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A Multisectoral Analysis of the Structural Adjustment of the Brazilian Economy in the 1980's

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Abstract

The essence of the policy designed to overcome the present external disequilibrium of the Brazilian economy in the long run seems to be a deep change in the sectoral growth pattern of the economy, in such way as to generate the structural adjustment consistent with the adoption of bold programs of import substitution and exports expansion, that will eventually give rise to substantial superavits in the trade balance. If it is accepted – as a working hypothesis – that this strategy may be reasonably realistic, there are key questions about its consistency that should be answered. So far, however, the adoption of such a strategy has been based on analyses that – though intuitively attractive – leave more room to merely impressionistic considerations that would seem fit. It is necessary therefore to try to find out in a more consistent and systematic way how that strategy really unfolds.

This paper is a contribution to that complex task. Section II presents a multisectoral consistency model that will allow an exploration – using simulations – of the logical consequences of the adoption of strategies designed to overcome the external disequilibrium of the Brazilian economy in the eighties, on the basis of bold programs of import substitution and exports expansion. The objective is to be able to visualize the extension and nature of the required changes in the productive structure and the growth pattern, as well as to outline the involved investment program. The hypotheses about key exogenous variables are discussed in section III. The results of the simulations referring to the growth pattern and the productive structure are presented in section IV. Those referring to the investment pattern in sections V and VI. The main conclusions are assessed in section VII.

I

A retrospect of the ways the economic policy in Brazil has been tackling the mounting foreign sector difficulties in the country over the last few years would hardly allow any clear-cut identification of the followed strategy. Quite on the contrary, particularly in what concerns the short and medium run policies, what has been observed is a succession of experiments that is far from outlining a plan of action. However, when it comes to the long run policy, it is much easier to detect – notwithstanding occasional contradictions – a clearer thread. The essence of the policy designed to overcome the external disequilibrium in the long run seems to be a deep change in the sectoral growth pattern of the economy, in such a way as to generate the structural adjustment consistent with the adoption of bold programs of import substitution and exports expansion, that will eventually give rise to substantial superavits in the trade balance.

That is clearly an optimistic strategy, particularly in what concerns the expectations about exports performance, over a period for which most forecasts of world trade growth are extremely pessimistic. Nonetheless, if it is accepted, merely as a working hypothesis, that this strategy may be reasonably realistic, one has to worry about other kind of questions. More specifically, what should be the nature, the magnitude and the speed of the structural changes that would be required in order to allow such a strategy to be successful? What does that mean precisely in terms of changes in the growth pattern of the economy? What is the nature of the necessary reallocation of investments? In particular, how should State investments be reallocated?

Those are key questions about the consistency of the chosen long run strategy to overcome the external disequilibrium of the Brazilian economy. So far, however, the adoption of such a strategy has been based on analyses that – though intuitively attractive – leave more room to merely impressionistic considerations, than would seem fit. It is necessary therefore to try to find out in more a consistent and systematic way how such strategy really unfolds.

This paper is a contribution to that complex task. In the next section, we present a multisectoral consistency model that will allow an exploration – using simulations – of the logical consequences of the adoption of strategies designed to overcome the external disequilibrium of the Brazilian economy in the eighties, on the basis of bold programs of import substitution and exports expansion. The objective is to be able to visualize the extension and nature of the required changes in the productive structure and the growth pattern, as well as to outline the involved investment program. The hypotheses about key exogenous variables are discussed in section III. The results of the simulations referring to the growth pattern and the productive structure are presented in section IV. Those referring to the investment pattern in sections V and VI. The main conclusions are assessed in section VII.

II

The model is a consistency model in the sense that it does not deal with questions of feasibility[1], but with what has been called "requirements analysis"[2]. The economy is disaggregated in 30 sectors following what might be seen as a two-digit industry classification altered to allow singling out sectors that – according to a priori considerations – were expected to play particularly important roles in the process under analysis.

As to the logical structure of the model, a distinguishing feature is that all endogenous variables relate to the same year, namely the terminal year of the planning period. That means that one may deal with changes that might happen during a period of time, but not with the time phasing within that period[3], the base and terminal year are 1978 and 1990[4]. Key exogenous variables are the sectoral import substitution and exports expansion targets, as well as the aggregate output growth rate. Once their values are established, the model in supposed to generate the required sectoral growth rates, the involved investment program and the implicit changes – also on a sectoral basis – in the productive structure.

In fact, that can be done in more than one way, the choice depending upon the sophistication of the hypotheses concerning the investment by sector of origin and upon how much one is concerned with eventual inconsistencies between the aggregate incremental capital-output ratio and the composition of the investment by destination. The model does it in a way that allows, at the same time, reasonable levels of analytical sophistication, computationa1 treatability and reliability of the results. There is no recourse to a dynamic model, but the investment is treated endogenously in a way that takes into account the main differences amongst the capital structure of the various sectors.

Table 1 provides a list of the model's variables and parameters. Variables with a zero subscript refer to values at the base year of the planning period. Those which refer to values at the terminal year are written without any numerical subscript. The model's formulation is given by the set of equations presented in table 2.

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[1] See Clark (1975) for a good discussion about the difference between consistency and feasibility models.

[2] See, for example, Bergsman and Manne (1966).

[3] In this sense the model is similar to those developed, for example, by Bruno (1966), Manne (1966), Lopes (1972) and Werneck (1980).

[4] We did not choose a more recent base year for several reasons. In the first place, the model assumes that each sector's growth, as well as the investment requirements, are determined by demand expansion. That may be a realistic hypothesis only if such expansion is referred to an initial situation for which it is fair to suppose full employment or, at least, low idle capacity. Being that the case, more recent years would be less appropriate than 1978. In the second place, the implementation of the present long run strategy, involving bold import substitution and exports expansion programs, become significantly more aggressive since 1979, with the mounting foreign sector difficulties. If we take into account the natural lags involved in investment maturation, the estimation of investment requirements using a more recent base year could lead to an exaggeration of the required capital outlays, since there would be no allowance for the investment effort already made. Finally, the most recent year for which we could get reasonably reliable data for the model was precisely 1978.

Equation [1] is a straightforward determination of the GDP at the terminal year, given an exogenous target for the average annual growth rate during the course of the planning period. In equations [2] sectoral gross output levels are determined in the usual way. Stock variations are supposed null, h comprising only gross fixed investment demand for what is produced in the i^{th} sector. Sectoral growth rates are given by equations [3].

