INTERREGIONAL EFFECTS OF ECONOMIC POLICIES: MULTI-SECTORAL GENERAL EQUILIBRIUM ESTIMATES FOR BRAZIL

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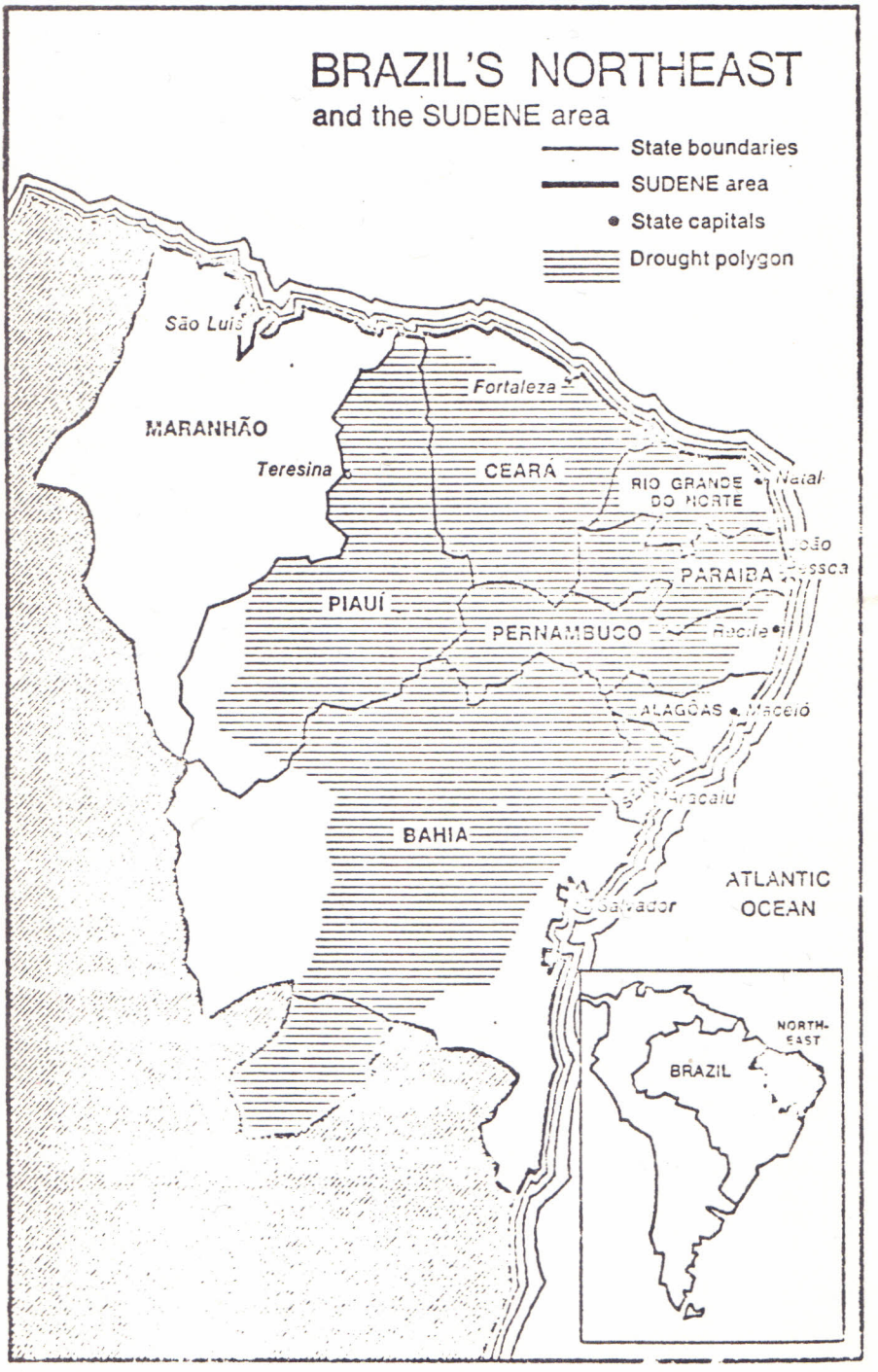
"We declare that we, the Bishops of the Holy Curch, are well aware of the supranatural and eternal mission that God has entrusted to us; but since it is necessary to work not only with pure spirits but also with human beings of flesh and soul, one must not forget that all that touches the flesh has its repercussion on the soul; we therefore affirm our right and duty to concern ourselves with the temporal well being of the people, especially in the underdeveloped region of the Northeast.

"Coming from us this interest shows our love for the flock which has been entrusted to us by Providence and helps save the social peace which has been endangered by the serious economic disparity between our region and the Center-South."

(Segundo Encontro dos Bispos do Nordeste, Natal, May 1959, Presidência da República, Rio de Janeiro, 1959, pp. 17-18, translated by Hirschman-1963, p. 85n).



Source: Roett (1972)

Chapter I

INTRODUCTION

1.1 Regional inequalities in the Brazilian process of economic development

The Northeast/Center-South duality has been a major concern not only for politicians but also for analysts of the Brazilian process of economic development.[1] A preliminary idea of the regional disparity, as of 1970, is indicated by the fact that the Northeast, with its 28.3 million people, represented 43.6% of the population but only 17.5% of the gross domestic product of the Center-South.

Throughout this study, the Northeast is considered to be composed by nine states: Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, and Bahia, which represented 14.4% of the Brazilian internal income in 1968. Center-South means the rest of Brazil, essentially composed - in terms of present income data - by the eight states of the Southeast and South (80.2% of the country's internal income in 1968). The Northeast occupies 18.2% of the Brazilian territory, or 600,000 square miles, larger than the combined area of France, Italy, Spain, and Portugal[2] - see map on the previous page.

Although a complete description of the regional duality is out of the scope of this study,[3] Table 1.1 gives a summary of twenty indicators of special relevance. These data give a gloomy picture of the regional problem that still exists, on which, to save time and space, no elaboration will be made here.

The stubborn persistence of the Northeast/Center-South income gap - and the perspective of the same trend for the 1970's as foreseen by the Bank of Northeast in its 1972 Report - seems surprising given the government investment policy adopted to remedy the regional duality. The data might suggest lack of effectiveness of such a policy, since in the period of its application and afterwards no significant changes have been observed in the relationship between the two regional incomes and related aggregates, despite important structural changes in sectoral composition. An alternative suggestion would be that the regional policy, per se, has indeed been effective in contributing to reduce the regional disparity, but other counterbalancing factors worked in the opposite direction. This poses an identification problem in the need to isolate and evaluate public policy effects.

Despite their political and economic relevance, regional aspects of protection and taxation in Brazil have

Table 1.1

SOCIO-ECONOMIC INDICATORS

Description	Northeast (1)	Center-South (2)	(1)/(2) (%)
1. Population, 1970 (million)	28.3	64.9	43.6
2. GDP at factor cost, 1970 (US$ billion equivalent)	4.7	26.8	17.5
3. Share of agriculture in domestic income, 1968 (percent)	37.9	19.6	193.4
4. Per-capita GDP, 1970 (US$)	166	413	40.2
5. Labor force as % of total population	29.0	33.3	87.1
6. Per-capita income of poorest 50% of labor force,1970(US$)	132	228*	57.9
7. Per-capita KWh consumption,'69	103	497	20.7
8. Per-capita gasoline consumption (liters), 1969	42	122	34.4
9. Per-capita cement consumption, 1969 (kg)	36	109	33.0
10. Illiteracy rate, 1970 (% of labor force)	54.8	29.7*	184.5
11. Enrollment ratio,'70(% primary)	45.0	70.0*	64.3
12. Percent of urban population supplied with water, 1970	30.0	51.0*	58.8
13. Percent of urban population served by sewerage, 1970	7.0	26.0*	26.9
14. Mortality rate, 1970 (per '000 population)	13.0	9.7	134.0
15. Infant mortality rate, 1970 (per '000 n.b.)	137.4	75.1	183.0
16. Life expectancy, 1970 (years of age)	49	61	80.3
17. Availability of medical doctors, 1968 (per 10,000 population)	2.3	7.9	29.1
18. Hospital beds, 1968 (per '000 population)	1.9	4.3	44.2
19. Protein daily intake, 1970 (% of minimum requirement by FAO)	85.0	125.0	68.0
20. Calorie daily intake, 1970 (% of minimum requirement by FAO)	74.0	120.0	61.7

* Brazil as a whole.

Sources: FGV (Contas Nacionais), IBGE (Anuários Estatísticos), BNB (Relatórios), and World Bank Reports.

only circumstantially and inadequately been dealt with in the literature. Most policymakers and analysts explicitly or implictly assume that economic policy adopted for Brazil as a whole affects all the regions in a uniform way or, if not, that the unequal regional responses do not concern the planner. Only the so-called "regional development" policies seem to attract the attention of those who deal with the regional problem.

Leff (1972), following earlier Brazilian discussion, stresses the nineteen-century divergent trends in export markets (growing coffee exports, in which the Southeast specialized, and declining world demand for sugar and cotton, produced mainly in the Northeast) as the origins of the regional disparities. An inference that can be taken is that historical differences in income would also account for unequal potentials for saving, investment, and growth. This backward-looking approach tends to leave little scope for the role of recent public policies in reshaping the interregional duality.

The adverse effects of foreign exchange policies were reasonably explored by CODENO (1959). The inter-regional consequences of industrialization policies are mentioned without elaboration by Baer (1966, p. 183): "the government industrialization policy carried a large

resource transfer to the South, reducing the net amount of income redistribution caused by the fiscal system." Goodman & Albuquerque (197-, p.12) point out that "import substitution consequently reinforced the industrial dominance of the Centre-South, profoundly differentiating its structure from that found in other, more peripheral areas."

The above mentioned CODENO document was the first attempt to apply modern economic analysis to evaluate the effects of government policies on the regional income differences. Written in 1959 and strongly motivated by political forces,[4] its suggestions led to the creation of SUDENE, introducing a different approach - at the regional planning level - to fight the century-old regional problem. The document concluded that

> "... the lack of an adequate understanding of problems arising from disparities in regional income levels has led to an aggravation of the situation by the developmental policies themselves. In addition to the deeper causes responsable for the secular trend of relative backwardness of the Northeastern economy - scarcity of arable lands, inadequate rainfalls, excessive concentration of income in the sugar economy, predominancy of the subsistence level in the cattle-raising areas of the semi-arid backlands, other causes have appeared of a more circumstantial type, created by the industrialization policy adopted for the last ten years. The scarcity of foreign currencies generated by developmental policies, as well as large scale subsidization of industrial

> investments owing to the policy of import controls, have widely favored the Center-South region, where potentialities for industrialization were readier. That part of the income from Northeastern exports which is spent in the Center-South markets has undergone a serious process of erosion." (CODENO-1959, pp. 2-3).

A recent analysis of the interregional effects of the multiple exchange rate system adopted in 1953-55 was done by Barrett (1972).[5] His conclusion was that the Northeast, in relation to the Center-South, lost real income through the operation of the exchange system. With respect to the regional nature of the analysis, besides using a different theoretical framework, his study differs from the present one in two major points: a) his definition of Northeast is different from that adopted in the present study, since he omits the states of Sergipe and Bahia, which in terms of internal income means the omission of one-third of the region (data for 1968). The definition used here contains the nine states officially included in recent national accounts and in legal geographic limits used for policy purposes since 1959; and, more importantly, b) he studied both regions as if they were completely independent from each other, depriving his analysis from the interregional character.

1.2 Aim of the study

It should be pointed out at the outset that serious intrarregional inequalities of income have been observed along with the interregional differences.[6] Goodman (1974), for instance, referring to the recent "regional" policies, says that "the point we wish to establish is that, despite the outstanding record, extremely grave social problems remain and probably were aggravated in this period (1960-73)." In spite of the seriousness of such internal discrepancies, they will not be analyzed in this study, which is purely interregional in nature. Also, due to the need to stress only interregional effects, changes in sectoral composition will not be investigated in a complete form. Another factor to be overlooked for simplifying purposes is the problem of interregional migration, analyzed by Graham (1970).

In the present study it is accepted that original disparities in endowment of natural resources and climatic conditions, together with historical structural economic and social differences and divergent trends in terms of trade for the regional export goods, have contributed to affect the regional gap of make it persist. It would be naive to deny the importance of such factors. However, the central concern here will be with government policies, such that the interregional disparity will be studied "in the broad context of Brazilian economic development."

In the modern era of central planning it is highly relevant to know to what extent public policies interact to reduce or aggravate regional imbalances. Such policies have played unquestionable rôle in the post-war Brazilian path to industrialization and economic development. The sample of quotations in the preceding section points to their perceived - though not adequately analyzed - interregional relevance.

It should be stressed the "regional equity standard" under which public policies will be analyzed in this study, whose scope excludes the investigation of policy effects, taken isolatedly, on the national or regional economies.

