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GOVERNMENT AND ECONOMIC GROWTH: A THREE-GAP VIEW OF THE LONG-RUN PROSPECTS OF THE BRAZILIAN ECONOMY

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1. INTRODUCTION

Brazil has been one of the fastest growing economies in the world in the present century. In real US dollars, per capita income has been multiplied by a factor of five between 1940 and 1980, whereas population was multiplied by three. Real GDP exhibited a rather steady annual average growth rate of 7% over the period.[1] After 1980, failure to stabilize the economy led to a dismal performance: the annual growth rate averaged only 1.6%. And, although population growth slowed down from more than 3% in the previous period to 1.9%, there was an accumulated fall in per capita income of around 2% between 1980 and 1994.

Mismanagement of troubled government finances is recognized to have been behind this dramatic change in economic performance. How the external debt crisis of the early eighties developed into a major deterioration in the federal budget may be described in three steps. In a first movement, during the second half of the seventies and the early eighties, the federal government played an important role in the redirection of investment which was necessary to diversify exports, change relative prices through exchange rate devaluation and cope with the domestic effects of the sudden shrinking of international finance. The excess of public investment over government savings was financed essentially by higher inflation and the nationalization of private sector external debt by the Central Bank up to 1985.[2] In a second movement, which took place in the second half of the eighties, the failure of repeated stabilization attempts, from the Cruzado Plan in 1986 to the Collor Plans in 1990/91, based on increasingly discretionary intervention on private contracts, led to

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[1] In only six of the forty years growth rate was below 4%, and only in 1942 there was a decline in GDP due to war-time shortages. For a detailed analysis of the long-run growth performance of the Brazilian economy, see Abreu (1990).

[2] See Carneiro (1987) on the nature of the adjustments of the economy following the two oil shocks and Carneiro and Werneck (1993) for the analysis of the effects of the disappearance of foreign finance on the composition of savings and investment in the 1980's.

growing uncertainty in asset markets, a disruption of the pricing mechanisms, a total disarray in the public budget administration and a decrease in the scope for voluntary public-deficit financing.

Following the abandonment of price controls in 1991 onwards and the deepening of liberalization of international trade and finance relations, foreign capital inflows responded favorably to the signals of a more liberalized economy. There was a gain of more than US$ 20 billion in international reserves in the generalized expectation that a Brady-type agreement with private creditors was around the corner and that a new boom in economic growth was about to start. In the meantime, avoidance of open hyperinflation -- through deficit repression, repeated promises of fiscal reform to curb explosive inflation expectations and the maintenance of positive real interest rates -- became the central aim of economic policy. Short run management of public debt was the only instrument available to prevent currency substitution from marking the final abandonment of the national currency.[3]

In spite of the political crises of 1992 and 1993, and the unbearable uncertainty associated with a 40% monthly rate of inflation, in early 1994, year of general elections, optimism concerning growth prospects was generalized. Hopes for economic and political recovery seem to be the rule after the traumatic impeachment of President Collor and after a Congress inquiry recommended that nineteen congressmen should lose their seats following charges of inappropriate behavior in the all powerful Congressional Budget Committee.

A new stabilization plan was launched in mid-1994. The monthly inflation rate was brought down from almost 50% in June to 2% in December, without resort to any kind of price-control. In order to consolidate its initial favorable results, the plan

[3] For a details of the monetary policy and the role of capital inflows in the period see Carneiro and Garcia (1993).

envisaged a scenario in which government action would be modernized, privatization of state companies would continue, trade and financial liberalization would proceed and the fight against poverty would not impair private investors' incentives. The sharp fall in inflation led to a resounding victory of former Finance minister Fernando Henrique Cardoso in the October presidential election, with a clear mandate to persist with the stabilization program and to carry on the required economic reforms.

The issue of state reform has been present in the political campaigns since the 1989 presidential election which led Fernando Collor to power. All political parties agree that in its present shape the present Brazilian state is inefficient and incapable of promoting economic growth by means of the directive action on private investment which has characterized its strategical behavior since the thirties. There seems to be a consensus that in its present shape, critically so since the second half of the 1980's, the role the Brazilian state has been playing as a big investor and banker, as well as producer of private goods and services, is not only inefficient and regressive from the viewpoint of income distribution but dominated by corporatist interests. Furthermore, it has become increasingly incapable of rendering the simplest and traditional governmental services such as public health, public education, urban security and justice, not to speak of its irreplaceable role as a regulator of economic power and protector of the environment.

The objective of this paper is to discuss issues bearing on the long run prospects for Brazilian economic growth between the second half of the nineties and the next decade, in view of the recent shifts in the discussions pertaining to the role of government expenditures and their implications for economic growth.

Following this introduction, section 2 looks beyond the present stabilization problems. An overview of the failure of the state as growth promoter in Brazil since the early eighties is presented in section 3. The issues of government and growth from

the new perspective of the mid-nineties are then discussed in section 4, in order to motivate, both theoretically and empirically, the simulation model presented in section 5. The results of a simple simulation exercise and some final remarks are presented in section 6.

2. LOOKING BEYOND THE STABILIZATION CHASM

With low inflation and good prospects for structural reform, inquiring on the growth possibilities of the Brazilian economy seems only natural. The vigorous industrial recovery which has been taking place since 1992, with an average growth in manufacturing of 7% in 1993-94, with practically no recovery in industrial investment, should not be overlooked. The performance was even more impressive as it occurred following the dismantling of the protectionist tariff and non-tariff barriers which have characterized the Brazilian industrialization. Defying the pessimistic forecasts of de-industrialization, which should be the inevitable consequence of openness, the manufacturing sector has responded positively to the stimuli of foreign trade expansion in the wake of MERCOSUR trade agreement as well as to the lower costs due to cheaper access to industrial components in the international markets.

There are some obvious advantages of starting a period of economic recovery after so many years of growth below historical trend. The basic idea here is a generalization of the phenomenon of the existence of a slack in productive capacity after many years of severe underutilization.

Playing with the idea of productivity wedge, Cohen (1993) presents evidence on the stock of knowledge a country can count on to raise its growth prospect as an additional explanation for differences in growth performance. On

the basis of this evidence, one could define different forms of slack (the reverse of "gaps"?) which seem to be relevant when one evaluates the prospects of economic growth for countries which have endured a long period of recession without destruction of productive capacity.