Table 1

List of the Model's Variables and Parameters[5]

1. Exogenous Variables

T – Length of the planning period

Y_0 – Gross domestic output at the base year

g – Target average annual growth rate of GDP

X_{io} – Output of the i^{th} sector at the base year

β_{i0} – Ratio of imports to domestic production for the i^{th} sector at the base year

β_i – Ratio of imports to domestic production for the i^{th} sector at the terminal year

v_i – Expected average annual growth rate for the i^{th} sector's exports

v_{i0} – Export demand for the i^{th} sector's output at the base year

C_{i0} – Consumers' demand for the i^{th} sector's output at the base year

Con_0 – Aggregate consumers' demand at the base year

g_N – Population growth rate

I_0^H – Gross residential investment at the base year

2. Endogenous Variables

Y – Gross domestic output at the terminal year

X_i – Output of the i^{th} sector at the terminal year

C_i – Consumers' demand for the i^{th} sector's output at the terminal year

G_i – Government's consumption demand for the i^{th} sector's output at the terminal year

I_i – Investment demand for the i^{th} sector's output at the terminal year

M_i – Imports competitive to the i^{th} sector's output at the terminal year

[5] Variables with a zero subscript refer to values at the base year of the planning period. Those which refer to values at the terminal year are written without any numerical subscript.

g_i – Average annual growth rate of the i^{th} sector's output

Imp – Total imports at the terminal year

V_i – Export demand for the i^{th} sector's output at the terminal year

Exp – Total exports at the terminal year

Inv – Aggregate investment at the terminal year

I^D – Non-residential net-investment at the terminal year

I^R – Non-residential replacement investment at the terminal year

I^H – Gross residential investment at the terminal year

J_i – Net investment in the i^{th} sector at the terminal year

r_i – Stock-flow conversion factor of the i^{th} sector

R_i – Accumulated net requirement of investment in the i^{th} sector

Gov – Aggregate government's consumption demand at the terminal year

Con – Aggregate consumers' demand at the terminal year

q_i – Share of the i^{th} sector in total value added at the terminal year

k – Aggregate incremental capital-output ratio (output measured as gross production)

k' – Aggregate incremental capital-output ratio (output measured as value added)

Z_i – Share of the i^{th} destination sector in the total net accumulated investment requirements

z_i – Share of the i^{th} destination sector in the terminal year investment

R_i^E – Accumulated net requirement of State investment in the i^{th} sector

J_i^E – Net State investment in the i^{th} sector at the terminal year

I^E – Aggregate net State investment at the terminal year

Z_i^E – Share of the i^{th} destination sector in total net accumulated State investment requirements

z_i^E – Share of the i^{th} destination sector in the terminal year net State investments

U – State's share in the total net accumulated investment requirements

u – State's share in non-residential net investment

3. Parameters

a_{ij} – Input-output coefficient

k_i – Incremental capital-output ratio of the i^{th} sector

δ – Depreciation coefficient (as a percentage of GDP)

ζ_i – Proportion of the net investment in the i^{th} sector that is made in constructions

$\bar{\zeta}$ – Proportion of the replacement investment made in constructions

Θ_i' – Distribution coefficient of demand for investment in equipment

b – Ratio of aggregate government's consumption to GDP

γ_i – Government's consumption demand distribution coefficient

ε_i – Engel's elasticity of the consumers' demand for the i^{th} sector's output

ε_H – Engel's elasticity of the residential investment demand

α_i^E – State's share in the i^{th} sector

Table 2

The Model's Formulation

I) Gross domestic output

[1] $Y = (1+g)^T Y_o$

II) Output by sector

[2] $X_i = \sum_{j=1}^{30} a_{ij} X_j + C_i + G_i + I_i + V_i - M_i \qquad i = 1, 2, \ldots, 30$

III) Growth rate by sector

[3] $g_i = \left[\frac{X_i}{X_{i0}}\right]^{\frac{1}{T}} - 1 \qquad i = 1, 2, \ldots, 30$

IV) Imports (competitive) by sector

[4] $M_i = \beta_{i0} X_i - (\beta_{i0} - \beta_i) X_i = \beta_i X_i \qquad i = 1, 2, \ldots, 30$

V) Total imports

[5] $Imp = \sum_{i=1}^{30} M_i$

VI) Exports by sector

[6] $V_i = (1+v_i)^T V_{i0} \qquad i = 1, 2, \ldots, 30$

VII) Total exports

[7] $Exp = \sum_{i=1}^{30} V_i$

VIII) Aggregate investment

[8] $Inv = I^D + I^R + I^H$

IX) Non-residential net investment

[9] $I^D = \sum_{i=1}^{30} J_i$

X) Net investment by sector of destination

[10] $J_i = r_i R_i \qquad i = 1, 2, \ldots, 30$

XI) Accumulated net investment requirement by sector of destination

[11] $R_i = k_i (X_i - X_{i0})$

XII) Stock-flow conversion factor by sector

[12] $r_i = \frac{g_i}{1 - e^{-g_i t}} \qquad i = 1, 2, \ldots, 30$

XIII) Non-residential replacement investment

[13] $I^R = \delta Y$

XIV) Investment by sector of origin

[14] $I_{25} = \sum_{j=1}^{30} \zeta_j J_j + \bar{\zeta} I^R + I^H$

[15] $I_i = \Theta_i' [\sum_{j=1}^{30} (1 - \zeta_j) J_j + (1 - \bar{\zeta}) I^R] \qquad i = 1, 2, \ldots, 24, 26, \ldots, 30$

XV) Aggregate government's consumption demand

[16] $Gov = by$

XVI) Government's consumption demand by sector

[17] $G_i = \gamma_i Gov$ $\quad i = 1, 2, \ldots, 30$

XVII) Aggregate consumers' demand

[18] $Con = Y - Gov - Inv - Exp + Imp$

XVIII) Consumers' demand by sector

[19] $C_i = \varepsilon_i \frac{C_{i0}}{Con_0} Con_0 + (1 + g_N)^T C_{i0}(1 - \varepsilon_i)$ $\quad i = 1, 2, \ldots, 30$

XIX) Residential gross investment

[20] $I^H = \varepsilon_H \frac{I_0^H}{Con_0} Con_0 + (1 + g_N)^T I_o^H (1 - \varepsilon_H)$

XX) Composition of the total value added by sector

[21] $q_i = \frac{\lambda_i X_i}{\sum_{i=1}^{30}(\lambda_i X_i)}$ $\quad i = 1, 2, \ldots, 30$

XXI) Aggregate incremental capital-output ratios

[22] $k = \frac{\sum_{i=1}^{30} k_i (X_i - X_{i0})}{\sum_{i=1}^{30}(X_i - X_{i0})}$

[23] $k' = \frac{\sum_{i=1}^{30} k_i (X_i - X_{i0})}{\sum_{i=1}^{30} \lambda_i (X_i - X_{i0})}$

XXII) Composition of the total net accumulated investment requirements by sector of destination

[24] $Z_i = \frac{R_i}{\sum_{i=1}^{30} R_i}$ $\quad i = 1, 2, \ldots, 30$

XXIII) Composition of the net investment by sector of destination

[25] $z_i = \frac{J_i}{I^D}$ $\quad i = 1, 2, \ldots, 30$

XXIV) Accumulated net requirement of State investment by sector of destination

[26] $R_i^E = \alpha_i^E R_i$ $\quad i = 1, 2, \ldots, 30$

XXV) State net investment by sector of destination

[27] $J_i^E = \alpha_i^E J_i$ $\quad i = 1, 2, \ldots, 30$

XXVI) Aggregate State net-investment

[28] $I^E = \sum_{i=1}^{30} J_i^E$

XXVII) Composition of the total net accumulated State investment requirement by sector of destination