This thesis serves essentially as an empirical illustration of how the Johansen's general equilibrium framework can be applied to estimate several interregional effects of various types of economic policies. The following relevant issues constitute the main concern of this work:

a) In the interregional input-output table for 1959, to be discussed in chapter III and presented in Appendix C, sectors classified as import-competing represent around 31% of gross production in the Center-South and 14% in the Northeast. Of central importance for the empirical results of this study is the sharp asymmetry in interregional

dependence. While the Northeast spends a large fraction of its income in the Center-South, the opposite is not true. In 1959 large disparities existed between the developed Center-South and the backward Northeast. A usually accepted hypothesis is that a tariff policy that protects import-competing sectors (in both regions) tends to increase the regional imbalance, since these sectors predominate largely in the Center-South. However, given interregional trade and general equilibrium repercussions, the final outcome is not obvious. Benefits and losses among sectors and between regions, during the process from an assumed initial equilibrium to a new equilibrium position, will be observed in different magnitudes. For instance, the positive effects on the protected sectors may be stronger in the Center-South, but a conterbalance may come from the negative impact on non-protected sectors of the same region. Additionally, interregional dependence may lead to both "spread effects" and "backwash effects." This study will make an empirical test of the mentioned initial hypothesis related to differential regional effects of a tariff policy.

b) The interregional input-output table indicates that the sectors to be classified as export sectors account for 33% of gross product in the Center-South and 45% in the Northeast. On the same previous line of thought, a hypothesis implicit in large part of the literature is that an export promotion policy tends to reduce interregional disparities. The empirical test of this hypothesis is the second target of this study.

c) Exogenous uniform exchange rate increases, by simultaneously and directly protecting export and import sectors, do not seem to lead to any prediction. However, the following remarks provide an initial basis to justify the widespread belief that exchange rate increases contribute to aggravate the regional imbalance: i) as explained in the next chapter, exchange rate increases are assumed to be exogenously reflected in price increases of import sectors, these prices being insensitive to demand fluctuations. This is determined by the assumption (retained in the present study) of perfectly elastic import supplies usually adopted in open-economy models; ii) in the model to be presented in the next chapter, export-sector prices are not necessarily increased, at the final equilibrium position, by the same increase in the exchange rate, since built in the price movements of these sectors are the respective world prices, these being subject to export-demand fluctuations. World prices usually decrease in response to an exchange rate policy intended to increase exports; iii) in general, non-traded sectors are less benefited by exchange rate increases than traded sectors, since they are only indirectly affected (through general-equilibrium reactions) by such policies; iv) the rigid assumption of exogenous price changes adopted for import sectors, along with the more flexible endogenous formulation used for prices of export sectors and non-traded sectors, would be conducive to the conclusion that

import sectors tend to be more benefited by a uniform exchange rate increase than the remaining sectors of the economy. And as these remaining non-import sectors account for 86% of the total production in the Northeast and 69% in the Center-South, we would expect some aggravation of the regional income disparity as a result of a uniform exchange rate increase. A fortiori, an exchange rate policy that discriminates in favor of import sectors, as adopted in postwar Brazil, would tend to worsen the regional parity. This hypothesis was tested and not rejected by Barrett (1972), and will also be empirically investigated in the present study.

d) indirect taxes have tended to be borne mostly by industrial sectors in postwar Brazil. As such sectors (here considered to be non-agriculture and non-service sectors) predominate in the Center-South, those taxes, though imposed on the whole country, are expected to strike more intensively that region. This is reinforced by the fact that the tax administration and collection is usually more efficient in a more developed region. For labor taxes a similar hypothesis can be formulated. The rôle of taxes as disparity-reducing has been emphasized in the literature since CODENO (1959). This assumption will be investigated in the present study.

e) Increases in exogenous demand only in one region are expected to have different interregional impacts, depending on the region in which such increases occur. The higher the dependence of one region on the others, the larger tend to be the income leakages resulting from a local exogenous demand increase. The investigation of such leakages has been the major objective of the interregional input-output models pioneered by Chenery, Isard, and Leontief. The model adopted in this work will estimate the extent of the asymmetric results.

f) Changes in interregional input-output coefficients, reflecting a varying pattern of interregional trade, determine corresponding changes in the intensity of the regional economic responses to government policies. This will be measured and analyzed in Chapter IV.

g) Finally, the empirical application of the model to some policies adopted in the sixties (production subsidy program, tariff reform, export incentives, and social security charges) will show how important were those policies in influencing interregional disparities.

From the beginning, some remarks should be presented with respect to the limited scope of this study, despite the

appearance on the contrary. The hypothetical policy changes, and especially the selected policies actually adopted in the sixties, whose isolated effects are sought, are not the only relevant instruments that have interferred differentially with the regional economies. Many other elements (natural and foreign conditions, as well as direct and indirect effects of development policies), have undoubtedly played outstanding influence.

To give an idea of the multiplicity of fiscal-incentiv devices that have been used in Brazil in the last decade, Table 1.2 presents a partial list of them. As we can see, what does exist is a complex system of protection claiming for a structural study to identify which sectors and regions get more benefits. The evaluation of each of them, disregarding the others, is obviously unable to identify the real effects. Uniform overall protection is no protection at all. And, more importantly, these fiscal-incentive instruments have been adopted without any effective coordination, what has made their evaluators misled by the fallcy of composition at the interregional and sectoral levels.

The empirical results suggest that such elements (natural and artificial) have neutralized, to a large extent, the important aggregate effects isolatedly caused by those policies

Table 1.2

SAMPLE OF FISCAL INCENTIVES
IN BRAZIL IN THE SIXTIES

Sector	Authority or working group	Area	Income tax exemption	Tariff exemption	Others (preferential credit, etc.)
All sectors	SUDENE	Northeast	x	x	x
All sectors	SUDAM	Amazon	x	x	x
Fishing	SUDEPE	Brazil	x	x	x
Aeronaut.	EMBRAER	"	x	x	x
Tourism	EMBRATUR	"	x	x	x
Reforest.	IBDF	"	x		x
Mining	GEIMI	"		x	x
Machinery	GEIQUIP	"		x	x
Motor veh.	GEIMOT	"		x	x
Chemicals	GEIQUIM	"		x	x
Textiles	GEITEX	"		x	x
Leather	GEICAL	"		x	x
Electricity	GEINEE	"		x	x
Food	GEIPAL	"		x	x
Paper, cellulose, print.	GEIPAG	"		x	x
Metallurgy	GEIMET	"		x	x
Construct.	GEIMAC	"		x	x
Shipyards	GEICON	"		x	x

of the sixties investigated with the model. To quantify how much of the neutralization process is due to all economic policies and how much is caused by external, historical, and natural factors would require a good deal of additional research. At any rate, the results of this study lend support to the contention that public policies do produce substantial interregional effects, and indeed the main contribution of this thesis is to give an empirical illustration of how such effects can be measured in general equilibrium. The neglect of consideration for the complete set of direct and indirect government instruments has led to serious mistakes in the appraisal of the so-called "development policies for the Northeast."

The alleged potential economic implications of "regional" development policies (such as the SUDENE investment program, PROTERRA agricultural policy, etc.), without looking at the taxation and "national" development policies (e.g., import substitution through tariff changes, exchange rate manipulations, overall export promotion, general investment incentives, promotion of the capital market, etc.), seems to overlook the whole spectrum of relevant phenomena. Indeed, the differential qualification of "regional" and "national" loses its meaning when a more adequate and comprehensive methodology is applied, i.e., when the interregional and

intersectoral policy implications are investigated on general equilibrium grounds.

1.3 Plan of the work

After this introduction, Chapter II will present details on the multi-sector interregional general equilibrium model to be used for numerical investigations. The main methodological limitations of the model are related to its short-run nature, but its results hopefully indicate the right directions of policy consequences. Chapter III discusses the statistical basis and estimation procedures. The numerical solutions suggest that refinement of the data (if it were possible) would not change significantly the results, especially with respect to relative interregional conclusions. The analysis of consequences of hypothetical policy changes is presented in Chapter IV, and the evaluation of a few policies actually adopted in the 1960's is the object of Chapter V. Some concluding remarks and suggested policy implications are presented in Chapter VI.

Chapter II

THE MULTI-SECTOR INTERREGIONAL MODEL

2.1 Introduction

For the analysis of interregional effects of economic policies in Brazil I will make use of some variants of Johansen's (1964, 1968) general equilibrium model. Under unemployment conditions (labor demand-determined specification), besides the variable-real-wage extensions presented for Chile by Taylor & Black (1973), a fixed-real-wage form of the model is introduced. Also, a full-employment version is studied. These three cases are adopted to evaluate the sensitivity of qualitative and quantitative conclusions to labor-supply assumptions. Cobb-Douglas and constant-elasticity-of-substitution production functions are alternatively used. Capital stocks are assumed to be fixed (unshiftable among sectors) but, in the unemployment versions of the model, this static and short-run assumption is partially compensated by the lack of restriction on the labor-supply side.

In the absence of reliable data indicating which are the non-competitive imports, all imports are supposed to be competitive. This means that the domestic

import sectors are able to compete with foreign suppliers of imports in a relatively short-run period. The large natural-resource base of the Brazilian economy turns this assumption not too unrealistic, essentially if we observe the flexibility of the several import sectors in the postwar industrialization (in the six-year span between 1960 and 1966, imports as percentage of total supply changed as follows i) durables, 3.3% to 1.0%; ii) intermediate goods, 11.9% to 6.8%; and iii) capital goods, 23.4% to 13.7% - cf. Baer & Kerstenetzky-1972, Table 9). On the advantages of the assumption of competitiveness for all imports, see the arguments presented by IPEA (1967, pp. 8-9).

Particularly for the case of commercial policy, the advantages of the general equilibrium approach over the conventional effective rate of protection (ERP) method were discussed, among others, by Black (1971), Taylor & Black (1973), Anderson (1970), and Barrett (1972). For lack of space I will not repeat the arguments here. But obviously a model that takes into account demand-supply balances, endogenous responses of prices to policy changes, indirect repercussions on non-traded sectors as consequences of policies primarily adopted for other types of sectors, etc., is usually

accepted as superior to partial equilibrium methods, of which the most popular is the mentioned ERP model.

The economy is supposed to be in equilibrium at the initial point of time. Then a set of equations is formulated to describe such an equilibrium. Not only economic meaningfulness but also mathematical determinacy must be assured, i.e., a necessary (not sufficient) condition is that the number of equations be equal to the number of endogenous variables. After first-order differentiation, a linear system of differential equations results, whose solution permits the local estimation of the effects of changes in the exogenous or economic-policy variables on the endogenous variables. The linearity of the system makes it work reasonably well for "small" changes, which become relevant due to the short-run character to be imposed on the model. The rôle of government is minimized, since it only imposes indirect taxes, tariffs, export incentives, and exchange rates, besides its exogenous demand for each sector.

Following the tradition of interregional models, each sector of the economy was divided between regions (Center-South and Northeast in the present case, but the number of regions could be larger), according to the interregional

input-output table that I have built under the rules explained in the next Chapter. A working, critical, and familiar assumption of interregional analysis, adopted here, is that the regional branches of each sector are sufficiently distinct to allow for individual treatment on the supply and demand sides. As Chenery (1953, p. 98) points out: "The essence of regional input-output analysis is that the demand for and supply of commodities varies among regions, and a commodity produced in one region is not always a substitute for a similar commodity produced elsewhere." It is my contention that the high level of aggregation, the long distance between the relevant regional economic centers, different economic and social structures, among other reasons, justify this treatment for the present two-region analysis of the Brazilian economy.

On the whole I assume q_1 import-competing sectors (corresponding to 10 sectors, five for each region), q_2 (=8) export sectors, and q_3 (=6) non-traded sectors. The total is then $n = q_1 + q_2 + q_3$ (=24) sectors, half for each region.

2.2 The production structure

Fixed intermediate-input coefficients are assumed. Cobb-Douglas production functions are initially used with the constant-return-to-scale form

$$X_i = A_i L_i^{\alpha_i} K_i^{1-\alpha_i} , \qquad (2.2.1)$$

where X_i is sector i's gross production level, L_i is labor input, K_i is capital input; α_i and A_i are constants. (Whenever possible, I will follow the notation used by Taylor & Black. Table 2.1 presents a glossary of variables and parameters to be adopted in this Chapter).

The short-run nature of the static model means that the capital stock is fixed as a whole and unshiftable between sectors, i.e., for the empirical application I will use decreasing returns to scale production functions. The lack of capital mobility, together with unequal production functions and different overall economic structures between regions, are the basic factors that will account for diverse responses of the regional economies to policy measures. This assumption leads to the following equations for the log-changes in gross production:

$$X_i' = \alpha_i L_i' \qquad (2.2.1') \quad \text{(n equations)}$$

where (and hereafter) the prime denotes log-change, i.e., $X_i' = dX_i/X_i$, etc.

TABLE 2.1

Glossary of variables, base-year values, and parameters

(subscripts refer to sectors)

Variables	Description	Number
p'_j, p'_k	Changes from base-year domestic producer's price levels of unity	n
τ'_j	Log-change in the level of one-plus-sector-tariff	q_1
ϕ'_k	Log-change in one-plus-sector-export-subsidy	q_2
π'_k	Log-change in world price of export goods	q_2
E'_k	Log-change in export volumes	q_2
r'	Log-change in exchange rate	1
t'_w	Log-change in one-plus-labor tax	1
θ'_i	Log-change in sector per-unit indirect tax rate	n
X'_i	Log-change in sector production level	n
w'	Log-change in the wage rate	1
L'_i	Log-change in setor employment level	n
L'	Log-change in total employment	1
Y'	Log-change in total consumption expenditure	1
Z'_j	Log-change in exogenous final demand	n
M'_j	Log-change in the level of imports	q_1
Δ'	Log-change in the level of balance-of-payments deficit	1
C'_j	Log-change in consumption of sector j	n

TABLE 2.1 - cont'd

Base-year levels

All of the above log-changes, when written without primes, and

X_{ji} Intermediate use by sector i of goods produced domestically by sector j

Parameters

η_k World demand elasticities for exports

a_{ji} Input-output coefficient, i.e., volume of sector j product required per unit output of sector i (assumed constant)

α_i share of labor payments in value added net of indirect taxes

g_{ji} Elasticity of consumer demand for the j^{th} commodity with respect to the price of sector i.

g_{jy} Elasticity of consumer demand for the j^{th} commodity with respect to total expenditure

σ_i Elasticity of substitution between labor and capital.