Capacity utilization being low (unusually low if one considers the experience of the pre-crisis years and take capacity output in the early eighties at its face value) renders irrelevant the usual methods of evaluation of utilized capacity. To be sure, nobody would believe physical capital growth to have occurred at the rates suggested by (gross) investment. Besides, one knows very little about real depreciation of the capital stock and next to nothing about the effects of technological obsolescence. What happened to human capital?

Has the productivity wedge thus defined increased along the eighties and in the first years of the present decade in the Brazilian economy? The argument could be developed in several directions. One possibility is to take the case of some crucial sectors. In the case of energy, for example, there was an excess hydroelectric generating capacity in the beginning of the nineties because the slowdown of investment has not followed the slowdown in consumption growth. One might also mention the potential increase in productivity due to the dismantling (or at least the rationalization) of the ethanol program which was conceived and implemented with the real price for imported oil at least five times the current price for 1993.[4] As a consequence, the expected recovery of the mid-nineties will benefit from a much lower energy cost.

[4] Investment in energy-related projects were top priority in the late seventies and early eighties due to the two shocks. A substantial degree of substitution of domestic sources of energy (oil and non-oil) for imported oil was achieved at a significant cost both in terms of microeconomic inefficiency and macroeconomic burden. The former was reflected in the estimated shadow price of imported energy implicit in the substitution-related projects, which has undermined the international competitiveness of many goods (such as petrochemicals, for example) when the real dollar price of oil came down in the second half of the eighties. Also, small regard for costs of oil-saving investment programs has certainly contributed to increase the relative price of capital-goods, as analyzed by Carneiro and Werneck (1993). The macroeconomic burden resulted from the disorganization of

Deregulation and privatization are likely to reduce costs of transportation, port facilities and telecommunication services. The latter services are also bound to be more efficiently provided in the wake of new legislation designed to lower barriers to imports of technology and equipment. The general effect of more liberal import policies on the productivity of investment as a whole is considered in the model of section 4 below. Yet another sector where potential increases in productivity are specially high is agriculture due to liberalization of input imports and improvements in transportation and storage.

Last but not least, there are two areas in which control over the inflationary process is likely to give rise to a period of higher economic growth: the first one relates to the better allocation of savings allowed by more transparent relative prices after a long period of very high and disorganizing rates of inflation which tend to blur relative prices; the second one is the conversion of the financial system from the supply of inflation-protected money substitutes back into the provision of credit for investment, production and purchase of durable goods. After a long experience with high inflation, firms' debt, as well as that of households', have practically disappeared as a consequence of the shrinking of credit markets due to unbearable levels of borrowers' as well as lenders' risk.[5] There is therefore the opportunity for a period of debt expansion by both households and firms. This period of credit-led growth of aggregate demand will benefit from the substantial initial slack of productive capacity.

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the public budget, the increasing dependence of public expenditures on debt financing (first on foreign debt), then on inflationary financing.

[5] Baumgarten (1993) estimates that households' outstanding debt with banks and consumer credit companies has declined from US$ 16 billion to less than one billion between 1980 and 1992.

3. GOVERNMENT AND GROWTH: AN OVERVIEW OF THE CRISIS

There seems to be a consensus that a major cause of the interruption of Brazilian long-run economic growth performance was the gap between expectations and reality concerning the role of the state in the process of resource allocation in the economy. The objective of this section is to analyze some long-run consequences of this gap and to point out the role that can now be expected from government as a growth promoter.

There has been a fall in public investment due to decreasing public saving plus a gradual inadequacy of finance through the substitution of inflationary for non-inflationary sources in the financing of overall government deficit.[6] Moreover, inadequate budgeting policies and frustrated stabilization attempts led to growing inefficiency of public apparatus as a result of iniquitous and uncertain rules for the definition of the public employees' pay, lack of commitment with long-run projects and a general deterioration of public services. All those factors have played their role in the process of impairment of the Brazilian state as a promoter of long-term growth.[7]

Incentive policies which had been adopted since the late sixties (following the fiscal and institutional reforms of the military regime in 1964-65) had been based on the ability of the federal government to generate a large primary surplus. Furthermore, the financial reforms promoted by the military in 1964-67 had opened ample room for public debt growth.[8] This domestic debt slack gave rise to the creation of a variety of successful mechanisms for capturing private sector savings and concentrating financial power in the hands of state agencies. Cheap credit for private investors, easy finance

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[6] The facts behind the fall in public savings are analyzed in Carneiro and Werneck (1993).
[7] These issues related to the vicious circle of worsening of state performance are explored in Werneck (1993).
[8] On the effects of the financial reforms of the sixties, see Sochaczewaki (1993), Goldsmith (1986) and Carneiro and Bodin de Moraes (1988)

for much needed bulky government projects in the modernization of infrastructure (energy, transport and communication) and financial support for a variety of subsidies to foster private entrepreneurship in privileged sectors were all part and parcel of the instruments used to channel investment funds -- private and public -- to the priority projects picked by the federal government planning authorities.

Protectionist trade barriers and sectoral complementarity were once the hallmark of this "intelligent intervention". With the crisis of the 1980's they became a big umbrella for inefficiency and abusive use of market power, a widespread source of rent-seeking, regressive income transfers and corruption. As growth prospects deteriorated and inflation accelerated, financial gains became a main source for profits and industrial concentration favored the ability to extract benefits from the financial crisis of the state. Slow growth rendered several of the state-sponsored projects of the late 1970's inadequate and unprofitable. Wrong incentives made possible ill-conceived projects.

Re-democratization that took place in the eighties could not be easily reconciled with the dismantling of the domestic industry protection and privatization of state enterprises. In the name of democracy, governmental institutions were auctioned among political parties supporting the Sarney government. Politically organized pillage of the state finances led to an inconsistent budget, where nominal spending was determined by the convergence of interests behind the dominant political coalition. The new Constitution voted in 1988 crystallized the inconsistency between the decentralization of tax revenue (from the federal to the state and local government levels) and the concentration of public expenditure commitments in the domain of federal agencies. In such a regime, real government spending ended up being determined *ex post facto* by an increasingly narrower ability to raise non-inflationary finance plus the necessary acceleration of inflation required to collect seigniorage from a shrinking real money stock. Indexation helped to accommodate higher and higher

inflation as well as to nurture the illusion that values could be preserved under *any* rate of inflation.