[29] $Z_i^E = \frac{R_i^E}{\sum_{i=1}^{30} R_i^E}$ $\quad i = 1, 2, \ldots, 30$

XXVIII) Composition of the net State investment by sector of destination

[30] $z_i^E = \frac{J_i^E}{I^E}$ $\qquad i = 1, 2, \ldots, 30$

XXIX) State's share in the total net accumulated investment requirements

[31] $U = \frac{\sum_{i=1}^{30} R_i^E}{\sum_{i=1}^{30} R_i}$

XXX) State's share in the non-residual net investment

[32] $u = \frac{I^E}{I^D}$

Imports and exports at the terminal year are determined in equations [4] to [7] through import substitution targets $(\beta_{i0} - \beta_i)$ and annual average growth rates of exports from the various sectors (v_i), which are established exogenously. Given the nature of the issues to be analyzed that seems to be a proper way to deal with exports and imports in the model. One may notice that all imports are treated as competitive. The scale and the degree of complexity already attained by the Brazilian economy make that a reasonable hypothesis to be assumed in a multisectoral model with the level of aggregation that is adopted here. Equations [4] assume a fixed proportion between a sector's gross output and the imports that are competitive to that sector's production. However, there is an allowance to changes in those proportions as a result of import substitution programs[6].

In equation [8] aggregate investment at the terminal year is divided into non-residential net investment (I^D), non-residential replacement investment (I^R) and gross residential investment (I^H). Such decorrposition is based, in the first place, on the sinple fact that residential and non-residential investments have quite different determinants, Furthermore, as will be seen below, the model determines the replacement component of the non-residential investment in a way that is well different from that which is adopted for the estimation of the net component.

The latter is given by equation [9], as the summation of net investments by sector of destination. Those, in turn, are determined in equations [10] that establish that the net investment in a given sector at the terminal year is a fraction (r_i) of the investment requirement, accumulated over T years in the sector. Such requirement is obtained in equations [11], where k_i is the i^{th} sector's capital-output ratio.

The fraction r_i – known in the literature as stock-flow conversion factor – may be obtained for the various sectors through equations [12]. It is assumed that net investment in each sector grows over the period at an exponential rate equal to the respective sector's output growth rate. Being that case, net investment made at year T as a proportion of total net investment, accumulated over T year, is given by equation [12]. A similar equation may be found in Manne (1966) that, however, adopts

[6] This is a common way to deal with competitive imports in multisectoral models. See Srinivasan (1975).

the same factor value for all sectors, based on what is expected to be the average sectoral growth rate. In the specification adopted in [12], not only we have different stock-flow conversion factors for each sector, but we also have an endogenous determination of such factors. That certainly makes the model more consistent, especially when the model is to be used be analyse a process in which significant structural changes are expected, with the sectoral growth rates showing a large variance. Though it is known that the value of r_i in expression [12] is not extremely sensitive to g_i, the differences may be quite important for g_i values that belong to a plausible sectoral growth rates range[7].

Non-residential replacement investment in year T is given by equation [13]. In fact, the greatest advantage of such specification is that it is fully consistent with the method by which depreciation is estimated in the Brazilian National Accounts – a fixed proportion of the aggregate output[8].

Equations [14] and [15] determine investment by sector of origin at the terminal year. There is a basic differentiation between investment in construction and in equipment[9]. The demand for construction is given by equation [14]. To the residential investment (I^H), it is added the part of non-residential replacement investment that takes place in the form of construction ($\bar{\zeta} I^R$), as well as the summation of construction net investments made in the various sector. Notice that it is assumed that the investment in construction is a fixed proportion – for each sector, though variable across sectors – of the net investment made. It is also assumed that a fixed proportion ($\bar{\zeta}$) of replacement investment takes the form of expenditure in construction[10].

Equations [15] determine the demand for equipment, supplied by the other capital-goods producing sectors. Total demand for equipment – resulting from the aggregation of the net investment in equipment in the various sectors and the replacement investment made in equipment – is broken down amongst the various capital-goods producing sectors though distribution coefficients Θ'[11].

Government's consumption demand for the goods and Services produced by each sector at year T is obtained from equations [16] and [17]. Government's aggregate consumption is estimated as a fixed proportion of GDP in [16] and broken down amongst the various sectors according to coefficients in [17].

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[7] Notice that we are using the stock-flow method to determine investment by sector of destination. That method has often been used for the determination of investment by sector of origin, on the basis of the accumulated requirements of various kinds of capital goods. On the use of the stock-flow conversion factor see also Manne and Rudra (1965), Chenery and Bruno (1962), Manne (1963), Clark (1975) and Taylor (1975).

[8] See Fundação Getúlio Vargas (1972).

[9] That is the basic differentiation used in Johansen (1960) and Johansen (1974), what allows "to take care of the more important differences in capital structure, without adding too greatly to the complexity of the model" [Johansen (1960), p. 42].

[10] Similar assumptions are adopted in Johansen (1960) and Johansen (1974).

[11] Differently from Johansen that assumes a single "equipments" producing sector, we are working with several capital goods producing sectors, besides construction.

Aggregate consumers' demand is determined by equation [18] in a residual fashion. It is implicitly assumed that the economy is always able to adapt the consumption level in order to attain the required savings ratio. That equation is consistent with several different hypotheses about the adjusting process. Equations [19] are simply linearization of a logarithmic specification of Engel curves, that allow to break down aggregate consumers' demand at year T amongst the various sectors. The same specification is used in [20] to determine gross residential investment[12]. The outputs composition at year T is obtained from equations [21], that determine each sector's share in total value added. Comparisons with the sectoral distribution of value added at the base year may allow a visualization of the direction of the main structural changes implied by a given growth pattern.

The implications in terms of the aggregate incremental capital-output ratio are determined by equations [22] and [23]. The first estimates such ratio on the basis of gross output, the second on the basis of value added.

The composition – by sector of destination – of the total net investment requirements accumulated over T year is given by equations [24]. Equations [25] give the composition of the total net investment at year T. The following equations have to do with the State investment. The net State investment requirements, accumulated over T years, by sector of destination, is determined in [26]; the net State investment in year T, by sector of destination, in [27]. Notice that, both in [26] and [27], it is assumed that the State's share in each sector remains constant over the period under analysis, that must be understood much more as a working hypothesis than as a forecast.

In fact, the sensitivity of the results of the simulations to changes in that particular hypothesis is reasonably easy to perceive.

In [28] net State investment in year T is obtained through the aggregation of the State investment in the various sectors. Similarly, to [24] and [25], [29] and [30] allow a breakdown of the State investment by sector of destination. The State's share in the accumulated investment is given by [31]; in the investment in year T by [32].

The model is block-recursive. Solution is obtained by first solving the system formed by equations [1] to [20] and then that which comprises equations [21] to [32][13].

[12] A similar specification for the determination of residential investment may be found in Bruno (1966). Notice that, both the model and the used input-output data do not consider residential investment as consumers' demand, what does *not* mean that we cannot use a specification as in [20].

[13] For details about the solution and the utilized data see Werneck (1982).