In the CES formulation, total production is determined by

$$(2.2.2) \qquad X_i = \gamma_i \{(1-\delta_i) K_i^{-\beta_i} + \delta_i L_i^{-\beta_i}\}^{-1/\beta_i}$$

where γ_i, β_i, and δ_i are constants, and the same equation (2.2.1') above will be used for gross production change, but now α_i (elasticity of output with respect to labor input) should be read

$$(2.2.3) \qquad \alpha_i = \delta_i (X_i/\gamma_i L_i)^{\beta_i}.$$

Under pure competitive conditions and profit maximization, labor demands are derived from the production functions:

$$(2.2.4) \qquad \alpha_i \, p_i^* \, X_i = w \, t_w \, L_i \, ,$$

where t_w is one-plus-sector-labor-tax (or the force of labor tax), assumed uniform accross sectors and regions; w is the net-of-tax wage rate (assumed uniform for perfect labor mobility), and p_i^* is the "net price" or the per-unit value added at factor cost that is distributed to the factors:

$$(2.2.5) \qquad p_i^* = p_i - \sum_j a_{ji} p_j - \theta_i ,$$

where p_i is the producer's price of commodity i and θ_i is the sector i's per-unit indirect tax rate.

Upon differentiation, labor demand, for Cobb-Douglas production functions, becomes

$$(2.2.4') \qquad X_i' - L_i' = w' + t_w' - p_i^{*\prime} \qquad \text{(n equations)}$$

where $p_i^{*\prime} = (p_i' - \sum_j a_{ji} p_j' - \theta_i \theta_i')/p_i^*$,

since throughout this study the working assumption is made that initial sector prices are unity, which turns absolute and proportional changes in these prices identical.

For the CES model, labor demand is defined by differentiation of (2.2.4) and taking account of (2.2.3):

$$(1 + \beta_i)X_i' - (1 + \beta_i)L_i' = w' + t_w' - p_i^{*\prime} \quad \text{or}$$

$$(2.2.4'') \qquad X_i' - L_i' = \sigma_i (w' + t_w' - p_i^{*\prime}) \qquad \text{(n equations)}$$

where $\sigma_i = 1/(1+\beta_i)$ is the elasticity of substitution between labor and capital in sector i.

It should be noted that the sectoral rental rates of capital are residually and directly related to output and employment changes. In fact, using an equation similar to (2.2.4) on the capital side, the following relationship results:

$$(2.2.5') \qquad s_i' = (1/\sigma_i)\, X_i' + p_i^{*\prime},$$

where s_i' is the log-change of the rental rate (residually determined). This equation, together with (2.2.4''), gives:

$$(2.2.6') \qquad s_i' = w' + t_w' + (1/\alpha_i \sigma_i) X_i' \qquad \text{and}$$

$$(2.2.7') \qquad s_i' = w' + t_w' + (1/\sigma_i) L_i'.$$

A dynamic and long-run interpretation of these static and short-run relationships could be that the policy-induced changes in rental rates serve as indicators of possible production and employment variations in the future.

2.3 The demand structure

The consumers' utility functions are assumed to be additive, which is a necessary condition for the application of the Frisch (1959) method to compute all direct and cross price-elasticities of demand. In general,

$$(2.3.1) \qquad C_j = C_j (p_1, p_2, \ldots, p_n, Y)$$

where C_j is the consumption of good j and Y is the total consumption expenditure. Upon differentiation, the log-change in consumption is expressed by

$$(2.3.1') \qquad C'_j = \sum_i g_{ji} p'_i + g_{jy} Y' \qquad \text{(n equations)}$$

where g_{ji} is the elasticity of consumption of good j with respect to the price of good i, and g_{jy} is the elasticity of consumption of good i with respect to total expenditure.

Problems related to user's prices versus producer's prices in the empirical application of this function will be discussed in the next chapter.

2.4 Trading-price relationships

A small-country assumption is made for imports: these are in completely elastic supply. However, demand elasticities for exports are supposed to be less than infinite. This is due not only to the size of some Brazilian exports, but also to some realities inherent to foreign trade (selling costs, product differentiation with geographical distance, tastes, ownership relations, etc.), especially those faced by developing countries.

Although domestic prices of non-tradables are endogenous, for import sectors they are fixed by international markets:

$$p_i = \tau_i \, r \, \pi_i \qquad (2.4.1)$$

where τ_i is the force of tariff, r is the exchange rate (assumed to be uniform accross sectors and regions), and π_i is the world price. Perfectly elastic supplies of imports mean that world prices are fixed:

$$p'_j = \tau'_j + r' \qquad (2.4.1')$$

for import sectors (q_1 equations).

Export prices are determined by

$$(2.4.2) \qquad p_k = \phi_k \, r \, \pi_k,$$

where ϕ_k is equal to one plus export subsidy.

Downward-sloping demand curves for exports mean that world prices may change endogenously:

$$(2.4.2') \qquad p_k' = \phi_k' + r' + \pi_k' \qquad \text{for export sectors } (q_2 \text{ equations}).$$

Demands for exports are expressed by

$$(2.4.3) \qquad E_k = b_k \pi_k^{\eta_k}$$

where E_k is the level of exports, b_k is a constant, and η_k is the export demand elasticity. Differentiation gives the effect of export volumes on world prices:

$$(2.4.3') \qquad E_k' = \eta_k \pi_k' \qquad (q_2 \text{ equations})$$

2.5 Demand-supply balances

The equilibrium relationships between sector supplies and demands are

$$(2.5.1) \qquad X_j \ (+M_j) = \sum_i X_{ji} + C_j + Z_j \ (+E_j)$$

where M_j is the import level, X_{ji} is the use of input j into sector i, and Z_j is exogenous demand. (The parentheses indicate that M_j enters only import sector equations, and E_j only export sector equations).

Upon differentiation:

$$(2.5.1') \qquad X_j X'_j \ (+M_j M'_j) = \sum_i X_{ji} X'_i + C_j C'_j + Z_j Z'_j \ (+E_j E'_j)$$

(n equations).

For the balance of payments, equilibrium between demand for and supply of foreign exchange can be written as

$$(2.5.2) \qquad \sum_j \pi_j M_j = \sum_k \pi_k E_k + \Delta \ ,$$

where Δ is the balance-of-payments deficit expressed in world price. The values for π_j and π_k are estimated from

equation (2.4.1) on the basis of initial values of p_i (=1), τ_i, and r.

In differential form, the balance-of-payments equation becomes

$$(2.5.2') \qquad \sum_j \pi_j M_j M'_j = \sum_k \pi_k E_k (\pi'_k + E'_k) + \Delta\Delta' \qquad \text{(1 equation)}.$$

2.6 Labor market assumptions

Labor force is assumed to be potentially available with perfect mobility between sectors and regions, leading to a uniform nominal wage change throughout the economy. This implies that wage differentials (partly determined by non-economic conditions) remain constant in the short run - See Johansen (1964), pp. 20-21, and Saito (1971), p. 12.

In this study I will deal with three alternative forms of labor market assumptions: a) unemployment with variable real wage (fixed nominal wage - net of taxes - and variable commodity prices); b) unemployment with fixed real wage; and c) full employment (with variable real wage). The us of these three forms was dictated by difficulties in trying to define underlying socio-economic conditions, and by the

fact, demonstrated in Chapter IV, that the basic model is highly sensitive to the labor assumption.

The first case - unemployment with variable real wage - has been used, among others, by Taylor & Black (1973) for Chile, and Nelson (1970) for Colombia. In this case there is usually a trade-off between employment and real wages. Increasing a sector domestic price through tariff, for instance, would tend to decrease real wage under absence of labor constraint. The resulting increase in the net price (or price of value added) relative to nominal wage leads to output increase according to the following supply function, easily derived from equations (2.2.1') and (2.2.4''):

$$(2.6.1') \qquad X'_i = \frac{\alpha_i \sigma_i}{1 - \alpha_i} (p^{*\prime}_i - w' - t'_w).$$

From this formula we can see that the essential difference between this model and the common effective rate of protection (ERP) method lies on the general equilibrium effects on values added exerted by: a) endogenous changes of non-tradables prices, and b) endogenous changes of export prices caused by world price changes.

This first unemployment case obviously presupposes the existence of a socio-economic basis that allows for easy

real wage manipulation by government policy. In a country with strong labor unions, for example, this case would not be that meaningful. As a longer discussion on this point for Brazil would not lead to any definite conclusion, I have preferred to work also with alternative (and quite extreme) forms.

The second case - unemployment with fixed real wage (i.e., supposing that the net-of-tax nominal wage deflated by a weighted average of output prices is constant) - seems more familiar among planning practitioners (Barrett-1972 worked with this assumption for Brazil). Now, as the nominal wage (net of tax) must be adjusted to account for general price changes, the absolute measure of output response is usually lower than in the previous case. The socio-economic constraint underlying this hypothesis is much tighter than the previous one when commercial policies are intended to be adopted.

The third case - full employment - leads to real wage endogenously adjusted for labor constraint. Several socio-economic arguments could be developed to justify this assumption even in some economies with "unemployment" or "underemployment." Non-homogeneity of labor force and skill differentials, for instance, may impose labor restriction in the short run, even in a "reserve army" environment.

The consequence of the first two assumptions is that labor is demand-determined: upon manipulation of exogenous variables, formula (2.6.1'), after allowance for demand-supply feedbacks, determines output changes that will require the sector labor increases or decreases according to (2.2.1'). Total employment change is then expressed by

$$\sum_i L_i L_i' = LL' \qquad \text{(2.6.2')} \qquad \text{(1 equation)}$$

where L is the total initial labor force.

The second case (unemployment with fixed real wage) requires an additional equation for fixed real wage (net of tax):

$$w' = P' \qquad \text{(2.6.3')} \qquad \text{(1 equation)}$$

where P' is defined by

$$P' = \sum_i \frac{X_i}{\sum_j X_j} p_i' \qquad \text{(2.6.4')} \qquad \text{(1 equation)}$$

i.e., the weighted average of sectoral price changes is equal to the nominal wage change.

For the third (full employment) case, L' is set equal to zero in equation (2.6.2').

Compatibility between endogenous variables and equations under these three cases will be discussed in section 2.8.

2.7 Numéraire

Following Johansen and Taylor & Black, in this study prices will be measured in wage units by assuming constant nominal wage net of tax:

(2.7.1') $w' = 0.$ (1 equation)

2.8 The equation system

2.8.1 Determinateness

According to the preceding sections, for the first labor employment case there are $5q_1 + 6q_2 + 4q_3 + 3$ equations for each production function specification, while in the Table 2.1 there are $8q_1 + 9q_2 + 6q_3 + 6$ variables. The excess of $3q_1 + 3q_2 + 2q_3 + 3$ variables over equations must be tagged as exogenous for the system to be determinate. In fact, the following variables will be classified as exogenous: levels of one-plus-sector tariff τ'_j, export subsidies ϕ'_k,

exchange rate r', labor tax t'_w, indirect tax rates θ'_i, exogenous demands Z'_j, and capital inflow Δ', adding up to the required total of exogenous variables. The remaining variables are endogenous: domestic price levels p'_j (for all sectors), world prices of export goods π'_k, export volumes E'_k, sectoral production levels X'_i, wage rate w', sectoral employment levels L'_i, total employment level L', total consumption expenditure Y', levels of imports M'_j, and levels of consumption C'_j. These add up to a total of $5q_1 + 6q_2 + 4q_3 + 3$ endogenous variables, closing the system. Let's recall that this accounting is valid for the first unemployment case (with variable real wage).

As explained by Taylor & Black (1973, p. 12n), "the model can be boiled down to excess demand functions for two factors - labor and foreign exchange - with corresponding rents. Treating one rent - the wage - as the numeraire is made necessary by the homogeneity properties of the whole system." This means that the whole system could be conceptually reduced to one equation involving the three variables L', Δ', and (r/w)'. Thus, two of these variables should be treated as exogenous to determine the third one as endogenous. Then, for the first unemployment case the following equilibrium implicit equation is required:

(2.8.1.1) $$F\{L', \bar{\Delta}', (\overline{r/w})'\} = 0,$$

where the bar means that the variables are treated as exogenous.