The disappearance of public savings, coupled with the melting of government possibilities of raising new finance to fund public investment, converted the growth of public debt from a mechanism to redirect saving to a mechanism to protect financial wealth under the mega-inflationary regime of the late eighties and early nineties. Under the high inflation rate of the eighties, the financial mechanisms behind the incentives devices became obsolete and unmanageable. At first, they contributed to external as well as domestic debt growth, but then they implied Ponzi financial schemes, outright giveaway of public money and accelerating inflation.

Growth of public enterprises was undermined by the impossibility to preserve the real value of the prices of the goods and services they produce.[9] Frustrated attempts at stabilization usually led to public tariffs controls. Illusion of perfect indexation of prices linked to "top priority projects" did not last long. On the other hand, overpricing of public works plus a generalized practice of cost padding led to the demoralization of project analysis and indexed contracts, as well as to improper relationships between contractors and public officials and politicians. A long history of frustrated stabilization policies resorting to "temporary" tariff controls contributed to demoralizing pricing rules for public services.

Attempts at prolonging *intelligent* intervention beyond its fruitfulness have led thus to a "privatization of state action", through the establishment of widespread corrupt ties in the relationships between public officials and private firms as well as between congressmen who voted the federal budget and interest groups who fought for a piece of the carcass.

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[9] See Werneck (1991).

Criticism of governmental action led to increasing political popularity of proposals for a smaller and less active state. Such proposals focused on issues such as privatization of state enterprises, de-regulation of economic activity, de-repression of external trade and liberalization of external financial relations, besides of course the favoring of measures to enhance those state activities related to the provision of public education, public health and urban security.

The victory of Fernando Collor in the 1989 presidential election on a reformist proposal encompassing several of these issues and the depth of the institutional reforms implemented following his inaugural speech were, by and large, overshadowed later on by the failures of his stabilization attempts in 1990 and 1991, as well as by the corruption scandals which led to his impeachment in 1992. But the core of his liberalizing reforms were taken up by his reluctant vice-president Itamar Franco. And the idea of having a smaller and a more efficient supplier of government services has been incorporated in almost all party programs in Brazil nowadays and became an important issue in the 1994 general elections. The claim for the need to reform the modes and means of *state intervention* gained strength as difficulties of financing traditional government functions such as basic education, the judiciary, public health and security attained a climax during a period of deficit repression from 1991 to 1993.

4. GOVERNMENT AND GROWTH: THE NEW ISSUES

In order to analyze the growth issues addressed in this paper, the workings of the Brazilian economy are described in a simple model, presented in the next section, which highlights the effects of trade liberalization and the new pattern of public spending on the country's growth possibilities. Incorporating the effects of the redirection in public spending in a growth model does not require any kind of

heterodox creativity in view of the recent trend in the new growth literature, as shown for example in Romer (1989).

The point of departure is a three-gap model previously applied to the Brazilian economy by Carneiro and Werneck (1989), as described in Taylor (1993). Amendments to the original model are mainly based on the new role of public investment, the capital/output ratio easing effects of redirected government expenditures and the possibilities opened up by the productivity-enhancing effects of trade liberalization, through access to lower cost and technologically up-to-dated equipment and construction services imports.

The stylized facts which have inspired the changes made in the model are the following. First, as the privatization program advances to its next phase, reaching public utilities, railroads, highways and port authorities, the composition of public investment will in all likelihood radically change, as it becomes mostly confined to those areas where strict complementarity between private and public capital is unequivocal. In such a context, public investment requirement is bound to be determined by the level and composition of private investment, and not the other way around, as it used to be the case in the past experience described in Carneiro and Werneck (1989, 1990), when state-led investment, both in private firms and through state-owned enterprises, were the mainspring of capacity growth.

Second, following the deterioration of traditional government functions during the past ten years or so, there is a movement to restore those functions and, therefore, to increase the importance of expenditures in education, public health, environment, urban security and science and technology -- a large portion of which is usually classified in the accounting practices as government *consumption*. Such a movement is bound to be accompanied by a decentralization of public responsibilities from the federal level to state and local governments.

Third, in the wake of a series of trade liberalization measures, adopted particularly since 1990, the country's average import tariff was brought down from 51% in 1988 to below 14% at present.[10] Non-tariff barriers were almost totally eliminated. Liberalization of imports of capital goods -- especially of computers -- had a substantial impact on the domestic prices of machinery and equipment. The resulting reduction in investment costs is expected to be further amplified in the near future as the liberalization process reaches construction services and government procurement policies.

The impact of such changes in the pattern of government spending and in trade policy on growth prospects will be modeled in a very simple manner, which underlines their direct effects on the productivity of investment and on private savings.

A variable (λ) measures the amount of government consumption (as a proportion of GDP) in technical education, modern technology dissemination, technological research support and other productivity-enhancing expenditures. And hypotheses on the way (λ) may influence growth through both higher investment productivity and higher savings are made. The first simplifying assumption is that (λ) will exert a direct negative impact on the incremental capital-output ratio. Accordingly, that kind of government expenditure-programs, measured by (λ), will be labeled "capital-output ratio easing activities" (K.O.R.E.A. for short).

It will be assumed as well, that after decades of strong protection of the capital-goods and construction industries, liberalization of imports of equipment and construction services and less discriminatory public-sector procurement rules will have

[10] See GATT (1993, pp. 104-105). Such rates do not take into account recent sizable reductions in import tariffs, which became effective after the announcement of the Real Plan.

a direct negative impact on the incremental capital-output ratio. The higher the import-content of aggregate investment the higher its efficiency.

Another assumption concerns the effect of (λ) on savings. Personal savings being directed mainly to finance private acquisition of homes and durable consumption goods, the fraction of private savings which is relevant for the financing of productive capital accumulation is composed of two sources: retained profits and institutional funds, such as pension funds and the technical reserves of insurance companies. Retained profits is the component on which attention should be focused. The simplifying assumption to be made at this point is that a positive effect on private savings available for the acquisition of physical capital will occur through a substitution of public spending for private spending in technical education and in-firm training.[11] Public expenditures would replace part of the relatively inefficient private sector's expenditures on training, for example.