III

We are basically concerned with exploring the sensitivity of the growth and investment patterns, as well as of the productive structure at the terminal year, to different hypotheses about exports expansion and import substitution during the period under analysis.

In the first place we had to find out a way to adopt different assumptions about the sectoral exports growth rate (v_i) that would allow a resonably sinnple sensitivity analysis. The starting point was the sectoral exports growth rates ($\bar{v}_i$), observed for the period 1970-78. The substitution of these rates in [6] and the use of [7] lead to

$$Exp = \sum_{i=1}^{30} (1 + \bar{v}_i)^T V_{io} = (1 + \bar{v})^T Exp_0 \quad [33]$$

where Exp_0 is the level of total exports in 1978, the base year of the model, and $\bar{v}$ the implicit growth rate of total exports.

Naturally, given the excellent performance of exports during that period – made feasible by peculiar and extremely favourable conditions in terms of world trade expansion – $\bar{v}$ represents an excessively optimistic hypothesis about total exports growth during the period 1978-1990. The question is how to adopt less optimistic hypothesis about exports expansion and, at the same time, take into account the distinct dynamism shown by exports from different sectors during the period 1970-1978.

Let v – instead of $\bar{v}$ – be a reasonable hypothesis for the total exports growth rate. On the basis of the rates $\bar{v}_i$, how could we also adopt more reasonable hypothesis about the sectoral exports growth rates (v_i), that are consistent with the rate v?

From [33] we have that the accumulated growth of total exports, in case the adopted rate was $\bar{v}$ – consistent with sectoral rates $\bar{v}_i$ – would be given by

$$\Delta Exp(\bar{v}) = [(1 + \bar{v})^T - 1]Exp_0 = \sum_{i=1}^{30} [(1 + \bar{v}_i)^T - 1]V_{io} \quad [34]$$

Similarly, with a rate v – consistent with sectoral rates v_i – we would have

$$\Delta Exp(v) = [(1 + v)^T - 1]Exp_0 = \sum_{i=1}^{30} [(1 + v_i)^T - 1]V_{io} \quad [35]$$

From [34] and [35] we get

$$\frac{\sum_{i=1}^{30}[(1 + v_i)^T - 1]V_{io}}{\sum_{i=1}^{30}[(1 + \bar{v}_i)^T - 1]V_{io}} = \frac{(1 + v)^T - 1}{(1 + \bar{v})^T - 1}$$

What may lead to

$$v_i = \{\frac{(1+v)^T - 1}{(1+\bar{v})^T - 1}[(1+\bar{v}_i)^T - 1] + 1\}^{\frac{1}{T}} - 1 \qquad i = 1,2,\ldots,30 \quad [36]$$

that establish sectoral exports growth rates, obtained on the basis of the rates $\bar{v}_i$ and consistent with the assumption of total exports growing at a rate v. In other words, equations [36] allow a normalization of the sectoral rates $\bar{v}_i$, according to the aggregate rate v[14].

In the simulations that will be discussed below four different hypotheses about total exports expansion during the period 1978-1990 where adopted, making v equal to 2.5, 5.0, 7.5 and 10%. Using equations [36], each one of these values gave place to consistent assumptions about the sectoral exports growth rates (v_i).

In what concerns the adoption of hypotheses about the intensity of the import substitution process, attention was concentrated in three basic intermediary goods producing sectors and in the mineral fuels extraction sector (3)[15]. It was assumed that the import coefficients β_i of the sectors iron & steel (5) and paper pulp (12) would be reduced to zero at the end of the period under analysis. For the non-ferrous metals (7) sector, it was assumed that the import coefficient would be reduced to 0.25 in 1990. All values were estimated on the basis of sectoral expansion plans which are in course[16]. Finally, for the mineral fuels extraction sector (3), the value of the import coefficient in 1990 was initially assumed to be equal to 1.5. Since such coefficient is defined as the ratio of imports to domestic production, that amounts to an assumption that imports would account for 60% of the total supply of mineral fuels. Latter, a sensitivity analysis of the results to that particular hypothesis was made.

For the remaining sector it was simply assumed that the import coefficients would not change during the period, what means no import substitution in those sectors. Again, that should rather be seen as a working hypothesis than as a forecast. Table 3 presents all imports coefficients at the base year (β_{i0}) and the assumed values for the terminal year.

As to the assumptions about the GDP growth rate, we considered values between 3 and 8% yearly.

[14] It should be noticed that this amounts to estimate the increment in a given sector's exports using the observed elasticity of that sector's exports with respect to total exports.

[15] The name of every sector mentioned will be followed by its number in our classification.

[16] See Secretaria de Planejamento da Presidência da República (1982) and Conselho de Desenvolvimento Industrial (1981).

Table 3

Import Coefficients

Sectors	Base Year β_{i0}	Terminal Year β_{i0}
1. Agriculture	.071	.071
2. Non-Fuels Mining	.163	.163
3. Mineral Fuels Extraction	6.505	1.500
4. Nonmetallic Minerais	.047	.047
5. Iron & Steel	.066	0
6. Foundry & Metal Processing	.064	.064
7. Nonferrous Metals	.915	.250
8. Machinery	.347	.347
9. Electric & Electronic Goods	.242	.242
10. Transportation Goods	.128	.128
11. Wood & Furniture	.009	.009
12. Paper Pulp	.121	0
13. Paper & Cardboard	.070	.070
14. Rubber, Leather & Plastics	.051	.051
15. Fertilizers, Alkalis & Others	.856	.856
16. Alcohol & Vegetable Oils	.008	.008
17. Refinery & Heavy Petrochemicals	.097	.097
18. Other Chemicals	.208	.208
19. Perfumery & Pharmaceutical	.045	.045
20. Textile, Clothing & Footwsar	.016	.016
21. Food, Beverages & Tobacco	.019	.019
22. Printing, Publishing & Others	.089	.089
23. Electricity	0	0
24. Water & Sewage	0	0
25. Construction	0	0
26. Commerce, Storage, Road & Air Transportation	0	0
27. Rail Transportation	0	0
28. Waterbome Transportation	.306	.306
29. Communications	0	0
30. Other Services	0	0

IV

Table 4 presents the average annual growth rates (g_i) for the various sectors, when it is a assumed that the average yearly aggregate growth rate (g), from 1978 to 1990, will be equal to 3%. As indicated in the table, the results are presented for different hypotheses about the exports expansion rate, v ranging between 2.5 and 10%.

It is easy to single out sectors with a performance extremely sensitive to the assumption about exports expansion. The growth rate of non-fuels mining (2), for example, becomes three times larger when the most optimistic assumption about v is adopted, instead of the most pessimistic one. Also extremely sensitive are the rates (g_i) corresponding to machinery (8) and electric & electronic goods (9). With a somewhat lower sensitivity – though still significant – are the cases of non-ferrous metals (7), transportation goods (10), paper pulp (12), paper & cardboard (13), refinery & heavy petrochemicals (17), other chemicals (18), rail transportation (27) and water borne transportation (28)[17].