For the second unemployment case (fixed real wage), in order to compensate for the two additional equations (2.6.3'-4') and one variable P', I have treated the balance-of-payments deficit Δ' as endogenous, along with the general price level definition P'. We can visualize this procedure by noting that the whole system can be reduced to the following two-equation equilibrium system necessary to determine the endogenous variables L' and Δ':

(2.8.1.2) $$G_1\{L', \Delta', (\overline{r/w})', (\overline{P/w})'\} = 0$$

(2.8.1.3) $$G_2\{L', \Delta', (\overline{r/w})', (\overline{P/w})'\} = 0.$$

For the full-employment case I have treated (according to Taylor & Black) the exchange rate r' as endogenous to compensate for the total labor force being treated as fixed, the deficit Δ' being again exogenous. To determine (r/w)', the model can be reduced to the following implicit equation:

(2.8.1.4) $$H\{\bar{L}', \bar{\Delta}', (r/w)'\} = 0.$$

2.8.2 Solution

The equation system, presented in the previous sections, can be written in matrix form as

$$A\xi = R\mu, \tag{2.8.2.1}$$

where A and R are matrices and ξ and μ are column vectors defined by

A = mxm matrix of coefficients for endogenous variables,

R = mxv matrix of coefficients for exogenous variables,

ξ = mxl vector of endogenous variables, and

μ = vxl vector of exogenous variables,

where m and v are the quantities of endogenous and exogenous variables, respectively.

The solution is then

$$\xi = A^{-1}R\mu, \tag{2.8.2.2}$$

whose computational procedures will be discussed in the next Chapter.

2.8.3 Balanced-budget adjustment

Second-round adjustments were made in the general solution for consistency with the assumption of government balanced budget, i.e.,

$$(2.8.3.1) \qquad \sum_i Z_i Z_i' = BB',$$

where B is the government budget level. In other words, the changes in government revenue (BB') caused by manipulation of taxes, tariffs, and subsidies were accompanied, in each case, by the appropriate changes $\sum_i Z_i Z_i'$ in total "exogenous" demand. The changes $Z_i Z_i'$-s were distributed among sectors in proportion to the levels of Z_i-s, i.e., according to the initial sector shares in the total $\sum_i Z_i$. Putting this in another way, the Z_i'-s, for the adjustment purpose, are uniform accross sectors:

$$(2.8.3.2) \qquad Z_1' = Z_2' = \ldots = Z_n' = BB' / \Sigma Z_i.$$

(A less distortive way of distributing the revenue change through exogenous demand among sectors, as suggested by Professor Glenn P. Jenkins - not adopted here for computing simplification -, should consider as weights not the initial levels of exogenous demand Z_i-s, but the values of endogenous consumption C_i-s weighted by the corresponding income elasticities g_{iy}-s).

The only two cases where the above adjustment was not made refer to: a) exchange rate policy (Tables 4.3a-b), where it is assumed that any imbalance in the government's foreign currency account does not interfere with the public budget and can be financed in the short run by outside resources; and b) changes in exogenous demand (Tables 4.9-4.10) where, once again, it is supposed that, especially in the short run, the expenditure change can be financed by outside resources (e.g., borrowing from abroad).

It should be noted that this second-round adjustment takes from the Z_i'-s their exogenous character, except for policies a (exchange rate) and b (changes in exogenous demand) above. For the remaining policies, the n variables Z_i'-s are accounted for by the n equations (2.8.3.2). B' is simply defined by exogenous change in the budget caused by the manipulation of government policy instruments.

2.8.4 Short run versus overdetermination

Much has been discussed about the problem of exogenously specifying price changes of tradable goods in tariff models with many goods and few factors of production. For the constant returns to scale case, Samuelson (1953-54) has shown that, as a consequence of fixing such prices, "there will result complete specialization in a number of industries, with the remaining number shut down completely."

Most multi-sectoral models avoid this difficulty by using decreasing returns to scale production functions, like the present one.

If we assumed capital to be a variable and shiftable factor, a capital constraint should be written down and, for each sector an equation such as

$$(2.8.4.1) \qquad X_i' - K_i' = \sigma_i (s_i' - p_i^{*\prime})$$

would be necessary, together with a production change determined by

$$(2.8.4.2) \qquad X_i' = \alpha_i L_i' + (1 - \alpha_i) K_i'$$

These two equations, together with the corresponding relationship for labor (2.2.4''), boil down to the following one (neglecting for the time being that w' is zero for numéraire):

$$(2.8.4.3) \qquad p^{*\prime}_i = \alpha_i (w' + t'_w) + (1 - \alpha_i) s'$$

where s' is the change in rental rate, now uniform for perfect capital mobility. The above equation shows that in this case factor payments exhaust value added.

Using the definition for $p^{*\prime}_i$ - equation (2.2.4') - in the above equation leads to the following linear system:

$$(2.8.4.4) \qquad F_i(p'_1, \ldots, p'_n, w', s') = 0, \quad i = 1, \ldots, n$$

which means that there are only two variables in excess to the number of equations. Thus, only two prices can be given exogenously. Tariffs may not determine directly many import-sector price changes, since in this case the system would have too many equations.

For export prices the problem is not serious since, like in the model used in this study, they can contain an endogenous component represented by world prices and thus

are not exogenously determined. For non-traded sectors the problem does not exist either, because their prices are endogenous. Overdetermination comes out when the model builder intends to fix import-sector prices exogenously.

One way to analyze this difficulty is as follows: The central point of the question seems to rely on the fact that imports M'_j are given the status of variables mathematically distinct from the corresponding domestic production levels X'_j, while keeping only one price for M'_j and X'_j. If we let p_{mj} denote prices for imports as different from import-competing sector prices p_j, the conventional treatment of tariff-determined import-sector prices corresponds to using the following equations:

$$p'_j = \tau'_j \qquad (2.8.4.5)$$

$$p'_{mj} = \tau'_j. \qquad (2.8.4.6)$$

The last equations (2.8.4.6) are truly determined by commercial policy, and correspond to the plausible small-country assumption that imports are available in perfectly elastic supply. However, the former equations (2.8.4.5) result from assumptions not necessarily acceptable on general equilibrium grounds where substitution between domestic and

foreign goods is not perfect. Some major comments should be made:

a) If imports have their supply functions implicitly imposed through equation (2.8.4.6), equilibrium in the model claims for corresponding demand functions.

b) M_j should drop from demand-supply balances for domestically produced goods - (2.5.1) -, since they are not perfect substitutes. Imports now are of the non-competitive type.

c) The consumption demand for domestically produced goods would change from (2.3.1') to

$$(2.8.4.7) \qquad C'_j = \sum_i g_{ji} p'_i + \sum_h g_{jm_h} p'_{mh} + g_{jY} Y'$$

where g_{jm_h} is the consumption demand elasticity of commodity j with respect to h-type-import price.

d) Equations $p'_j = \tau'_j$ should be replaced by endogenous import demands of the form

$$(2.8.4.8) \qquad M_j M'_j = \Sigma M_{ji} X'_i + M_j \left(\Sigma g_{m_j i} p'_i + \Sigma_h g_{m_j h} p'_{mh} + g_{m_j Y} Y' \right),$$

where M_{ji} is the intermediate use of import j by sector i (assuming fixed coefficients), and $g_{m_j i}$, $g_{m_j h}$, $g_{m_j Y}$ are

import demand elasticities relative to domestic prices, import prices, and total consumption, respectively.

e) Net prices p_i^*-s are influenced by tariffs, both through direct impact on imported input prices and through general equilibrium repercussions on prices of all other goods. Thus, the linear system (2.8.4.4) turns now to a more complex form:

$$(2.8.4.9)\quad G_i(p'_1,\ldots,p'_n,\ p'_{m1},\ldots,p'_{mq_1},\ s',\ w') = 0,\qquad i = 1,\ldots,n$$

This system has n equations and $n+q_1+2$ variables. By using $w'=0$ for numéraire and fixing the q_1 import prices $p'_{m1},\ldots,p'_{mq_1}$, we are left with $n+1$ degrees of freedom necessary for the treatment of the n shiftable capital stocks K'_i and the rate of return s' on their own right as endogenous variables. This is one way of eliminating the problem of overdetermination.

It should be noted that, with the above modification, the model changes in nature from supply-determined to demand-determined in production, since the supply function (2.6.1') is not valid anymore. Due to the fact that any change in value added is barely enough to pay for pure factor remunerations, no direct incentive is provided by commercial policy.

The introduction of import demand functions, treating import prices different from total sector prices, was made by Stone & Barker in the study of the determinants of Britain's visible imports - Cambridge (1970). A conceptual difficulty in their work arises from the fact that, while imports (m) are assigned demand functions distintct from those of domestic output (q), they are treated as competitive imports (q is added to m in their demand-supply balance equation) as if m were perfect substitute for q. The allowance for different demand functions for two goods m and q should be inconsistent with perfect substitutability between them. This is the reason why imports were proposed to be treated as non-competitive in item b above. Import demand functions for Brazil have been estimated, among others, by Clark & Weisskoff (1967) and Morley (1969).

Because the solution of the constant-returns-to-scale model would require additional data on import demand elasticities, import coefficients, capital stocks, etc., which for Brazil are very scarce in quantity and quality, and given the time-and-resource-consuming computation already needed for the previous formulation, I did not venture into implementing the new form analyzed in this subsection, leaving it for future research that I intend to undertake. In other words, only the specifications presented in sections 2.1 to 2.8.3 will be numerically implemented in chapters IV and V.

Chapter III

STATISTICAL BASIS AND ESTIMATION PROCEDURES

3.1 Introduction

As it was explained in the first chapter, the aim of this study is the estimation of relative interregional impacts of protection and taxation in Brazil. In other words, only relative orders of magnitude are relevant. The differential nature of the model itself will eliminate some of the effects of the errors of scale in data introduced by the initial values.

3.2 The interregional input-output table

A basic piece of information for this study is an interregional input-output table. Even though there are difficult statistical problems in getting data to build such a table, I believe that making use of an imperfect table is much better than to ignore completely the interregional relations as has previously been done by some writers (e.g.,

the analysis by Barrett-1972 for Brazil).

The point of departure to construct the table is the national input-output table built in the Ministry of Planning for 1959 - IPEA (1967) - with 32 sectors. To get manageable proportions in my study I aggregated it to a 12-sector table. Then, each sector was divided between the two regions, and thus the resultant table will comprise 24 sectors.

The sectors were aggregated following three basic constraints: a) manageable proportions for computation; b) relevance for the problems under investigation; and c) deficiencies of statistical data. Table 3.1 shows the correspondence between the original IPEA table and the new one. Both are shown in full detail in Appendices A and B.

It should be pointed out that the sector classification between regions is dictated by simplification purposes and not intended to be very realistic. In a more detailed study, a commodity could be tagged as import-competing in one region and export or non-traded sector in the other. Chemicals in the Northeast, for instance, have a composition that is very distinct from chemicals in the Center-South (I am grateful to Dr. Luís Fernando Correia de Araújo, SUDENE's Deputy Superintendent, for having brought this point to my attention).

Table 3.1 Aggregation Scheme

Sectors in the new table	Sectors in the original table
1. Agriculture	Vegetable product/animal product
2. Extractive industry	Extractive industry
3. Non-metallic minerals	Non-metallic minerals
4. Metallurgy	Metallurgy/machine tools/ electrical goods/trans-portation goods
5. Leather	Leather
6. Chemicals	Chemicals/pharmaceuticals/ perfumery/fuels/plastics
7. Textile, clothing	Textile/clothing
8. Food, beverages	Food/beverages
9. Paper,tobacco,miscellaneous	Paper/tobacco/rubber/wood/ packaging/waste/publishing/ furniture/miscellaneous
10. Electric energy	Electric energy
11. Construction	Construction
12. Services	Services/commerce/transportation

Classification of sectors in the present study:

Import sectors: 2, 3, 4, 6, and 9.

Export sectors: 1, 5, 7, and 8.

Non-traded sectors: 10, 11, and 12.

To go from the 12-sector national table to the 24-sector interregional table I followed three steps:

a) Application of the Chenery (1953, 1959) method[1] of assuming fixed regional supply coefficients, i.e., each interregionally traded sector (both as shipping and as receiving) was split into two regional branches according to the region's initial share in total production for 1959 as given by the Industrial Census - IBGE (1960) - and by the national accounts - FGV (1971).

Non-traded sectors are taken to be sectors 10 (electric energy), 11 (construction), and 12 (services), both with respect to interregional and international trade. In interregional analysis terms they are "local" sectors, whose production levels are highly influenced by the location of demand. The remaining sectors were classified as "national" sectors, for which the location of demand is not very important for the source of supply.

In summary, denoting by A_{ij} the shipment of sector i to sector j in the national table, it was divided vertically into two parts A_{i_sj} and A_{i_nj} proportionally to the shares of Center-South and Northeast, respectively, in total production of shipping sector i. Then, each of these elements was divided horizontally in two elements according to the regional shares

in the receiving sector j, giving rise to the four elements $A_{i_s j_s}$, $A_{i_s j_n}$, $A_{i_n j_s}$, and $A_{i_n j_n}$, with the property that they add up to A_{ij}.

b) The next step was the adjustment of the figures obtained above, according to the regional supply coefficients published by SUDENE (1972a, p.38) for 1961. This adjustment represents an improvement on the crude production shares, since they reflect interregional trade data estimated directly by SUDENE. In general, the coefficients corresponding to the supply from Northeast to Northeast are substantially higher than those obtained in step a above, since a great part of each sector is not exported to the C.South according to the assumption underlying the Chenery method. Such assumption is that, in the Northeastern market, the supply from the C.South is determined merely by the share of the latter region in the national production of each sector. This tends to overestimate the actual interregional trade flows, and thus should be corrected with available data.