The macroeconomic logic of the model may be described in very simple terms. The first equation states that private investment (i_p) is constrained by the existence of finance, and thus may be written, as a proportion of GDP, as the excess of the sum of private (s_p) plus foreign savings (ϕ) over the public deficit (d). Public investment (i_g), financed by public savings plus the public deficit, is determined by the level of private investment, now that the state does not induce but only satisfies private investors' needs for complementary activities. Thus one may write:

$$i_p = s_p + \phi - d \qquad [4.1]$$

and

$$i_g = i_o + \Omega\, i_p \qquad [4.2]$$

[11] Amadeo et al. (1993) estimate that around 1% of GDP is spend annually by firms in the industrial sector in training both **in situ** and in technical schools in courses of short duration.

By decomposing total savings into its three components, private, public and foreign savings -- defined by the current account deficit --, the economy's equilibrium will be determined by equating total investment (private plus public) to total savings. Total investment and its productivity will thus define the maximum growth rate attainable in a given horizon, according to (a) the total availability of saving; (b) the possibilities to transfer savings between the public and the private sectors. This transfer is done by the available forms of deficit financing between the two "sectors". In the past experience of the Brazilian economy, different forms of financing have occurred. In the late sixties and early seventies, the public sector surplus resulting from the financial reforms was transferred to the private sector either by cheap credit or by direct subsidies generally implying negative interest rates; in the late seventies the private sector surplus was transferred to the public sector in the form of increasing public debt, with increasing interest rates.

One may imagine thus this long-run equilibrium having been determined by interest rates by means of two relationships, given the degree of openness, the level of productivity enhancing government expenditures and the exchange rate. The first relationship defines (g_h) the maximum growth rate allowed by the fiscal constraint:

$$g_h = g_h(\Gamma_1, \lambda, r, e) \qquad [4.3]$$

The second one (g_s) is the maximum growth rate consistent with the savings constraint:

$$g_s = g_s(\Gamma_1, \lambda, r, e) \qquad [4.4]$$

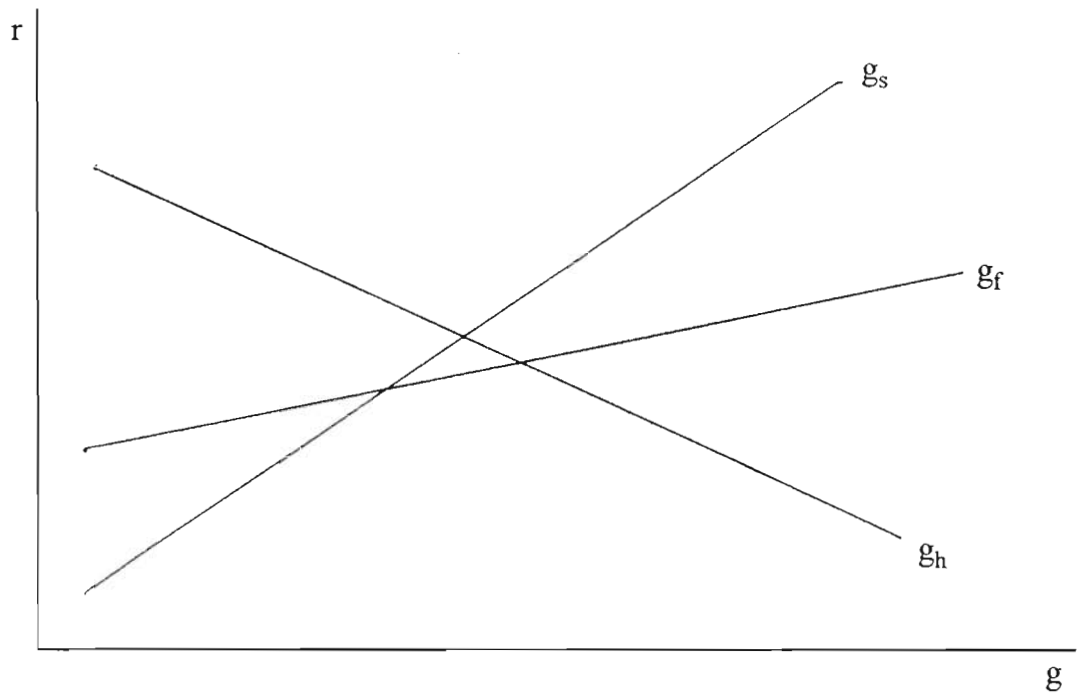
Both are positively affected by the first two arguments, namely (Γ_1), the marginal propensity to import machinery and construction services, and (λ), government expenditures in capital/output easing activities (K.O.R.E.A.), as a result of their of their positive effects on investment productivity and private savings. The effects of

these variables will be explored in detail in the next section, and they will be left aside in the remainder of this section.

It will be supposed that the effect of the real interest rate on the fiscal-constrained rate of growth defined by [4.3] is negative, since higher interest means that higher deficits are required to transfer private savings to finance public investment (as in the late seventies). It will also be assumed that the effect of higher interest rates on the savings-constrained rate of growth [4.4] is positive, since the external interest rate is kept constant and new unfavorable external-debt scenarios are not considered. In that case, higher domestic interest rates will draw a higher volume of foreign savings into the country.

For each level of real exchange rate (e), the system formed by equations 4.3 and 4.4 defines the values of the equilibrium growth rate and real interest rate consistent with the savings constraint and with the budget constraint. Figure 4.1 illustrates the long-run equilibrium. Equilibrium means that total savings are sufficient to finance total investment (public plus private) and furthermore that the interest rate is consistent with the fiscal deficit to be financed. There is no guarantee, however, that the real exchange rate used to define both loci, the amount of foreign finance attracted by the combination of (r) and (e) will be sufficient to close the balance of payments. A third locus could thus be defined as the combination of growth rates and interest rates consistent with external equilibrium. This locus would be increasing since higher growth rates requires higher imports of capital goods and *coeteris paribus* a higher interest rate to finance a higher current account deficit. Consistency between the interest rate and the exchange rate will occur only if the external constraints meet the other two at their intersection. If at the domestic equilibrium interest rate the growth rate warranted by the external constraint is smaller, a real devaluation of the exchange rate would be necessary in order to promote general equilibrium.