The sensitivity of the growth rates (g_i) of non-ferrous metals (7) and paper pulp (12) are not higher still because – as mentioned above and indicated in the table – the simulations assume quite intense import substitution processes in both sectors, what reduces the relative importance of the dynamic effect stemming from exports expansion. It may be seen that even for $v = 2.5\%$, the growth rates of both sectors are well above the average sectoral growth rate. This same discrepancy may be observed, in a much more significant way, in the case of mineral fuels extraction (3)[18].

[17] The observed sensitivity for rail transportation (27) is explained by the way the input-output matrix deals with the gross rail transportation margin associated to exports, which is treated as exports form sector (27).

[18] The fact that the construction sector (25) shows negative growth rates – though close to zero – is easily explainable. This is basically a capital goods producing sector, and the low investment ratio, required to make the economy grow at only 3% annually causes the sectoral output at the terminal year to be lower than it was at the base year, when the investment ratio was much higher. The same kind of effect appears in other capital goods producing sectors, as machinery (8), electric & electronic goods (9) and transportation goods (10), although it does not lead to negative growth rates, either because they do not produce only capital goods or because the produced capital goods are tradable goods, what allows those sectors' growth rates to be sensitive to the hypothesis about exports expansion.

Table 4

Average Annual Growth Rates by Sector (g_i)

Assumptions	g	3%			
	β_i	$\beta_3 = 1.5, \beta_5 = 0, \beta_7 = .25, \beta_{12} = 0$			
		$\beta_i = \beta_{i0}, i = 1, 2, 4, 6, 8, 9, 10, 11, 13, \ldots, 30$			
	v	2.5%	5.0%	7.5%	10.%
Sectors					
1. Agriculture & Livestock		3.00	3.00	2.99	2.98
2. Non-Fuels Mining		1.45	2.38	3.48	4.73
3. Mineral Fuels Extraction		13.11	13.58	14.17	14.87
4. Nonirtetallic Minerais		.32	.35	.39	.45
5. Iron & Steel		1.89	2.54	3.34	4.27
6. Foundry & Metal Processing		1.26	1.67	2.17	2.79
7. Nonferrous Metals		6.86	7.62	8.54	9.62
8. Machinery		0.79	1.86	3.10	4.49
9. Electric & Electronic Goods		1.35	2.30	3.42	4.70
10. Transportation Goods		1.54	1.98	2.53	3.20
11. Wood & Furniture		2.62	2.51	2.36	2.17
12. Paper Pulp		5.05	6.77	8.62	10.60
13. Paper & Cardboard		3.61	4.32	5.18	6.17
14. Rubber, Leather & Plastic		2.45	2.67	2.95	3.31
15. Fertilizers, Alkalis & Others		2.78	3.05	3.39	3.81
16. Alcohol & Vegetable Oils		5.76	6.02	6.36	6.77
17. Refinery & Heavy Petrochemicals		2.63	3.06	3.59	4.24
18. Other Chemicals		2.38	2.79	3.30	3.92
19. Perfumery & Pharmaceutical		3.83	3.72	3.58	3.39
20. Textile, Clothing & Footwear		3.41	3.57	3.76	4.01
21. Food, Beverages & Tobacco		3.03	3.00	2.97	2.93
22. Printing, Publishing & Others		3.48	3.47	3.46	3.45
23. Electricity		3.05	3.13	3.23	3.36
24. Water & Sewage		3.22	3.13	3.02	2.87
25. Construction		-.52	-.59	-.68	-.79
26. Commerce, Storage, Road & Air Transportation		3.10	3.05	2.97	2.88
27. Rail Transportation		2.19	2.65	3.22	3.90
28. Waterbome Transportation		1.48	1.89	2.40	3.02
29. Communications		4.72	4.48	4.17	3.75
30. Other Services		3.89	3.77	3.61	3.40

It should also be noticed that the growth, rates of the non-tradable goods producing sectors are, in general, lower the higher the assumed exports expansion rate. What is only natural since the

economy's growth rate is being kept constant. Besides construction (25), already mentioned, one nay list amongst those sectors other services (30), communications (29), commerce, storage etc. (25) and water & sewage (24)[19]. Electricity constitutes an important exception.

A growth pattern characterized by the leadership of exporting and import substituting sectors seems to emerge from the simulations. One should include amongst the import substituting sectors, the special case of alcohol & vegetable oils (16). The outstanding performance of this sector stems, however, not from a reduction in the sectoral import coefficient, but from a change in the consumption pattern, implied in the adopted value for the sector's Engel's elasticity[20].

What has to be analysed now is the impact of this new growth pattern on the productive structure of the economy. This may be done using table 5 that presents – for the same set of hypotheses that generated the results of table 4 – the importance of the various sectors in terms of value added generation at the terminal year (q_i). To make comparisons easier, values referring to the base year are also presented.

Especially outstanding is the increase, between 1978 and 1990, in the share of sectors for which import substitution was assumed: mineral fuels extraction (3)[21], non-ferrous metals (7) and paper pulp (12). The exception is iron & steel (5) which presents a fall in its share when the most pessimistic assumption about exports expansion is adopted. This is a consequence of that sector's low import coefficient at the base year. Even a reduction of this coefficient to zero does not lead to a very significant effect upon the sector's growth. However, it should be noticed that its share is highly sensitive to the assumption about exports expansion.

Quite a high sensitivity may also be observed for other sectors, particularly, non-fuels mining (2), machinery (8), electric & electronic goods (9) and transportation goods (10). Nonetheless, those sectors would only show higher shares at the terminal year, under extremely optimistic assumptions about exports expansion. The sensitivity of non-ferrous metals (7) and paper pulp (12) to v is also very clear, even though the increase in their shares follows to a large extent from the import substitution hypotheses, as was seen above. It should also be noticed the rise in the importance of alcohol & vegetable oils (16) as a consequence of changes in the pattern of fuels consumption, just mentioned.

[19] It must be remembered that, due to the way the input-output matrix deals with the exports' commercialization and transportation margins, the production of rail transportation (27) and part of sector (26), commerce, storage etc. may in fact be classified as tradable.

[20] Since the mid-seventies Brazil has been engaged in an important and original program designed to disseminate the use of alcohol in passengers' cars as a substitute for gasoline. So far that programme has been surprisingly successful. The adopted value for the sector's Engel's elasticity assumes the fulfilment of the program's targets.

[21] It should be pointed out that, as all data are estimated at 1970 prices – to be consistent with the input-output matrix – the share of the mineral fuels extraction (3) sector is well below what it would be, had the data been estimated at prices referring to 1978, for example.