This adjustment was made such that the new elements $A^*_{i_s j_n}$ and $A^*_{i_n j_n}$, relative to the supply to Northeast from Center-South and Northeast, respectively, were consistent with the proportions presented by SUDENE. Additionally, the elements $A_{i_s j_s}$ and $A_{i_n j_s}$ were adjusted such that the totals of the input-output table remained the same. For this last requisite, where the full application of the adjustment to SUDENE coefficients resulted in some negative element $A_{i_s j_s}$ or $A_{i_n j_s}$, the extent of the adjustment was reduced to leave such an element at the zero level.

c) Finally, the elements of the table so far adjusted, relative to Metallurgy, Chemicals, and Textile & Clothing, in the Northeast, were readjusted to reflect the intersectoral relationships contained in the research work undertaken by Goodman & Albuquerque (197-)[2] with respect to the two most important industrial states of the region - Pernambuco and Bahia. This is a very important step for the following reasons: i) it takes advantage of a local direct research in the Northeast; ii) it affects a substantial part of figures relative to the Northeastern industry, since the sectors adjusted represent 60% of total industrial production in that region; and iii) one crucial and largely criticized assumption in the Chenery method is that the regional input-output coefficients are identical accross regions; this deficiency is partially alleviated at this step.

The correction adopted in this step was made according to the rules used in step b above, i.e., getting consistency with the new proportions and preserving the totals of the input-output table. - See Note to Appendix C.

The final regional supply coefficients implicit in the adjusted interregional input-output table are presented in table 3.2.

Table 3.2

REGIONAL SUPPLY COEFFICIENTS

Sector	Supply to C.South		Supply to Northeast	
	From CS	From NE	From CS	From NE
1. Agric.	.8225	.1775	0	1.0000
2. Extr.ind.	.9511	.0489	0	1.0000
3. N.met.min.	.9906	.0094	.4653	.5347
4. Metallurgy	.9811	.0189	.7594	.2406
5. Leather	.9051	.0949	.6983	.3017
6. Chemicals	.8910	.1090	.8000	.2000
7. Text.,cloth.	.9313	.0687	.3199	.6801
8. Food, bev.	.9762	.0238	.2592	.7408
9. Paper, tob...	.9957	.0043	.7920	.2080
1o. Elect.energy	1.0000	0	0	1.0000
11. Construction	1.0000	0	0	1.0000
12. Services	1.0000	0	0	1.0000

3.3 Demand elasticities

3.3.1 Consumption elasticities

Another piece of information required for statistical implementation of the model is an array of direct and cross partial price elasticities of demand. The estimation of such elasticities with few available data becomes possible by using the Frisch (1959) "complete scheme." The key simplifying assumption for the practical application of this method refers to independent utilities. This means that the utility function has the property of separability:

$$(3.3.1.1) \qquad U(C_1^u, C_2^u, \ldots, C_n^u) = \sum_i U_i(C_i^u)$$

where C_i^u is the consumption of good i valued at user's price. This implies that trade margins are included in the consumption values, and thus consumption of trade as a separate sector is excluded. The implication of distinguishing buyer's prices from seller's prices will be discussed below in this section.

As stated previously, the high level of aggregation adopted in this study is supposed to conform to Frisch's assumption of "want independence." He pointed out that "if the goods are aggregated in a reasonable way (using a volume

index for each group) one will in practice get goods about which we can say a priori with considerable confidence that they are want-independent. For such goods the demand elasticities with respect to price may then be worked out by the technique developed in the sequel." (Frisch-1959, p.186). For the inter-regional splitting of sectors, besides the high level of aggregation, it could be added that in Brazil the long distance between the important economic poles of Center-South and Northeast, the low degree of integration in the national market - Rocca (1970, p.241) -, the difference between regional tastes, distinct economic and social structures, among other reasons, justify the separate treatment of regional branches of the same sector.

The formula derived by Frisch to compute the direct price demand elasticity is

$$(3.3.1.2) \qquad e_{ii} = -g_{iy}\left(a_i - \frac{1 - a_i g_{iy}}{\omega}\right)$$

where g_{iy}, as defined in the previous chapter, is the demand elasticity of commodity i with respect to total consumption; a_i is the budget proportion of the i^{th} good; and ω is the "flexibility of the marginal utility of money" as defined by Frisch: the elasticity of the marginal utility of money relative to total expenditure, i.e.,

$$\omega = \frac{d\lambda}{dY}\frac{Y}{\lambda},$$

where λ is the marginal utility of money (the familiar marginal-utility/price ratio obtained in the solution of the problem of constrained consumption maximization).

For the cross demand elasticity the expression is

(3.3.1.3) $$e_{ik} = -g_{iy}a_k(1 + g_{ky}/\omega), \qquad i \neq k.$$

Some explanation should be presented with respect to these elasticity formulas. Both expressions are derived from the general form

(3.3.1.3a) $$e_{ik} = e_{ik}\Big|_{\lambda=\text{const.}} - a_k g_{iy}(1+g_{ky}/\omega), \qquad \begin{matrix}(i=1,\ldots,n\\ k=1,\ldots,n).\end{matrix}$$

(Frisch-1959, pp.184-187).

The first term on the right-hand side represents Frisch's substitution effect, i.e., the price elasticity compensated for changes in the marginal utility of money (keeping λ constant). The second term represents the income effect ($-a_k g_{iy}$) and money-utility effect ($-a_k g_{iy} g_{ky}/\omega$). This breakdown should be compared to the Slutsky equation

(3.3.1.3b) $$e_{ik} = e_{ik}\Big|_{U=\text{const.}} - a_k g_{iy},$$

in which the marginal utility of money is assumed constant, and

where total commodity utility (not money utility) is kept constant in the substitution effect $e_{ik}\big|_{U=const.}$

The assumption of "want-independence" of good i, in Frisch's definition, means that "the marginal utility of good i depends only on the quantity of good i and not on any other quantity," (id., p.185), i.e.,

$$(3.3.1.3c) \qquad e_{ik}\big|_{\lambda=const.} = 0, \qquad i \neq k.$$

He also shows (id., p.186) that this condition leads to the following equation:

$$(3.3.1.3d) \qquad e_{ii}\big|_{\lambda=const.} = g_{iy}/\omega \ .$$

Equation (3.3.1.3c), together with (3.3.1.3a), gives (3.3.1.3), i.e., the expression for the cross-price elasticity. Equation (3.3.1.3d), combined to (3.3.1.3a), gives (3.3.1.2), i.e., the formula for the own-price elasticity of demand.

Criticisms of Frisch scheme in particular, and of the additivity assumption of utility functions, in general, have been made by Brown & Deaton (1972, section 5), Deaton (1974), and Sato (1972). Although they do not present very promising alternative methods to estimate the whole matrix of direct and cross price elasticities of demand, there is a common

suspicion of the high price that must be paid for the simplicity of Frisch scheme. Deaton (1974) has shown that the additivity assumption implies approximate relationships between own-price and income elasticities, such relationships being "a priori implausible and there exists no empirical evidence in their favor." It seems that the usefulness of the Frisch scheme has relied so far on the lack of good and practical substitute methods.

Given the elasticity formulas (3.3.1.2-3), and provided we know the sectoral budget shares and income elasticities, then if we get some independent information about own-price elasticity for at least one sector, the magnitude of the "money flexibility" ω can be assessed and thus also all the remaining own and cross elasticities. For Brazil, Milone (1974) has found, for automobiles an income elasticity of 2.465 and an own-price elasticity of -1.61 Applying this to the transportation goods sector of the national input-output table, we get ω =-1.52. Using the income elasticity of 2.881 estimated by Lopes (1972), we get ω =-1.77. And as the available evidence indicates that ω is most probably around -2 -Johansen (1964, p. 107), Ayanian (1969, p.81) -, I have chosen this value (ω =-2) for the empirical estimation of the price elasticities of demand.

For empirical checks, the nature of Frisch estimation procedure is such that, among others, the following adding-up properties are met:

(3.3.1.4) $\sum_i a_i g_{iy} = 1$ (Engel aggregation),

(3.3.1.5) $\sum_k e_{jk} = -g_{jy}$ (homogeneity condition, i.e., for a proportional change in all prices and income, the quantities remain constant).

One problem in the application of this method is that consumers are motivated by the behavior of buyer's prices, while the prices used in this study are supposed to be seller's prices. In other words, Frisch's scheme is linked to buyer's-price demand elasticities. One suggestion given by Johansen (1964, p. 86) is the estimation of "all coefficients directly in one step in terms of seller's prices, treating services as a good on a par with other goods," although he points out that this is not realistic, since "trade services from the consumer's point of view are connected with the purchase of other goods and perform no independent function in his utility or preference scale."

Johansen worked with derivatives instead of elasticities. The formulas derived by him (1964, pp. 95-97) to transform demand derivatives from buyer's-price into seller's-price forms are

(3.3.1.6) $$\frac{dC_i}{dY} = (1 - \beta_i)\frac{dC_i^u}{dY}$$ and

(3.3.1.7) $$\frac{dC_i}{dp_j} = (1 - \beta_i)(1 - \beta_j)\frac{dC_i^u}{dp_j^u}$$

where β_i = trade margin in sector i, assumed constant;

C_i^u = consumption of good i valued at user's prices, whose connection with the seller's price concept C_i is given by

(3.3.1.8) $$C_i = (1 - \beta_i)C_i^u;$$

p_j^u = user's price of good i;

Y = total consumption expenditure, whose value is the same under both criteria: when evaluated at buyer's prices, trade is excluded as a sector but prices include its margin; when evaluated at seller's prices, trade is treated as a separate sector but prices exclude trade margins.

As I am working with elasticities instead of derivatives, formula (3.3.1.6), by using (3.3.1.8) above, reduces in elasticity terms to

(3.3.1.9) $$g_{iy} = \frac{dC_i}{dY}\frac{Y}{C_i} \equiv \frac{1 - \beta_i}{1 - \beta_i}\frac{dC_i}{dY}\frac{Y}{C_i}$$

i.e., the undimensional property of the elasticity concept assures that income elasticities are indifferent to the price concept.

As for the price derivatives (3.3.1.7), a similar transformation leads to

$$(3.3.1.10) \qquad g_{ij} = \frac{dC_i}{dp_j} \frac{p_j}{C_i} = (1 - \beta_j) \frac{dC_i^u}{dp_j^u} \frac{p_j^u}{C_i^u}$$

where we see that the seller's price concept requires a reduction from the user's price elasticity according to the trade margin in the sector where the price changes.

Trade margins include transportation costs. What is not clear is Johansen's (1964, p. 99) statement that, additionally, "trade margins include indirect taxes minus subsidies on consumer's goods." From the following equivalent formulas for total consumption expenditure:

$$(3.3.1.11) \qquad Y = \sum_i p_i^u C_i^u$$

$$(3.3.1.12) \qquad Y = \sum_i p_i C_i + \sum_i p_i \beta_i C_i$$

(where $1+\beta_i$ is assumed to be equivalent to $\frac{1}{1-\beta_i}$),

we see, as Johansen (1964, p. 96) concluded, that the term $\sum_i p_i \beta_i C_i$ corresponds to the output of the trade sector. Thus, if indirect taxes are included in β_i, the trade sector would be receiving indirect taxes, which does not make sense, since government is not part of it (neither an endogenous sector) in Johansen's model. Furthermore, Johansen's formula (3.2;7) for

net price, corresponding to expression (2.2.5 [illegible] the present study, necessarily implies that indirect taxes are included in producer's prices p_i. Thus, trade margins (differences between user's prices and producer's prices) could not include indirect taxes. If indirect taxes were excluded from producer's prices it seems that the model, for consistency, should treat government as a separate endogenous sector. This obviously poses hard problems, and leaves unclear the practical convenience of the correction method proposed by Johansen.

Even without the above problem, I do not know of any reliable source of information from which to get trade margins. Moreover, the IPEA input-output table leaves serious doubts as to which price concept was used in its estimation. For instance, on page 7 of IPEA (1967) the authors of the table say that the figures were corrected to get the values at producer's prices, but on page 18 they conclude that in many cases the values are at user's prices.

Due to these difficulties, I did not think worthwhile the correction recommended in equation (3.3.1.10). In other words, as the IPEA table is here interpreted as being valued at seller's prices, I have adopted the simplification suggested by Johansen to calculate "all coefficients directly in one step in terms of seller's prices, treating trade services as a good on a par with other goods." (Johansen-1964, p. 86). The price we pay is a doubtful realism, as he pointed out on the same page. In the case of the present study, the

repercussion of this error is reduced by the fact that commerce is aggregated with transportation and services to form sector 12 (services), whose total role in consumer behavior is more meaningful per se than commerce alone.

Given these comments, we can proceed to the empirical information. The income (or expenditure) elasticities were derived from Lopes (1972). They refer to the country as a whole, and lacking other data I have assumed that they are the same for both regions. They were corrected for the adding-up property (3.3.1.4) - mostly in services - and are shown in column 1 of table 3.3.