FIGURE 4.1



In the simulation model described in detail in the next section, both the current account deficit and the fiscal deficit are fixed in each scenario, as sensitivity analysis is made for given values of (r) and (e). Simulations involving a complete specification of the roles of prices in bringing about general equilibrium would require more complex specification of the investment and savings functions. Needless to say, the fixprice simulations analyzed in the following sections are more interesting if they refer to prices not too far from their equilibrium values. In section 6 comments are made concerning the signals of price movements reflecting potential disequilibria.

5. A Simple Simulation Model

All level variables are defined as a proportion of GDP. Public sector savings are given by equation [5.1]. The variable (t) refers to the net-tax revenue: total taxes, net of subsidies, transfers and interest payments on government's debt.[12] Public consumption expenditures are broken down into two parts: expenditures in productivity-enhancing programs (λ), which were labeled K.O.R.E.A.[13] in section 4 above, and other public consumption (c_g). The effect of an eventual fiscal-adjustment effort is given by a separate variable (τ).

$$s_g = t + \tau - \lambda - c_g \qquad [5.1]$$

Private savings (s_p) is a function of private sector's disposable income, mainly retained profits and net expansion of pension funds. The marginal propensity to save out of disposable income is itself a function of the government expenditures in K.O.R.E.A., following last section's discussions, with $\sigma'_1(\lambda) > 0$ and $\sigma''_1(\lambda) < 0$:

[12] Public-enterprises' aggregate surplus is also included in (t).
[13] Capital-output ratio easing activities.

$$s_p = \sigma_o + \sigma_1(\lambda).(1 - t - \tau) \qquad [5.2]$$

Foreign savings are defined in equation [5.3] as the balance of payments' current account deficit (ϕ).

$$\Gamma_o + \Gamma_1 (i_p + i_g) + m + j - x = \phi \qquad [5.3]$$

Exports are designated by (x) and interests on the external debt by (j). Capital goods imports are given by

$$\Gamma_o + \Gamma_1 (i_p + i_g) \qquad [5.4]$$

where total investment ($i_p + i_g$) is written as the sum of private and public investments and Γ_1 is the import-coefficient of capital goods and construction services. All other imports and the algebraic sum of other current account items are included in (m).

Private investment is determined by the available financing funds, which are given by the excess of the sum of private savings (s_p) and the current account deficit ϕ over the amount absorbed by the government to finance its deficit (d).

$$i_p = s_p + \phi - d \qquad [5.5]$$

Public investment (i_g) is divided into two components. An autonomous component (i_o) and another one which represents a fixed proportion (Ω) of private investment (i_p).

$$i_g = i_o + \Omega\, i_p \qquad [5.6]$$

The public sector deficit may be written as the difference between public investment (i_g) and savings (s_g):

$$i_g - s_g = d \qquad [5.7]$$

The average annual growth rate (g) is determined in the equation [5.8] as a function of aggregate investment. The parameter (k) is the output-capital ratio and (g_o), which would usually be negative, may be associated to a depreciation allowance.

$$g = g_o + k\,(i_p + i_g) \qquad [5.8]$$

As seen in the last section, the output-capital ratio (k) is supposed to be a positive concave function of both (Γ_1), the import-coefficient of capital goods and construction services in [5.4] and (λ), the government expenditures in K.O.R.E.A.:

$$k = k\,(\Gamma_1, \lambda) \qquad [5.9]$$

According to equation [5.6] above, there is a fixed marginal proportion between private investment and public investment. But if private investment is too high, government may be financially unable to make a proportional public investment effort. Private investment would thus become restricted by the fiscal constraint. Substituting [5.1] and [5.6] into [5.7], and solving for i_p, one may write (i_h), the maximum level of private investment allowed by an exogenously given sustainable public sector deficit (d), as:

$$i_h = (t + \tau + d - c_g - \lambda - i_o)/\Omega \qquad [5.10]$$

Private investment may also be constrained by savings. Substituting [5.2] and [5.7] into [5.5], using the expression for (s_g) given by [5.1] and the one for (i_g) given by

[5.6] and rearranging terms, one may obtain equation [5.11]. For any exogenously given feasible current account deficit (ϕ), it establishes the maximum level (i_s) of private investment allowed by aggregate savings.

$$i_s = [\sigma_o + \sigma_1(\lambda).(1 - t - \tau) + \phi + t + \tau - \lambda - c_g - i_o]/(1 + \Omega) \qquad [5.11]$$

Finally, a high level of private investment may lead to capital-goods imports which would imply an excessively high current account deficit. Substituting equation [5.6] into [5.3] one may determine (i_f), the maximum level of private investment that is consistent with an exogenously given feasible current account deficit (ϕ):

$$i_f = (x + \phi - m - j - i_o \Gamma_1 - \Gamma_o)/[\Gamma_1 (1+ \Omega)] \qquad [5.12]$$

If the maximum values i_h, i_s and i_f, given by equations [5.10], 5.11] and [5.12], are substituted, on at a time, into the equation which results from substituting [5.6] and [5.9] into [5.8], one may get three other equations which establish the average annual growth rates implied by each of those previous three consistency equations. In [5.13], g_h establishes the maximum average annual growth rate allowed by the fiscal constraint:

$$g_h = g_o + k (\Gamma_1,\lambda).[i_o + (1 + \Omega) i_h] \qquad [5.13]$$

In [5.14], g_s is the maximum average annual growth rate consistent with the savings constraint:

$$g_s = g_o + k (\Gamma_1,\lambda).[i_o + (1 + \Omega) i_s] \qquad [5.14]$$

And g_f, given by [5.15], determines the maximum average annual growth rate allowed by the external constraint.

$$g_f = g_o + k\,(\Gamma_1,\lambda).[i_o + (1 + \Omega)\, i_f] \qquad [5.15]$$

The most interesting policy variables to which attention should be focused in the analysis of the interplay of equations [5.13] to [5.15] are τ, Γ_1 and λ. The first one is the fiscal adjustment variable. The value of Γ_1 depends on the degree of import liberalization of both capital goods and construction services. And λ is determined by the volume of government expenditures in K.O.R.E.A..

