{\partial Q}{\partial K} \bar{S}_d + (\frac{\partial Q}{\partial K} - r)\bar{S}_f + \lambda(1 + r\bar{D}) + n(r\bar{D} - \frac{\partial Q}{\partial K} \bar{K})$$

1/ For simplicity it is assumed that population and the labor force grow at the same rate, but changes in the participation rate can be easily incorporated into the model.

The basic conclusion thus remains: increased reliance on foreign saving will raise the growth of national income only insofar as $\partial Q/\partial K > r$. If the production function is Cobb-Douglas, the condition becomes $\alpha\, Q/K > r$, where α is the elasticity of domestic output with respect to the capital stock. If the marginal product of capital initially exceeds the interest rate, capital accumulation financed by foreign borrowing will result in higher growth of output and will lower the output/capital ratio to the point where $\alpha\, Q/K = r$.

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