The budget shares used were those of the interregional input-output table. Table 3.3 shows the own-price elasticities estimated through formula (3.3.1.2). These values should be interpreted in the context of an interregional model: for instance, the own-price elasticities -.3594 and -.3024 obtained for sector 8 (food) of C.South and Northeast, respectively, indicate that, for a "typical" Brazilian consumer, food produced in C.South is more sensitive to its price than food produced in the Northeast. Thus, the elasticities do not refer to regional consumers but to regional products. The set of all own- and cross-price elasticities of demand is presented in Appendix D. All of them meet the homogeneity condition (3.3.1.5).

Table 3.3

EXPENDITURE AND PRICE ELASTICITIES

Sector	Expenditure elasticities	Own-price elasticities C.South	Northeast
1.Agr.	.8750	-.5052	-.4555
2.Ext.ind.	1.0100	-.5050	-.5050
3.N-m.min.	1.5600	-.7816	-.7801
4.Met.	1.5600	-.7911	-.7804
5.Leather	1.1532	-.5771	-.5766
6.Chem.	.9868	-.5121	-.4959
7.Text.,cl.	1.1588	-.6214	-.5860
8.Food	.5904	-.3594	-.3024
9.Pap.,misc.	1.0000	-.5275	-.5006
10.El.en.	.9868	-.4946	-.4935
11.Constr.	1.9380	-.9702	-.9692
12.Services	1.0828	-.7088	-.5673

Source: See text.

3.3.2 Export demand elasticities

Primary-sector exports (sector 1) are supposed to have demand elasticities equal to -6. For the remaining sectors (5, 7, 8 in both regions) I used -10. These values are in the range suggested by Balassa (1971, Appendix C) for Brazil.

3.4 Labor shares and employment

Statistical data on factor shares in Brazil are very deficient. The 1959 Industrial Census registers, for each sector, besides "wages and salaries," a more significant group of expenses classified as "miscellaneous expenses." This poses hard problems for anyone who intends to know the factor shares. As it is impossible to identify to whom or for what all those "miscellaneous expenses" are paid, I deducted such expenses from the item "value of industrial transformation" ("valor da transformação industrial-VTI") (roughly equal to gross value of production less payments for intermediate inputs). From the result, a 5% depreciation rate was subtracted as is usually done in the Brazilian national accounts.[3] The final result, i.e., 0.95(VTI-misc.expenses), was the base by which "wages and salaries" were divided to arrive at the labor shares. In other words, the above procedure means that the labor

share, for each industrial sector, was estimated by the formula

$$\alpha = \frac{\text{"wages and salaries"}}{0.95(\text{VTI-misc.expenses})} .$$

Underlying the use of this formula is the assumption that the numerator underestimates total labor payments in the same proportion as the denominator underestimates the value added. Additionally, this method presupposes that labor shares in "miscellaneous expenses" are equal to labor shares in the difference between VTI and those expenses, since the above formula is equivalent to

$$\alpha = \frac{\text{"wages and salaries"} + \alpha \times 0.95 \text{misc.expenses}}{0.95 \text{ VTI}} .$$

In this alternative version, the numerator is assumed to overestimate total labor payments in the same proportion as the denominator overestimates value added.

It seems difficult to find a better procedure for the estimation of labor shares.[4] Included in the "expenses" are labor- as well as non-labor payments. It appears incorrect to take the "wages and salaries" figures from the Census and then conclude that they represent the total payments for labor services, as it has been done, among others, by Barrett (1972); labor shares on his page 52 are abnormally low, even unbelievable when compared to other countries' data.

For agriculture, electric energy, construction, and services, due to lack of data I used the labor shares estimated for Mexico by Franchet et al. (1973), and they were assumed to be equal for both regions. It is probable that labor shares in these sectors are actually higher in the Northeast than in the Center-South. Then the assumed equality between regional labor shares tends to underestimate the absolute differences between the output reactions of these sectors to public policies, for the supply elasticities of equation (2.6.1') are increasing functions of the labor shares:

$$\frac{\partial}{\partial \alpha_i}\left(\frac{\alpha_i\ \sigma_i}{1\ -\alpha_i}\right) = \frac{\sigma_i}{(1\ -\alpha_i)^2} > 0,$$

i.e., the weaker the dependence of each sector on the immobile capital factor, the larger its freedom of responding to price fluctuations.

The estimated labor shares are presented in Table 3.4. The results should not be very surprising: although the Northeast seems to have a much higher unemployment rate than the Center-South - see, for example, Goodman & Albuquerque (1971, ch. 3) -, the majority of its sectors is less labor-intensive than in the C. South, if by this term we mean the relation between regional labor shares. This could be partially explained by the fact that, while the Northeast industry employs more workers per unit product than in the C. South,

Table 3.4

LABOR SHARES AND ELASTICITIES OF SUBSTITUTION

Sector	Labor Shares		Elasticities of substitution
	C.South	Northeast	
1.Agric.	.6662	.6662	.310
2.Extr.ind.	.5094	.4061	.510
3.N-m.min.	.4923	.4037	.207
4.Metall.	.4928	.5673	.374
5.Leather	.5219	.3580	.320
6.Chem.	.3440	.1693	.809
7.Text,cl.	.6020	.4210	.504
8.Food	.3535	.3876	.415
9.Pap.,misc.	.4580	.3693	.388
10.El.energy	.4447	.4447	.320
11.Constr.	.6878	.6878	.320
12.Services	.4713	.4713	.320

Source: See text.

each "operário" in the Northeast works under inferior conditions of economies of scale, infrastructure, know-how, skill, supply of intermediate goods, etc., inherent to an economy with low degree of industrialization - see Rocca (1970). Therefore, due to interregional disparities in labor productivity, the industrial sectors in the Northeast are more labor-quantity intensive but less labor-payments intensive than in the C.South.

As for the labor-employment figures, I used the estimates by Cline (1972) for 1959. The data were divided regionally according to the sector proportions of "pessoal empregado" (people employed) in the 1959 Industrial Census. For agriculture, extractive industry, and services, the regional proportions were taken from the 1960 Demographic Census. The final figures for employment are shown in columns 1 and 2 of table 3.5.

3.5 Elasticities of substitution

For implementation of the forms of the model related to CES production functions, the figures relative to elasticities of substitution in Brazilian industry (sectors 3-9) were taken from Bacha (1972). For the remaining sectors, Behrman's (1972) study for Chile was the source, due to lack of other statistical basis. For this same reason, each sector

Table 3.5

EMPLOYMENT IN 1959

(thousand man-years)

Sector	Center-South	Northeast
1. Agriculture	6 931.2	3 360.7
2. Extr.industry	35.6	18.6
3. Non-met.min.	80.9	40.7
4. Metallurgy	358.0	10.1
5. Leather	16.1	7.3
6. Chemicals	104.3	18.9
7. Textiles, cloth.	317.1	105.2
8. Food, bev.	179.3	106.9
9. Paper,tob.,misc.	273.9	36.8
10. Electr.energy	21.4	2.6
11. Construction	189.4	60.0
12. Services	2 115.6	1 087.5
	10 622.8	4 855.3

Source: see text.

was supposed to have the same elasticity of substitution between regions. These figures are shown in column 3 of table 3.4.

I did not take higher elasticities, e.g., from Goodman, Albuquerque, & Sena (1971) or Tyler (1972), because the methodology of these studies seems to involve a bias towards unitary elasticities of substitution - see Macedo (1974).

3.6 Taxes, tariffs, and export subsidies

One of the aims of this study is to analyze the interregional effects of indirect tax changes from the initial tax rates of 1959. Initially, data on the revenues relative to the federal industrial tax "Impôsto sôbre produtos industrializados-IPI" for 1960 were taken from Ministry of Finance, Anuário Econômico Fiscal 1970 by sector and region. As the same information was not available for 1959, I simply reduced all 1960 revenues by a common factor in order to get consistency with the total revenue of that tax in 1959 as given by Fundação Getúlio Vargas (1969). Then, the resulting tax revenues by sector and region were divided by the value of total production in 1959 to get the tax rates as percent of gross production values. These rates are shown in columns 1 and 2 of table 3.6.

Table 3.6

FEDERAL AND STATE INDIRECT TAXES IN 1959

(as percent of gross value of production)

Sector	Impôsto s/Produtos Industrializados (IPI)		Impôsto s/Circulação de Mercadorias (ICM, former IVC)	
	C.South (1)	North. (2)	C.South (3)	Northeast (4)
1.Agric.	0	0	3.5	1.8
2.Extr.ind.	0	0	0	0
3.N-m.min.	3.9	3.6	5.5	3.0
4.Metall.	3.6	1.5	5.5	3.0
5.Leather	3.4	0.7	5.5	3.0
6.Chem.	2.7	0.4	5.5	3.0
7.Text.,cl.	4.9	1.4	5.5	3.0
8.Food	2.0	1.3	5.5	3.0
9.Paper,misc.	9.9	7.5	5.5	3.0
10.El.energy	0	0	0	0
11.Constr.	0	0	0	0
12.Services	0	0	1.6	1.2

Source: see text.

For the state tax "Impôsto sôbre Vendas e Consignações-IVC", revenue data for 1959 were taken from IBGE Anuários Estatísticos relative to the total for each region, and then, as an initial step, the resulting overall rate on total value of gross production was assumed to hold for all sectors, except extractive industry, electric energy, and construction (not significantly charged by IVC). An adjustment was made for agriculture on the assumption (or informed guess) that this sector was charged by only two-thirds of the overall rate. This is due to the numerous exemptions and difficult assessment of agricultural tax basis. To get the rate for services, I supposed that a percentage corresponding to the share of commerce in this sector was applicable on the overall rate. All these rates are made to be consistent with the total revenue of Cr$93.4 million in 1959. The resulting rates are presented in columns 3-4 of table 3.6.

For the analysis of tariff changes, besides the simplified investigation of uniform changes in forces-of-tariffs, the study of the effects of tariff decreases of 1967 requires estimation of actual sectoral changes occurred. These were taken from Bergsman (1970) and supposed to be valid for both regions. The changes in forces of tariffs from 1966 to 1967 are shown in column 1 of table 3.7.

Table 3.7

TARIFF CHANGES AND EXPORT INCENTIVES IN THE SIXTIES

(percent decreases in forces-of-tariffs and increases in forces-of-export-subsidies)

Sector	Tariff changes (1966/mar.'67)	Export Incentives (as of 1971)
1. Agric.		27.4
2. Extr.ind.	- 2.0	
3. N-m.min.	-14.1	
4. Metall.	-10.6	
5. Leather		61.9
6. Chem.	- 3.3	
7. Text.,cl.		54.9
8. Food		24.4
9. Paper,misc.	- 8.4	

Sources: tariff changes: Bergsman (1970) relative to tariff decreases from 1966 to March, 1967.

export incentives: Mendonça et al.(1973). The figures above were adjusted for computation. See text.

Export subsidies for 1971 were taken from Mendonça et al. (1973) and assumed to be equal between regions. The subsidies consist of exemptions of the "Impôsto sôbre Produtos Industrializados - IPI" and of the "Impôsto sôbre Circulação de Mercadorias - ICM" (former IVC), as well as credits (negative charges on IPI and ICM accounts) granted to exporters. After estimating the total in Cr$ of exemptions and credits for 1971, for each sector, Mendonça et al. computed the relationship between that total in Cr$ and the FOB value in US$ of exports for the same year. The results in Cr$/US$ were treated as indicators of sectoral subsidy discrimination and, when compared with the prevailing exchange rate (Cr$/US$), the percentages served as rough measures of the export subsidy levels. It was assumed that the incentives began in 1967. To get the levels prevailing in the sixties, the 1971 rates were discounted by the annual 1967-71 rate of increase. The resulting figures are shown in column 2 of table 3.7.

It should be noted that the export incentives above estimated refer only to the traditional export sectors (1, 5, 7, and 8) as defined in this study, and not to all sectors that have had their exports promoted in the sixties, among which are some sectors here classified as import-competing.

For the estimation of world prices, tariff and exchange rates were taken from Bergsman (1970) - from equation (2.4.1) we see that, after assuming that all p_i-s are initially equal to one, the world prices are determined from the exchange rate and the forces-of-tariffs.

3.7 Production subsidies

As it will be explained later, due to the nature of the model, production subsidies in the sixties were estimated from the SUDENE data relative to private investment incentives. Data for 34/18 private investments by sector, in the 1960's, were taken from Goodman & Albuquerque (197-) and deflated back to 1959 by using the index of general price level (FGV-Conjuntura Econômica- col. 1). The estimate was made that 40% of the 34/18 disbursements were represented by pure subsidies. This seems to be an underestimate, since a mininum average of 50% of the total investments have come from SUDENE, and other government agencies have financed about 25% at negative real rates of interest. The subsidy rates were estimated by dividing the subsidy values thus obtained by the gross production values. They

Table 3.8

PRODUCTION SUBSIDIES ESTIMATED FOR THE SIXTIES
(40% of 34/18 disbursements, excluding power, construction, and services)

Sector	Amount of subsidy (Cr$1,000 of 1959)	Percent of 1959 gross production
1. Agric.	2 219.3	2.3
2. Extr. ind.	564.0	24.7
3. N-m.min.	1 994.4	44.4
4. Metallurgy	4 163.3	43.0
5. Leather	138.9	8.7
6. Chemicals	4 614.3	16.8
7. Text., cl.	3 226.9	12.5
8. Food	1 733.9	5.5
9. Paper,misc.	1 468.5	33.7

Source: see text.

are shown in table 3.8. It should be pointed out that these subsidy rates will represent only an underestimate of the private investment incentives made through SUDENE. No inclusion was made of the public direct investments through SUDENE, which in value are almost equivalent to the total private projects. Due to this fact, investments in electric energy (sector 10), construction (sector 11), and services (sector 12) were excluded.