The effects of a change in τ are quite obvious. Both the fiscal constraint [5.12] and the savings constraint [5.14] are slackened by an increase in τ. And the external constraint is not affected by it. That means that

$$\partial g_h/\partial\tau > 0;\ \ \partial g_s/\partial\tau > 0;\ \ \ \partial g_f/\partial\tau = 0$$

The impact of a change in Γ_1 is also easy to perceive. Again, both the fiscal constraint [5.12] and the savings constraint [5.14] are relaxed by an increase in Γ_1:

$$\partial g_h/\partial\Gamma_1 > 0;\ \ \partial g_s/\partial\Gamma_1 > 0$$

The effect on the external constraint is given by

$$\partial g_f/\partial\Gamma_1 = (\partial k/\partial\Gamma_1)\, i - k\,[i_o + (1 + \Omega)\, i_f]/\Gamma_1 \qquad [5.16]$$

where $i = i_f + i_g$ is the maximum total investment allowed by the external constraint. It may be shown that the external constraint would be slackened by an increase in Γ_1 only if $(\Gamma_1/k)\ \partial k/\partial\Gamma_1 > 1$, a most implausible assumption for the value of this elasticity. Therefore it may be assumed that $\partial g_f/\partial\Gamma_1 < 0$.

Finally, there are the effects of a change in λ. The external constraint is positively affected by λ, exclusively through k. The effect on the fiscal constraint is given by

$$\partial g_h/\partial\lambda = (\partial k/\partial\lambda)\, i - k\,(1 + \Omega)/\Omega \qquad [5.17]$$

where $i = i_h + i_g$, is the maximum total investment allowed by the fiscal constraint. It may be shown that this effect will be positive if

$$(\lambda/k)\, \partial k/\partial\lambda > [(1 + \Omega)/\Omega]\, \lambda/i \qquad [5.18]$$

For sufficiently low values of (λ), the condition established by [5.18] will hold and an increase in (λ) will release the fiscal constraint. But as the volume of government expenditures in productivity-enhancing programs rises, a point will be reached in which an increment in (λ) will eventually have the effect of tightening up the fiscal constraint.

What remains to be examined is the effect of a change in λ on the savings constraint [5.14], which is given by

$$\partial g_s/\partial\lambda = (\partial k/\partial\lambda)\, i - k\,[1 - (1 - t - \tau)\, \partial\sigma_1/\partial\lambda] \qquad [5.19]$$

where $i = i_f + i_g$ is the maximum total investment allowed by the savings constraint. This derivative will be positive if

$$(\lambda/k)\, \partial k/\partial\lambda > \lambda/i - [\sigma_1(1 - t - \tau)/i]\, (\lambda/\sigma_1)\, \partial\sigma_1/\partial\lambda \qquad [5.20]$$

Again, if the value of the elasticity $(\lambda/\sigma_1)\, \partial\sigma_1/\partial\lambda$ is sufficiently low, that condition will hold for low values of (λ). Under such circumstances, an increase in λ, would slacken

the savings constraint. But as λ becomes higher, the sign of the effect may eventually change.

Simulations based on the model assumed constant-elasticity functions for both $\sigma_1(\lambda)$ and $k(\Gamma_1,\lambda)$ allowing some useful insights and a better perception of the possible magnitude among the involved effects. Those functions were written as

$$k = k_0 \Gamma_1^{\mu 1} \lambda^{\mu 2} \qquad [5.21]$$

and

$$\sigma_1 = v_0 \lambda^{v} \qquad [5.22]$$

6. Simulation Exercises and Final Remarks

In order to use the model for simulations, plausible values were attributed to the parameters and exogenous variables. Typically, the values of the parameters were obtained on the basis of known passage points and plausible elasticity values.

The chosen base year was 1996, on the assumption that carrying on the ongoing stabilization program will be the main first-year task of the new President that will take office in early 1995. Accordingly, the values of the exogenous variables (t) and (c_g) are consistent with a post-stabilization scenario in which the public sector will already have made a sizable adjustment. Big enough to assure the success of the stabilization program, but falling short of the fiscal adjustment required to allow a new sustainable rapid economic growth path. The role of the variable (τ) in the model is precisely to gauge the magnitude of the additional -- post-stabilization -- fiscal effort. The value of the parameter (Ω), which establishes the link between private and public investment, was assumed to be equal to $^2/_3$.

The values of external-sector variables take into account the successful closure of the external-debt negotiations and roughly reflect the 1993 sound foreign accounts values, corrected to allow for a probably much higher rate of capacity utilization in 1996.

The base-year value for (λ) was assumed to be .005 (i.e. 0.5% of the GDP). Using [5.22], the value of v_0 was established in such a way as to make $\sigma_1(\lambda)$ equal to 0.2 when (λ) assumes the base-year value. A graph of $\sigma_1(\lambda)$ for two different assumptions about the elasticity (v) in [5.21] is available in the appendix. In the simulation discussed below (v) was assumed to be equal to 0.1.

A similar treatment was given to (k). Using [5.21], the value of k_0 was determined in such a way as to make the incremental capital-output ratio (1/k) equal to 3.5 -- for any pair of assumptions about the elasticity values ($\mu 1$) and ($\mu 2$) -- when (Γ_1) and (λ) assume their base-year values. In the case of (Γ_1), the assumed base-year value was 0.15. Two other graphs in the appendix show cross-sections of $1/[k(\Gamma,\lambda)]$ for different values of the elasticities ($\mu 1$) and ($\mu 2$). In the simulations below, ($\mu 1$) was assumed to be equal to 0.25 and ($\mu 2$) to 0.1.