Table 5

Sectoral Shares in Total Value Added

Year	1978		1990			
Assumptions		g	3%			
		β_i	$\beta_1 = 1.5, \beta_5 = 0, \beta_7 = .25, \beta_{12} = 0$ $\beta_i = \beta_{i0},\ i = 1, 2, 4, 6, 8, 9, 10, 11, 13, \ldots, 30$			
		v	2.5%	5.0%	7.5%	10.0%
Sectors						
1. Agriculture & Livestock	10.97		11.26	11.16	11.03	10.87
2. Non-Fuels Mining	.50		.43	.47	.53	.61
3. Mineral Fuels Extraction	.17		.54	.56	.59	.63
4. Nonmetallic Minerals	2.04		1.52	1.52	1.51	1.50
5. Iron & Steel	1.75		1.57	1.69	1.83	2.01
6. Foundry & Metal Processing	2.38		1.98	2.06	2.17	2.30
7. Nonferrous Metals	.25		.39	.42	.46	.51
8. Machinery	.2.88		2.27	2.56	2.92	3.39
9. Electric & Electronic Goods	1.78		1.50	1.66	1.88	2.14
10. Transportation Goods	3.79		3.27	3.42	3.61	3.85
11. Wood & Furniture	1.82		1.78	1.74	1.70	1.63
12. Paper Pulp	.06		.07	.09	.11	.14
13. Paper & Cardboard	.86		.95	1.02	1.11	1.23
14. Rubber, Leather & Plastics	1.26		1.20	1.23	1.25	1.29
15. Fertilizers, Alkalis & Others	.57		.57	.58	.60	.62
16. Alcohol & Vegetable Oils	.32		.45	.46	.47	.49
17. Refinery & Heavy Petrochemicals	1.43		1.40	1.46	1.53	1.63
18. Other Chemicals	.82		.78	.81	.85	.91
19. Perfumery & Pharmaceutical	1.88		2.12	2.08	2.02	1.95
20. Textile, Clothing & Footwear	2.52		2.71	2.74	2.77	2.81
21. Food, Beverages & Tobacco	5.99		6.16	6.09	6.00	5.89
22. Printing, Publishing & Others	3.06		3.31	3.28	3.24	3.19
23. Electricity	2.27		2.34	2.34	2.34	2.35
24. Water & Sewage	.22		.23	.22	.22	.21
25. Construction	7.70		5.20	5.12	5.01	4.88
26. Commerce, Storage, Road & Air Transportation	26.34		27.35	26.95	26.44	25.79
27. Rail Transportation	.16		.15	.15	.16	.17
28. Waterborne Transportation	.86		.73	.76	.80	.85
29. Communications	1.50		1.87	1.80	1.72	1.62
30. Other Services	13.86		15.77	15.42	14.97	14.41
Total	100.00		100.00	100.00	100.00	100.00

As expected, the share of non-tradable goods producing sectors is, in general, lower the higher the v value, although shares below the base year level may only be observed under an extremely

optimistic assumption about exports expansion. The exception is the significant reduction in the importance of the construction industry (25) that however stems from the assumption of a relatively low aggregate growth rate, as was already explained above. This same assumption is responsible for the reduction in the shares of the remaining capital goods producing sectors, that may be observed for low v values[22].

That suggests an analysis of the sensitivity of the sectoral growth rates (g_i) and value added shares at the terminal year (q_i) to different hypotheses about the aggregate growth rate (g). When higher g values are adopted, the first thing to be noticed is that those sectors for which quite rapid import substitution processes were assumed, continue to show growth rates significantly above the aggregate rate, what leads to a rise in their relative importance over the period. However, the discrepancies between those sectors' performance and the economy's tend to become smaller as g is increased.

On the other hand, though the sensitivity of some sectors' performance to the assumption about exports expansion remains detectable, it becomes smaller as the assumed aggregate growth rate increases. That happens with sectors whose performance is positively affected by exports expansion as well as with those that are negatively affected. When the value of v is risen from 2.5% to 10%, the growth rate of a typical exporting sector as non-fuels mining (2), increases from 5.3 to 7.6%, when g is assumed to be equal to 8%; while it increases frcm 1.4 to 4.7%, when g is made equal to 3%. Analogously, non-tradable goods producing sectors as, for example, communications (29) and other Services (30), still show falls in their growth rates when the v value is risen.

However, such falls tend to become smaller as g increases. Naturally, this lower sensitivity of the sectoral growth rates (g_i) to the hypothesis about exports expansion means an equally lower sensitivity of the sectoral terminal year value added shares (q_i) to the same hypothesis.

It should also be pointed out that the assumption of higher aggregate growth rates have a quite significant positive effect upon the performance of the capital goods producing sectors and their shares in the terminal year value added.

As a general statement, one may say that the impact of import substitution and exports expansion upon the growth pattern and productive structure tends to be rather substantial when it is assumed that the economy will grow at a relatively slow rate. But that impact tends to become less important, if more optimistic assumptions about the expansion of the aggregate output over the period under analysis are considered. As the difficulties that the Brazilian economy has been facing do not leave much room to optimism on that matter, it is reasonable to assume that scenarios that take into

[22] Similar reductions may be observed for sectors strongly linked to the capital goods producing sectors, construction (25) inclusive. That is the case of non-metallic minerals (4) and foundry & metal processing (6).

account slower growth rates represent more faithful outlines of what will be the expansion pattern and consequent changes in the productive structure over the next years.

V

Table 6 presents the composition of the net accumulated investment requirements by sector of destination, when a 3% annual aggregate growth rate is assumed, and the basic import substitution hypothesis previously adopted is maintained. The results are presented for different values assigned to the exports expansion rate (v). The percentage of the net investment requirement that has the i^{th} sector as destination is given by Z_i. Analogously, Z_i^E is the percentage of the State investment requirement that has the i^{th} sector as destination.

Naturally, those sectors with a performance that proved to be sensitive to the hypothesis about v in the previous section, show a share in investment that is equally sensitive to that sane hypothesis. Thus, as increasingly optimistic assumptions about exports expansion are adopted, the Z_i and Z_i^E values are altered, outlining a realocation of investrrents that, in general, is characterized by a fall in the share of non-tradable goods producing sectors and an increase in the share of the exporting sectors. Taking State investment, one may see that a rise in the v value generates significant increases in the participation of sectors as non-fuels mining (2), iron & Steel (5), non-ferrous metals (7), paper pulp (12) and rail transportation (27)[23], for example, and a sharp fall in the participation of sectors that typically produce non-tradable goods, as is the case of communications (29). When one takes total investment requirements, one may notice the gains in participation of machinery (8), electric & electronic goods (9), transportation goods (10), for example, and the losses of commerce etc. (26) and other services (30).

Some non-tradable goods producing sectors deserve special comments. The first one has to with the stability of the participation of electricity (23) that follows from the relative insensitivity of the aggregate demand of electricity to the composition of the aggregate output. The other one has to do with the zero participation of construction (25). With a negative growth rate, that sector's investment requirements should also be negative according to equation [11]. However, in the model's solution, we adopted the convention that in such cases the requirements would be considered equal to zero, what amounts to use [11] only when $X_i \geq X_{i0}$.

[23] As was pointed out before, the rail transportation margin associated to exports is considered as exports from sector 27, what explains the sensitivity of Z_i^E to v.