3.8 Estimation procedures

The computation of the model was made on the IBM 360/65 at Harvard by using subroutine DGELG with double precision, appropriate to solve a general system of simultaneous linear equations. The solution is done by means of Gauss-elimination method with complete pivoting. This is much less time-and-resource-consuming than trying to invert matrix A (through subroutine MINV) and then performing matrix multiplications (subroutine GMPRD) in the normal order as seen by the solution $\xi = A^{-1}R\mu$.

Including the estimation of sectoral values added and other aggregates, the whole job consisted of solving

various linear systems of 138 equations and equal number of endogenous variables. The independent matrix R contained 68 columns, one for each exogenous variable.

Chapter IV

POTENTIAL EFFECTS OF SIMULATED POLICY CHANGES

4.1 Introduction

The enormous amount of information contained in the general solution of the model could not be fully investigated or even presented within the feasible dimensions of the present study. What I will do is to analyze the aggregate results that I consider most relevant to compare interregional effects of hypothetical changes in tariffs, export subsidies, exchange rate, taxes, and exogenous demands, as well as the sensitivity of the results to interregional input-output coefficients.

4.1.1 Aggregate concepts

In most of the tables that appear hereafter, I will make use of the following aggregate concepts:

a) output = average of gross production changes, weighted by their 1959 levels;

b) employment = average of sectoral employment changes, weighted by their 1959 employment levels;

c) industrial employment = average of employment changes for sectors 3-9, weighted by their 1959 levels;

d) net price = average of net price changes, weighted by value added levels for 1959;

e) output price = average change of sector prices, weighted by 1959 gross-production levels;

f) money income = output changes (a) accumulated with net-price changes (d); and

g) real income = money income (f) deflated by output price (e), taking for each region its output price as the deflator.

4.1.2 The mechanics of the model

To explain how the model works is not a simple task, since what we will see in the following tables is the final outcome of simultaneous interactions among almost one hundred economic variables. In the present comparative-static analysis, the only causal chain that can be established is between an initial exogenous disturbance and a movement to a new equilibrium situation. Static relationships between endogenous variables can only be analyzed in terms of consistency within the simultaneous system and not in terms of causality, since no time lag is involved - See Nagel (1961, p. 77). Hopefully, some remarks should make easier the interpretation of the solutions, and for this illustrative purpose I will make use of the tariff-policy effects of the next section.

Let's begin with case 1 (fixed nominal wage) of the policy discussed in the next section, i.e., a ten-percent decrease in all forces-of-tariffs (the first two columns of

figures of Tables 4.1a-b). We can note a general decrease in aggregate variables (Table 4.1a) corresponding to varying degrees of sectoral output changes (Table 4.1b). A 10% reduction in the forces-of-tariffs is translated into a 10% decrease in the prices of import sectors (2,3,4,6,9) - equation (2.4.1'). Equation (2.6.1') suggests that, on the supply side, the policy tends to restrict import-sector outputs, which is consistent with a lower intermediate demand for the remaining commodities. This is accompanied by a lower money income Y, which is highly sensitive to the output decline (Y'=-11% and -7%, respectively, for C.Douglas and CES cases; these figures are not shown in Table 4.1a, but they are approximately the averages between the regional money-income rows of the same Table). The initial disturbance (fall) in equilibrium prices of import sectors is also compatible with demand movements from non-import sectors to import sectors, but these are penalized by competing import increases. At the final equilibrium position, due largely to the income reduction, the general price level declines in the range between -5.4% and -6.7% (cf. output-price rows of Table 4.1a). The prices of non-import sectors fall by less than 10%, such that the import-sector goods become cheaper in terms of the remaining commodities. The favorable effect of this fact for non-import sectors through relatively lower input prices does not prevent them from getting negative net-price changes and then decreases in production.

Another way to explain the working of the model is simplified by observing that the supply function (2.6.1') can be written in a slightly different form:

$$(2.6.1'a) \qquad X_i' = \frac{\alpha_i \sigma_i}{1 - \alpha_i} \{ (\frac{p_i^*}{P})' - (\frac{w}{P})' - t_w' \},$$

where P, as before, is the general price level. This equation shows the relationship between output changes, on one side, and changes in net prices relative to the general price level $(p_i^*/P)'$ and real wages $(w/P)'$, on the other side. In case 1 (fixed nominal wage and declining P), the real wage term plays a crucial role as a negative factor on the right side. In other words, domestic firms are disturbed in two ways: a) by a structural change in relative prices, which in general is more detrimental to import sectors; and b) by a general negative real wage effect (higher real wages must be paid). As in case 1 the general price level falls by 5.4%-6.7%, the real wage effect is equal to this negative magnitude for all sectors. As for the relative price effect $(p_i^*/P)'$, it tends to be more negative for import sectors, reinforcing the negative wage effect. The non-import sectors suffer a general output decline, with the exceptions of export sectors 5(Leather) and 8(Food), where the positive relative price effects (along with high export increases) are larger in absolute value than the negative real wage effect.

In case 2 (fixed real wage), the term $(w/P)'$ disappears from equation (2.6.1'a) and only the relative price term $(p_i^*/P)'$ is linked to output levels. Since all sectors are now allowed to pay a real wage that does not increase, and since the general price level is now fixed by assumption (together with $\underline{w}$ for numéraire), the whole mechanics of the model is simply explained in terms of relative prices. As import-sector prices fall by the force-of-tariff change, the remaining sectors, on the aggregate, must have their prices increased. Thus, the outputs of import sectors decrease and those of the remaining sectors increase (Table 4.1b-case 2), the net aggregate result being positive (first two rows in Table 4.1a-case 2).

In case 3 (full-employment), the aggregate price level is again allowed to move and we have a negative wage effect (between -1.09% and -2.19%, cf. Table 4.1a-case 3-output price) for all sectors. Import and non-traded sectors have this effect reinforced by the negative relative-price effect and their output levels decrease. But export sectors (1, 5, 7, 8) have positive relative price effects that produce net total effects that are positive and consistent with output increases. This means that, in case 3, labor force moves from import and non-traded sectors to export sectors, where labor has now a relatively higher productivity.

Obviously, the intersectoral differences also reflect the various magnitudes of supply elasticities, which depend on labor shares and elasticities of substitution, i.e., on the shapes of sectoral production functions.

As for the interregional results at the sectoral level, we should bear in mind that the labor shares (Table 3.4) play a crucial role in the supply elasticities. The sectors more intensive in the non-fixed labor factor (less dependent on the fixed capital factor) have more freedom to react to public policies. Let's examine the case of the sectors directly affected by the tariff policy, i.e., the import sectors. In Table 4.1b, first column, the output of sector 2(Extr.industry) declines by 10.81% in the Center-South as a result of the tariff cut, while in the Northeast the reduction is only 7.16%. This is essentially a consequence of the fact that the supply elasticity in the latter region is 65.9% of the former's. Outputs of sector 3 decline by 10.33% (CS) and 7.27% (NE), while the supply elasticities have a relationship of 1/0.698. In sector 4 the output changes are -10.36% (CS) and -14.07% (NE), while the proportion between supply elasticities is 1/1.35. In sector 6 the outputs decrease by 3.73% (CS) and 1.5% (NE), while the elasticity relationship is 2.57 to 1. Finally, in sector 9 the proportions are (-10.85%)/(-7.51%) for output and 1 to 0.693 for elasticities.

These observations indicate that the estimated differences in input-output coefficients between regions are not very important to change the output responses suggested by supply elasticities, as far as the sectors directly affected by the policy are concerned. However, the reactions of the remaining sectors (export and non-traded goods in the case of tariff policy) are less predictable by looking only at the supply elasticities.

A similar line of empirically based arguments can be used to explain the results of Tables 4.2a-b related to export subsidies, as well as the remaining numerical solutions.

In summary, the differential aggregate interregional effects of the policies examined in this work can be decomposed in two parts: a) variations among sectors, accounted for by i) relative price effects, ii) real wage effects, and iii) supply elasticities; and b) variations between regions, i.e., differences between regional branches of each sector, which depend mostly on the form of the production functions for primary inputs.

4.2 Tariffs and export subsidies

As hypothesized in the introductory chapter, the structural economic differences between the Center-South and the Northeast would be conducive to increasing regional disparities subsequent to tariff protection. This should be no surprise, since a more industrialized region is expected to take more advantage from industrial protection than a less industrialized one (in 1959 the import-competing sectors accounted for 31% of gross production in the C. South and 14% in the Northeast).

In the numerical solution, general equilibrium repercussions did not change the conclusion. The six different forms of the model systematically do not reject the above hypothesis, as it can be seen from Tables 4.1a (relative to regional aggregates) and 4.1b (relative to sectoral disaggregation). The output, employment, and real-income rows of Table 4.1a indicate that, upon a uniform tariff cut, such aggregates either decrease more in the Center-South or increase more in the Northeast, depending on the assumptions underlying the empirical estimation.

Table 4.1a

Percent changes in regional aggregates in response to a 10% decrease in all forces-of-tariffs

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	-5.78	-2.05	1.19	0.10	-1.10	-0.51
NE	-4.48	-1.49	5.24	1.68	0.02	0.02
Employment: (total) CS	-9.22	-3.24	8.59	2.82	-0.28	-0.12
NE	-8.16	-2.79	10.85	3.82	0.61	0.28
Net price: CS	-5.91	-5.72	2.14	2.19	-1.19	-1.44
NE	-4.57	-4.43	5.17	5.19	-0.28	-0.33
Money income: CS	-11.35	-7.65	3.33	2.29	-2.29	-1.95
NE	-8.85	-5.85	10.58	6.96	-0.26	-0.31
Output price: CS	-6.66	-6.49	-0.31	-0.30	-1.82	-2.19
NE	-5.56	-5.40	2.22	2.18	-1.09	-1.30
Real income: CS	-5.02	-1.24	3.64	2.59	-0.47	0.24
NE	-3.50	-0.45	8.18	4.68	0.83	0.99

Notation: CS=Center-South
NE=Northeast

C.D. = Cobb-Douglas production function
C.E.S. = Constant Elasticity of Substitution production function

Table 4.1b

Percent changes in sectoral outputs in response to a 10% decrease in all forces-of-tariffs

Sector and Region	Case 1		Case 2		Case 3	
	Fixed Nom. Wage		Fixed Real Wage		Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr. CS	- 4.34	-1.54	6.66	2.37	0.95	0.40
NE	- 4.24	-1.46	6.72	2.39	1.03	0.48
2.Ext. CS	-10.81	-5.52	-12.98	-6.65	-5.54	-3.41
NE	- 7.16	-3.66	- 8.50	-4.20	-4.47	-2.25
3.N-m.m.CS	-10.33	-2.15	-13.57	-2.82	-5.44	-1.37
NE	- 7.27	-1.59	- 9.64	-2.00	-3.84	-0.85
4.Met. CS	-10.36	-3.90	-13.38	-5.03	-5.42	-2.45
NE	-14.07	-5.29	-18.32	-6.87	-7.38	-3.35
5.Leath.CS	0.33	0.50	4.50	0.84	6.28	2.81
NE	0.36	0.69	2.90	0.42	4.51	1.68
6.Chem. CS	- 3.73	-3.03	- 5.95	-4.90	-2.16	-2.13
NE	- 1.51	-1.22	- 2.43	-1.96	-0.88	-0.85
7.Text. CS	- 6.13	-1.63	10.94	4.26	0.90	0.96
NE	- 4.64	-1.07	8.24	2.75	0.89	0.75
8.Food CS	0.72	0.79	1.96	0.28	3.97	1.76
NE	0.84	0.87	2.06	0.24	4.35	1.96
9.Pap...CS	-10.85	-4.28	-15.73	-6.09	-6.12	-2.90
NE	- 7.51	-2.98	-11.17	-4.30	-4.62	-2.04
10.El.en.CS	- 4.27	-1.85	2.08	0.85	-1.20	-0.61
NE	- 6.71	-1.98	6.56	2.24	-0.78	-0.29
11.Const.CS	- 3.31	-1.01	7.12	3.33	-0.44	-0.04
NE	- 3.11	-0.95	6.90	3.20	-0.38	-0.18
12.Serv. CS	- 6.30	-1.92	8.55	2.81	-1.28	-0.52
NE	- 5.72	-1.78	9.37	3.05	-1.02	-0.41

For the fixed nominal wage case, both Cobb-Douglas and CES specifications indicate that a slight move towards import liberalization (ten-percent decrease in all forces-of-tariffs) tends to reduce regional disparities of gross production, employment[1], money and real incomes (Table 4.1a). These aggregates decrease in both regions, but they do so more sharply in the Center-South, the more developed region.

For the case of fixed real wage, we get again the confirmation of the initial hypothesis, although with different signs: the regional disparities decrease as a result of trade liberalization, and both regions in general have positive changes in their aggregate variables. The general positive effect comes as a consequence of higher net prices and thus a higher rental rate participation in the net prices of non-traded and export sectors. These sectors are relatively more important in the Northeast, which leads to higher benefits for this region.