The simulation exercise described here explores the post-stabilization feasible average annual economic growth rate in a more open economy and under a more growth-oriented pattern of public expenditure. The constructed scenario assumes a considerable liberalization of imports of both capital goods and construction services; enough to double the import coefficient (Γ_1) from 0.15 to 0.3, giving rise to a much more favorable k. The scenario also assumes a significant post-stabilization fiscal-adjustment effort, making (τ) equal to 3.6% of GDP. For an economy which would be emerging from fifteen-year long high inflation experience, it was prudently assumed that the sustainable public-sector deficit (d) would actually be negative. It was made equal to -0.8% of GDP. On the other hand, given the many years of very sound

external accounts, and assuming the maintenance of the external liberalization policy adopted after 1990, it was reasonable to assume that (ϕ), the sustainable current account deficit, could be equal to 1.3% of GDP.

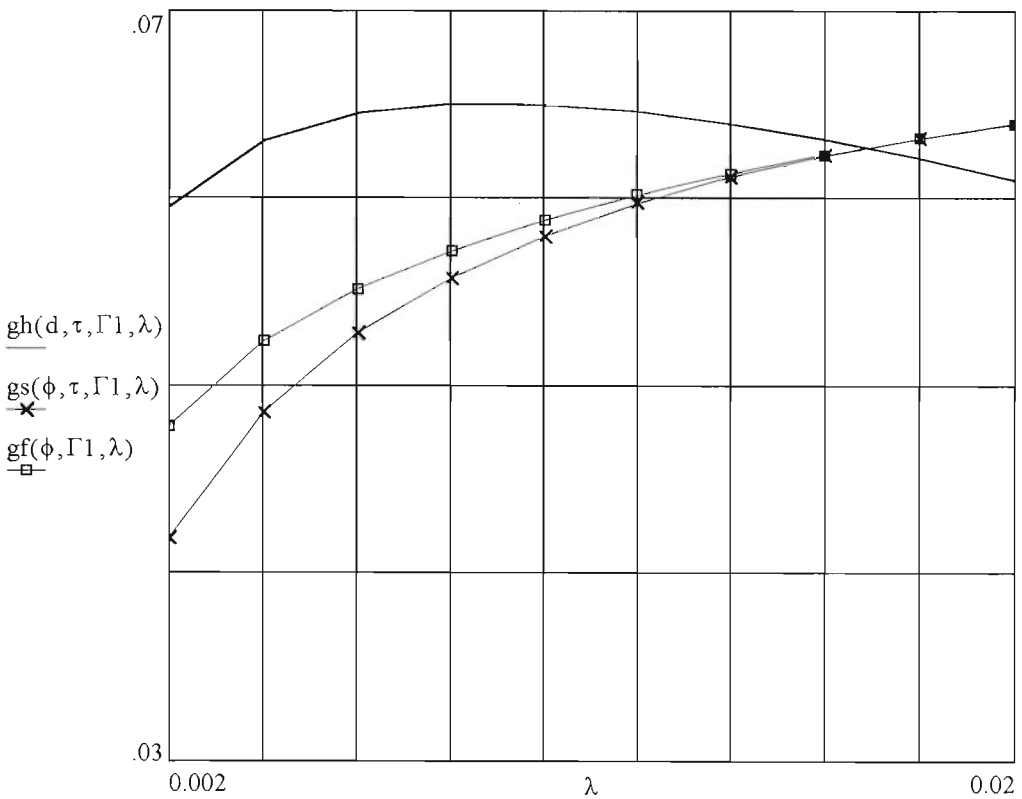
The growth possibilities of such scenario may be examined below in figure 5.1. It shows the maximum average annual GDP growth rates established by the constraints given by equations [5.13] to [5.15], for different assumptions about (λ), the volume of government expenditures in productivity-enhancing programs. The maximum feasible growth rate consistent with the three constraints taken together would be roughly 6.3%.

It is interesting to notice that, from the viewpoint of the fiscal constraint, given by the schedule (g_h) in the upper part of the graph, the level of (λ) that would maximize the average annual growth rate would be much lower than the one which makes (g_h) equal to approximately 0.063, or 6.3%. The derivative $\partial g_h/\partial\lambda$ eventually becomes negative (for (λ) values greater than approximately 0.01), as suggested by [5.17] above. This means that a budget-based planner could be led to choose a value for (λ) so as to obtain maximum (g_h). Nevertheless, in the logic of gap-analysis when the savings (g_s) and external (g_s) constraints are also taken into account and prices are unable to adjust, it becomes clear that the maximum growth rate allowed by the (g_h) schedule alone would not be attainable under the assumed value for the parameters. Therefore it makes sense for a three-gap conscious K.O.R.E.A. planner to expand (λ) beyond 0.01 because that contributes to slacken the other two constraints.

Given the set of values used for the parameters, condition [5.20] will hold, for any value of (λ) in the considered range, making $\partial g_s/\partial\lambda > 0$. As seen above, the external constraint is always positively affected by (λ) through the effect on investment productivity .

FIGURE 5.1

THE THREE GROWTH CONSTRAINTS



A final remark could be made regarding alternative closures for the model through the roles of the exchange rate and the interest rate using the situation explored in the above example. First, note that lower expenditures in K.O.R.E.A. than is necessary for satisfying both the external and the savings constraint would mean that there would be pressures both for a real devaluation and for higher domestic interest rates relatively to international rates which would shift both constraints upwards and the fiscal constraint downwards, bridging the gap between the gaps. This suggests that the resulting equilibrium growth rate would probably lie somewhere between the fiscal-minded K.O.R.E.A. planner growth rate and the long run rate that would be obtained by a three-gap conscious K.O.R.E.A planner. The ability of such price movements to perform their expected roles in the long run adjustment depends, of course on assumptions concerning their dynamics which are far beyond the scope of this paper.