Table 6

Composition of the Net Accumulated Investment Requirements by Sector of Destination

Assumptions	g	3%							
	β_i	$\beta_3 = 1.5,\ \beta_5 = 0,\ \beta_7 = .25,\ \beta_{12} = 0$ $\beta_i = \beta_{i0},\ \ i = 1, 2, 4, 6, 8, \ldots, 11, 13, \ldots, 30$							
	v	2.5%		5.0%		7.5%		10.0%	
Sectors		Z_i	Z_i^E	Z_i	Z_i^E	Z_i	Z_i^E	Z_i	Z_i^E
1. Agriculture & Livestock		11.53	0	11.24	0	10.87	0	10.43	0
2. Non-Fuels Mining		.26	.57	.44	.94	.67	1.38	.94	1.87
3. Mineral Fuels Extraction		7.69	28.93	8.00	29.46	8.39	30.07	8.86	30.77
4. Nonmetallic Minerals		.18	0	.19	0	.21	0	.23	0
5. Iron & Steel		1.52	3.53	2.07	4.70	2.76	6.09	3.59	7.68
6. Foundry & Metal Processing		.82	.04	1.08	.05	1.40	.07	1.80	.08
7. Nonferrous Metals		.85	.84	.96	.93	1.11	1.04	1.28	1.16
8. Machinery		.27	.04	.66	.09	1.14	0	1.72	.22
9. Electric & Electronic Goods		.28	0	.49	0	.75	0	1.06	0
10. Transportation Goods		.91	.15	1.18	.18	1.5	.23	1.90	.28
11. Wood & Furniture		.68	0	.63	0	.57	0	.5	0
12. Paper Pulp		.13	.12	.18	.17	.25	.23	.34	.3
13. Paper & Cardboard		1.04	0	1.26	0	1.54	0	1.87	0
14. Rubber, Leather & Plastics		.5	0	.54	0	.59	0	.64	0
15. Fertilizers, Alkalis & Others		.4	.37	.44	.40	.48	.42	.53	.46
16. Alcohol & Vegetable Oils		.93	.05	.96	.05	1.01	.05	1.06	.06
17. Refinery & Heavy Petrochemicals		1.10	3.35	1.28	3.82	1.51	4.36	1.78	4.98
18. Other Chemicals		.5	.07	.58	.08	.68	.09	.81	.1
-19. Perfumery & Pharmaceutical		1.0	.06	.95	.06	.88	.05	.79	.04
20. Textile, Clothing & Footwear		3.83	.33	3.95	.34	.09	.34	4.25	.34
21. Food, Beverages & Tobacco		5.86.	.31	5.67	.29	5.43	.27	5.15	.25
22. Printing, Publishing & Others		1.25	.21	1.22	.20	1.18	.19	1.13	.18
23. Electric!ty		4.14	15.47	4.16	15.21	4.19	14.91	4.22	14.57
24. Water & Sewage		.42	1.60	.4	1.48	.37	1.34	.34	1.18
25. Construction		0	0	0	0	0	0	0	0
26. Commerce, Storage, Road & Air Transportation		23.63	11.82	22.59	11.05	21.31	10.15	19.76	9.12
27. Rail Transportation		.51	1.93	.62	2.29	.75	2.71	.91	3.19
28. Waterborne Transportation		1.10	2.25	1.38	2.81	1.75	3.47	2.20	4.22
29. Communications		3.51	12.49	3.21	11.19	2.85	9.66	2.40	7.90
30. Other Services		25.20	15.47	23.68	14.21	21.79	12.73	19.50	11.04
Total		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Reflecting what was already analysed in the previous section, import substituting and exporting sectors tend to show less important shares in the investment program when more optimistic hypotheses about the aggregate growth rate are assumed. In other words, the impact of import substitution and exports expansion fades away as higher expansion rates for the economy are assumed.

The investment pattern proved to be rather sensitive to the hypotheses about the import substitution process. Notice that, under the set of hypotheses adopted so far, mineral fuels extraction (3) occupy an outstanding position in the allocation of investment, particularly of the State investment, whatever the assumptions about v and g considered so far. Though this is partly explainable by the sector's high capital intensity, it is reasonable to verify to what extent it may also be attributed to the intense import substitution process assumed for the sector in the simulations.

So far, the value assigned to β_3 was 1.5 what, as was already pointed out before, corresponds to the assumption that 60% of the total supply of mineral fuels would be imported at the terminal year. To analyse the sensitivity of the results to that particular hypothesis, the simulations were run again for alternative β_3 values equal to 3, 2 and 1, which correspond to imports accounting to 75%, 66% and 50% of total supply respectively[24]. We also considered a separate scenario assuming non-occurrence of import substitution in all sectors ($\beta_i = \beta_{i0}$).

Comparisons of the obtained results allow in the first place the detection of an extreme sensitivity to the import substitution hypothesis of the share of iron & steel (5), paper pulp (12) and non-ferrous metals (7) particularly for the latter sector, for which a more intense substitution process was previously assumed. Furthermore, it is easy to detect a clear growing prominence of the share of mineral fuels extraction (3), as bolder hypotheses about import substitution in the sector are adopted. In fact, the value of proved to be a basic determinant of the composition of the State investments.

Naturally, this sensitivity to the import substitution targets is partially weakened when scenarios that contemplate more optimistic hypotheses about the aggregate growth rate are simulated.

Still about the investment pattern, it is worth making some comments on the results of the simulations for sane the aggregate variables. For low growth rates (g), the aggregate capital – output ratios, either in terms of gross output (k) or in terms of value added (k'), show some sensitivity to the hypothesis about exports expansion, both tending to diminish with an increase in v. On the other hand, this sane increase gives rise, in general, to an increment, though not very significant, in the State's share in total investment requirement (U). The sensitivity of those three variables to v tends to diminish when higher g values are assumed. As to import substitution, the adoption of the basic set

[24] As the β_i coefficient is defined as the ratio between imports and domestic production, the imports' share in total supply is given by $\beta_i/(1+\beta_i)$.

of assumptions – described in section III – causes k, k' and U to be higher than what they would be had we assumed no irrport substitution in all sectors.

With the results presented above one may visualize with some detail the outlines of the investment reallocation process involved in the probable structural adjustment of the Brazilian economy in the 1980's. However, given the need to make a reasonably simple sensitivity analysis, it was unavoidable to bunch together a large number of exogenous variables – as was done with the sectoral exports growth rates – as well as to limit to a certain extent the scope of the hypotheses about import substitution. That, undoubtly, may impose upon the results a certain degree of arbitrariness. What will be done now is to remedy in part that deficiency by presenting a more detailed sensitivity analysis of the investment reallocation process. Such analysis, in fact allows the estimation of sectoral parameters that may be used as guidelines of that process.

The starting point is a particular solution for the model corresponding to reasonable assumptions about the values of the key exogenous variables. For that matter g was set equal to 4%, v to 5% and the same basic set of import substitution hypotheses – described in section III and widely used above – was adopted. Once that solution was obtained, we tried to check the sensitivity of the net accumulated investment requirements, by sector of destination, to relatively small increments in a given sector's demand in the terminal year.

That increment may in fact be interpreted either as a rise in the sector's exports or as substitution of imports that are competitive to that sector's output. Thus, we could obtain estimations of the direct and indirect net investment requirements associated to the production corresponding to this increment in demand, distributed by sectors of destination of the investment. That exercise was repeated for various sectors, using always the same value for the demand increment – Cr$ 100 million at 1970 prices – in such a way as to get results that are comparable across sectors.

Hence, it was possible to generate a set of parameters that permit to estimate the impact upon the investment pattern of any rise in exports or import substitution in any sector of the economy. It also permits the identification of important linkages between investments that are made in different sectors, as well as between private and State investments. It permits still to compare investment efforts required by the same increment in exports – or import substitution - in different sectors[25].

Space constraint only allows to present here a sample of the obtained results, referring to an important exporting sector (table 7) and a sector for which an intense import substitution process has been assumed (table 8)[26]. Comprehension of those results may be made by some brief comments. According to table 8 a Cr$ 100 million cruzeiros rise in exports – or import substitution – in non-

[25] In fact, it would be preferable to work with the same foreign exchange generation value in each sector, measured in dollars instead of cruzeiros. Unhappily, that was not possible.
[26] Results referring to other sectors are presented in Werneck (1982).

ferrous metals (7) requires and investment effort amounting to Cr$ 280.93, of which only 62.57% refers to investment outlays in the sector itself. The total requirement of State investment amounts to Cr$ 101.25, of which 45.14% in the sector itself, 27.87% in electricity (25), 6.71% in rail transportation (27) and 5.79% in non-fuels mining (2). On the other hand, comparison of tables 7 and 8 allows one to conclude that although the direct and indirect investment required by a given increment in sectoral exports (or import substitution) is roughly comparable in both sectors, the requirements referring to non-fuels mining (2) involve a much larger participation of State investment.

VII

There is evidence that the impact of import substitution and exports expansion on the performance of most sectors of the Brazilian economy *during the seventies* was rather limited, to the point of not affecting in a significant way the growth pattern observed during that period[27].

However, the analysis developed in the previous section suggests that during the eighties such impact may become quite substantial. That analysis allowed a visualization of probable consequences of a strategy designed to overcome the structural external disequilibrium of the Brazilian economy, cri the basis of bold programs of import substitution and exports expansion during the period.

The results of the simulations, made with the model presented in section II, in fact indicate that, unless very optimistic assumptions about the aggregate growth rate are made, import substitution and exports expansion may prove to be fundamental determinants of the economy's growth and investment patterns. During the seventies, those effects were much less significant due to the great dynamism the economy was able to maintain. Under slower growth conditions, as those that probably will have to be faced during the eighties, such effects may become very important.

Broadly, the simulations reveal the outlines of a probable, and natural, increment in the importance of tradable goods producing sectors, particularly of those engaged in import substitution programs or more directly involved in export activities. What, as was seen, may require considerable changes in the investment pattern, especially in the composition of the State investment, that is bound to be determined to a large extent by intensity of the oil import substitution effort will effectively be made till the end of this decade.

[27] This evidence is presented in Werneck (1983).

Table 7

Direct and Indirect Investment Requirements, by Sector of Destination, of an Increment in Exports, or in Import Substitution, Amounting to Cr$ 100 millions in the Non-Fuels Mining Sector

Sectors of Destination of the Investment	Total Additional Investment		Additional State Investment	
	Cr$ millions	%	Cr$ millions	%
1. Agriculture & Livestock	.98	.36	0	0
2. Non-Fuels Mining	220.28	82.23	126.22	81.46
3. Mineral Fuels Extraction	6.85	2.55	6.80	4.39
4. Nonmetallic Minerais	1.06	.39	0	0
5. Iron & Steel	1.64	.61	1.00	.65
6. Foundry & Metal Processing	1.53	.57	.02	.01
7. Nonferrous Metals	.40	.15	.10	.06
8. Machinery	2.91	1.08	.10	.07
9. Electric & Electronic Goods	.30	.11	0	0
10. Transportation Goods	.22	.08	0	0
11. Wood & Furniture	.05	.02	0	0
12. Paper Pulp	.17	0	0	0
13. Paper & Cardboard	.14	.05	0	0
14. Rubber, Leather & Plastics	.20	.07	0	0
15. Fertilizers, Alkalis e Others	.95	.35	.23	.15
16. Alcohol & Vegetable Oils	.06	.02	0	0
17. Refinery & Heavy Petrochemicals	2.90	1.08	2.32	1.50
18. Other Chemicals	.93	.35	.03	.02
19. Perfurrery & Pharmaceutical	.02	0	0	0
20. Textile, Clothing & Footwear	.07	.02	0	0
21. Food, Beverages & Tobacco	.04	.01	0	0
22. Printing, Publishing & Others	.08	.03	0	0
23. Electricity	12.48	4.65	12.32	7.95
24. Water & Sewage	0	0	0	0
25. Construction	.36	.13	.03	.02
26. Commerce, Storage, Road & Air Transportation	8.00	2.98	1 .05	.68
27. Rail Transportation	4.06	1.51	4.06	2.62
28. Waterborne Transportation	.87	.32	.48	.31
29. Comunications	.01	0	.01	0
30. Other Services	.18	.07	.03	.02
Total	267.87	100.00	154.93	100.00

Table 8

Direct and Indirect Investment Requirements, by Sector of Destination, of an Increment in Exports, or in Import Substitution, Amounting to Cr$ 100 Millions in the Non-Ferrous Metals Sector

Sectors of Destination of the Investment	Total Additional Investment		Additional State Investment	
	Cr$ Millions	%	Cr$ Millions	%
1. Agriculture & Livestock	.86	.30	0	0
2. Non-Fuels Mining	10.24	3.64	5.87	5.79
3. Mineral Fuels Extraction	5.27	1 .87	5.24	5.17
4. Nonmetallic Minerais	.61	.21	0	0
5. Iron & Steel	3.64	1.29	2.23	2.20
6. Foundry & Metal Processing	6.36	2.26	.08	.08
7. Nonferrous Metals	175.80	62.57	45.70	45.14
8. Machinery	1.26	.44	.04	.04
9. Electric & Electronic Goods	.34	.12	0	0
10. Transportation Goods	.41	.14	.01	.01
11. Wood & Fumiture	.08	.03	0	0
12. Paper Pulp	.05	.02	.01	.01
13. Paper & Cardboard	.73	.26	0	0
14. Rubber, Leather & Plastics	.32	.11	0	0
15. Fertilizers, Abkalis & Others	2.24	.79	.54	.54
16. Alcohol & Vegetable Oils	.11	.03	0	0
17. Refinery & Heavy Petrochemicals	2.12	.75	1.70	1.68
18. Other Chemicals	1.42	.50	.05	.05
19. Perfumery & Pharmaceutical	.05	.02	0	0
20. Textile, Clothing & Footwear	.19	.06	0	0
21. Food, Beverages & Tobacco	.14	.05	0	0
22. Printing, Publishing & Others	.27	.09	.01	.01
23. Electricity	28.58	10.17	28.21	27.87
24. Water & Sewage	0	0	0	0
25. Construction	.61	.22	.05	.05
26. Cornmerce, Storage, Road & Air Transportation	30.81	10.96	4.06	4.01
27. Rail Transportation	6.79	2.41	6.79	6.71
28. Waterbome Transportation	.71	.25	.39	.38
29. Conmunications	0	0	0	0
30. Other Services	.68	.24	.11	.11
Total	280.93	100.00	101.25	100.00

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