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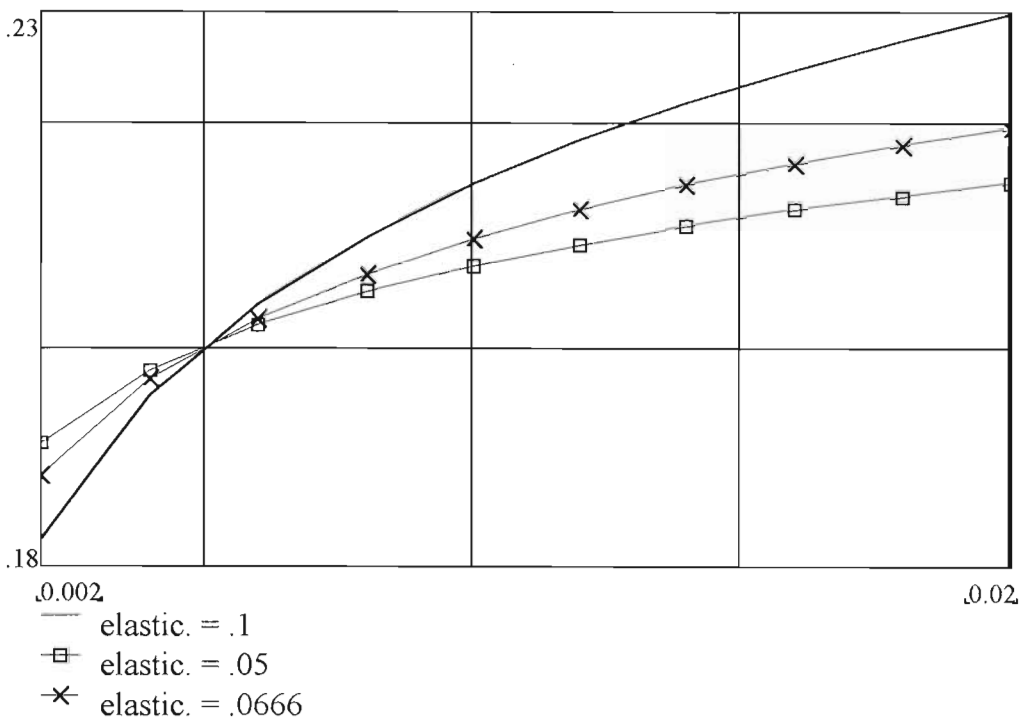
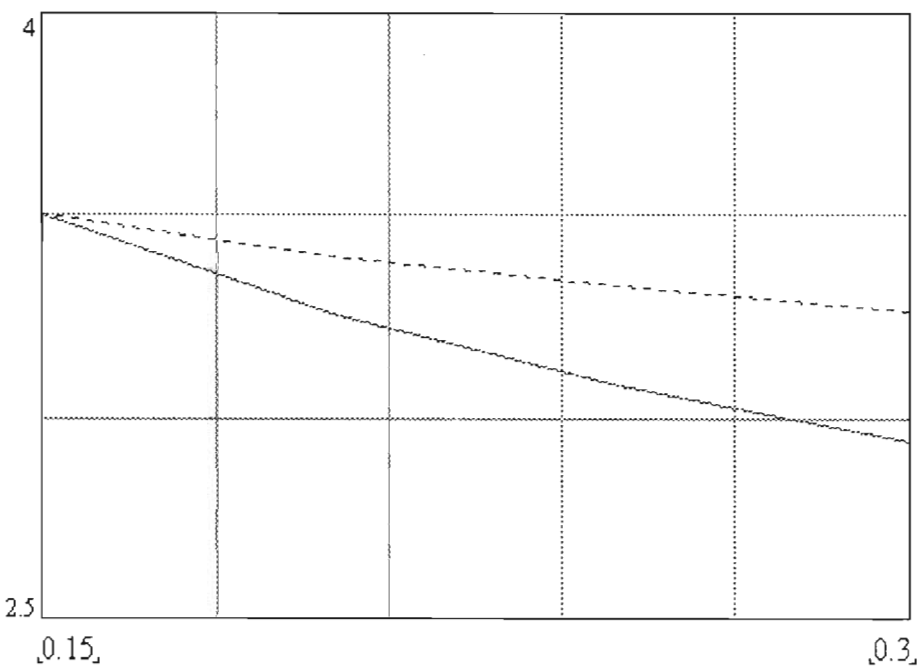
APPENDIX

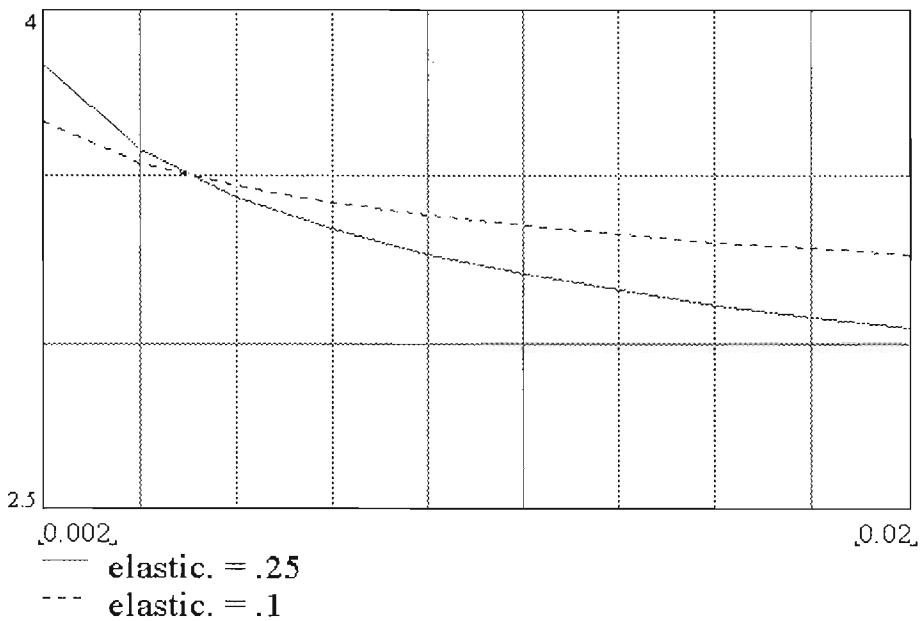
$\sigma_1(\lambda)$ FOR DIFFERENT VALUES OF THE ELASTICITY (v)



THE INCREMENTAL CAPITAL-OUTPUT RATIO (1/k)
AS A FUNCTION OF (Γ_1)
FOR DIFFERENT VALUES OF THE ELASTICITY ($\mu 1$)
($\lambda = .05$ and $\mu 2 = .01$)



THE INCREMENTAL CAPITAL-OUTPUT RATIO (1/k)
AS A FUNCTION OF (λ)
FOR DIFFERENT VALUES OF THE ELASTICITY ($\mu 2$)
($\Gamma_1 = .15$ and $\mu 1 = .25$)



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