The full-employment case is more restrictive and, like the previous ones, does not reject the initial hypothesis: the burden of the tariff cut falls on the C.South with respect to output change and obviously increases labor employment in the Northeast to keep total employment unchanged.

The conclusion drawn from these results is that a movement toward import liberalization leads to a reduction of

regional economic disparities, no matter which labor market assumption or production function specification are adopted. Conversely, the tariff protection used for import substitution in post-war Brazil would have contributed to the widening of regional imbalances, as argued by CODENO (1959).

For export subsidies, the initial hypothesis was that their existence or increase would tend to reduce regional disparities between C.South and Northeast. As the latter depends more on export sectors (45% of total production) than the former (33%), it tends to draw relatively more benefits from export protection. This hypothesis is not rejected by the available data used in this study, according to the following table 4.2a. In general, a uniform decrease in the levels of one-plus-sector-export subsidies contributes to increase regional disparities. The only and minor exception to this rule is for the fixed-real-wage case, in which output in the Northeast decreases slightly less than output in the Center-South.

In all production function specifications and labor market assumptions, the uniform cut in export subsidies causes a decrease in Northeast's output and employment and a smaller decrease in the C.South, except in the case above mentioned. Upon subsidy cut, real income decreases more in

Table 4.2a

Percent changes in regional aggregates in response to a 10% decrease in all forces-of-subsidies

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	-3.06	-1.48	-0.35	-0.30	1.13	0.53
NE	-4.05	-1.97	-0.26	-0.27	-0.02	-0.01
Employ-ment: CS (total)	-7.74	-3.95	-0.80	-0.66	0.28	0.13
NE	-8.50	-4.23	-0.89	-0.71	-0.62	-0.28
Net price: CS	-3.01	-4.11	0.18	0.18	1.22	1.49
NE	-3.56	-4.97	0.23	0.19	0.30	0.35
Money income: CS	-5.98	-5.53	-0.17	-0.12	2.36	2.02
NE	-7.47	-6.84	-0.03	-0.08	0.28	0.34
Output price: CS	-2.49	-3.35	-0.02	-0.02	1.86	2.25
NE	-2.90	-3.97	0.13	0.14	1.12	1.34
Real income: CS	-3.58	-2.26	-0.15	-0.10	0.49	-0.23
NE	-4.71	-2.99	-0.16	-0.22	-0.84	-1.00

Table 4.2b

Percent changes in sectoral outputs in response to a 10% decrease in all forces-of-subsidies

Sector and Region	Case 1		Case 2		Case 3	
	Fixed Nom. Wage		Fixed Real Wage		Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr. CS	- 5.96	-3.14	- 1.55	-0.97	-0.96	-0.41
NE	- 6.02	-3.19	- 1.65	-1.00	-1.05	-0.50
2.Ext. CS	0.51	0.36	- 0.34	-0.25	5.58	3.45
NE	0.35	0.25	- 0.37	-0.38	4.51	2.28
3.N-m.m.CS	0.77	0.22	- 0.52	-0.38	5.48	1.40
NE	0.57	0.24	- 0.36	-0.16	3.89	0.86
4.Met. CS	0.74	0.39	-0.49	-0.25	5.49	2.47
NE	1.03	0.55	-0.63	-0.34	7.46	3.39
5.Leath.CS	-11.92	-4.53	-10.25	-5.36	-6.34	-2.84
NE	- 8.45	-3.07	- 7.44	-3.25	-4.55	-1.70
6.Chem. CS	0.69	0.82	-0.28	-0.24	2.19	2.16
NE	0.28	0.33	-0.08	-0.11	0.89	0.86
7.Text. CS	- 7.60	-4.70	-0.77	-1.38	-0.91	-0.97
NE	- 6.13	-3.36	-1.00	-1.21	-0.89	-0.75
8.Food CS	- 7.11	-3.11	-6.61	-3.43	-4.01	-1.78
NE	- 7.88	-3.50	-7.24	-3.82	-4.38	-1.99
9.Pap...CS	1.61	0.89	-0.34	-0.14	6.16	2.94
NE	1.21	0.65	-0.22	-0.08	4.65	2.09
10.El.en.CS	- 4.26	-1.29	0.56	0.29	1.25	0.64
NE	- 4.82	-2.12	0.48	0.02	0.79	0.30
11.Const.CS	- 2.35	-1.36	1.84	1.11	0.46	0.04
NE	- 2.22	-1.32	1.77	1.12	0.39	0.19
12.Serv. CS	- 3.35	-1.52	2.48	1.15	1.31	0.54
NE	- 3.47	-1.54	2.53	1.16	1.05	0.42

the Northeast than in C.South, pointing to the opposite roles played by import tariffs versus export subsidies with respect to interregional income movements.

At the sectoral level (Table 4.2b) we can note that, in case 1, in only four sectors (4, 5, 7, 11) the subsidy cut does not aggravate interregional disparities. Recalling the arguments of the preceding section, this can be explained by the interregional differences in supply elasticities. In some cases, and this will also be noticed in later Tables, the differences in supply elasticities are not enough to conter-balance the differential relative-price effects. For instance, in Table 4.2b-case 2-C.Douglas-sector 7, the absolute change in the Northeast is greater than in the Center-South despite the smaller supply elasticity, and this is due to the relative-price effect (in case 2 there is no real wage effect).

The above results on the gap-reducing effects of export subsidies should be interpreted only as a general conclusion and not looked at as the consequences of the present pattern of export promotion in Brazil. The recent and successful incentives for manufactured exports will almost certainly benefit more the Center-South. The high level of aggregation and the dichotomy between export and import sectors prevent the present model from predicting such relevant facts. The analysis of export promotion, in this study, refers only to the traditional sectors.

It should be pointed out that, both for tariff and subsidy cuts, in cases 1 and 2, the results would be different if the exchange rate were allowed to change endogenously. Indeed, in a competitive foreign-exchange market, there is usually a trade-off between import tariffs or export subsidies, on one side, and the exchange rate, on the other side. Higher tariff levels shift the demand curve for foreign exchange to the left, and higher export subsidies shift the supply curve to the right. For instance, in case 3 (the only case in which the exchange rate is endogenous), the elasticity of the exchange rate with respect to a uniform change in all forces-of-tariffs is equal to -0.5127 for Cobb-Douglas production functions and -0.4107 the CES specification. Therefore, in the case of tariff cuts (Tables 4.1a-b), a free market exchange rate would go up and thus, from the trading-price equations (2.4.1') and (2.4.2') we see that, in general, the resultant sectoral price fluctuations (and the remaining policy effects) would have lower absolute magnitudes. In case 3 (full employment) this fact, together with the labor demand-supply constraint, explains why the policy consequences, for sectors primarily and directly affected, are usually weaker than in the first two cases.

4.3 Exchange rate

Exchange rate as a policy instrument can only be analyzed, with the present model, in case 1 (fixed nominal wage) and case 2 (fixed real wage), since in case 3 (full employment) it is an endogenous variable. Tables 4.3a-b present sectoral and regional breakdowns of numerical results for output, as well as the aggregates defined in the initial section.

As we can see from Table 4.3a the overall conclusion is that the exchange rate is another instrument of increasing interregional disparities. This is essentially due to the predominant role played by tariffs when compared to export subsidies, especially in the fixed-real-wage case.

At the sectoral level (Table 4.3b), the different responses are mostly the combination of the previously analyzed policies of tariff and subsidy cuts. In fact, in the absence of balanced-budget adjustments in tariff and subsidy policies, changing the exchange rate by some magnitude would correspond to changing simultaneously the forces-of-tariffs and the forces-of-subsidies by the same proportional magnitude (this is not true when the treatment among sectors is not uniform). We should recall that, as explained in subsection 2.8.3, no balanced-budget adjustment was made in the solution of

Table 4.3a

Percent changes in regional aggregates in response to a 10% increase in the exchange rate (Cr$/US$).

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	8.82	3.51	- 0.84	0.20	In this case the exchange rate is endogenous.	
NE	8.47	3.43	- 4.99	- 1.42		
Employment: (total) CS	16.85	7.11	- 7.84	- 2.19		
NE	16.53	6.99	-10.50	- 3.14		
Net price: CS	8.89	9.80	- 2.27	- 2.37		
NE	8.09	9.35	- 5.41	- 5.39		
Money income: CS	18.49	13.65	- 3.11	- 2.17		
NE	17.25	13.10	-10.13	- 6.73		
Output price: CS	9.12	9.80	0.33	0.32		
NE	8.43	9.35	- 2.34	- 2.29		
Real income: CS	8.59	3.51	- 3.44	- 2.49		
NE	8.13	3.43	- 7.98	- 4.54		
Industrial employment CS	19.43	7.67	15.84	7.39		
NE	19.84	7.47	7.59	5.12		

Table 4.3b

Percent changes in sectoral outputs in response to a 10% increase in the exchange rate (Cr$/US$)

Sector and Region		Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
		C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr.	CS	10.30	4.68	- 5.11	-1.40		
	NE	10.26	4.65	- 5.07	-1.39		
2.Ext.	CS	10.30	5.16	13.32	6.90		
	NE	6.81	3.41	8.87	4.58		
3.N-m.m.	CS	9.56	1.93	14.09	2.98		
	NE	6.70	1.35	10.00	2.11		
4.Met.	CS	9.62	3.51	13.87	5.28		
	NE	13.04	4.74	18.95	7.21		
5.Leath.	CS	11.59	4.03	5.75	4.52		
	NE	8.09	2.38	4.54	2.83		
6.Chem.	CS	3.04	2.21	6.23	5.14		
	NE	1.23	0.89	2.51	2.07		
7.Text.	CS	13.73	6.33	-10.17	-2.88		
	NE	10.77	4.43	- 7.23	-1.54		
8.Food	CS	6.39	2.32	4.65	3.15		
	NE	7.04	2.63	5.18	3.58		
9.Pap...	CS	9.24	3.39	16.07	6.23		
	NE	6.30	2.33	11.39	4.38		
10.El.en.	CS	8.53	3.14	- 2.64	-1.14		
	NE	11.53	4.10	- 7.04	-2.26		
11.Const.	CS	5.66	2.37	- 8.96	-4.44		
	NE	5.33	2.27	- 8.67	-4.32		
12.Serv.	CS	9.65	3.44	-11.03	-3.96		
	NE	9.19	3.32	-11.90	-4.21		

In this case the exchange rate is endogenous.

the present exchange rate problem. However, the balanced-budget adjustments are not very significant as compared to non-adjusted results. Thus, the analysis of exchange rate in its interregional implications is approximately equivalent to the joint analysis of the two instruments studied in the previous section.

As for the total employment effects of the exchange rate - Table 4.3a-employment(total) -, it should be mentioned the approximation between the present results and those obtained by Taylor & Black (1973, p. 18) for Chile: In case 1 (one of their cases) the elasticity of total employment with respect to the exchange rate was found to be 1.67 in this study and 1.69 in their work, when Cobb-Douglas production functions are used. For the CES case, the elasticities fall to 0.71 and 0.87, respectively.

When used as discriminating instruments of protection, multiple exchange rates should be analyzed in their proper capacities - both as tariffs (for import sectors) and as subsidies (for export sectors). A multiple exchange rate system of protection was set up in Brazil from 1953 to 1955 - see Kafka (1956). Its role as a means to increase regional disparities was examined by CODENO (1959) and more recently by Barrett (1972). The conclusion has

been that the multiplicity of exchange rates discriminated against the Northeast. Although under a different theoretical framework, the present study would lead to similar results. As in that system the import sectors had exchange rates that in general were higher than those for export goods - see Kafka (1956, p. 310) -, it protected more heavily the sectors predominating in the Center-South. Uniformity of protectionist regime alone would have been enough to increase regional disparities, according to the preceding analysis of this section. Discrimination in favor of import industries, a fortiori, led to further discrepancy of regional incomes.

4.4 State taxes

As of 1959, state fiscal revenues in Brazil are almost totally represented by the "Impôsto de Vendas e Consignações - IVC" (sales tax). It was assessed on a turnover basis at every stage from production to consumption. For the purposes of this study, it will be treated as equivalent to a value added tax, due to the open-economy nature of the model with its rigid price assumptions. Furthermore, instead of IVC, I will refer to the tax as ICM - "Impôsto de Circulação de Mercadorias" (commodity circulation tax), as it has been called after the 1967 tax reform.[2] The analysis of this reform has been made by Araújo et al.(1973) and Haddad & Andrade (1973).

Despite the approximate uniformity of the legal rates, the tax collection data presented in the last Chapter show a pronounced discrepancy between regions. Actual rates in the Northeast are half of those in the Center-South, on the average. This has to do with different complex social and economic structures, reflected in the efficacy of tax administration.[3] Discussion of this topic is out of the scope of the present study. What matters here is the interregional effects of hypothetical tax changes in each region.

Tables 4.4 and 4.5 (a-b) show the results of imposing an ICM rate increase of 10% (i.e., ten percent of the rates

Table 4.4a

Percent changes in regional aggregates in response to a 10% increase in the ICM rate in Center-South

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	-0.76	-0.29	-0.59	-0.24	-0.21	-0.13
NE	-0.36	-0.07	-0.12	-0.01	0.17	0.10
Employ-ment: CS (total)	-1.19	-0.38	-0.73	-0.28	-0.14	-0.07
NE	-0.74	-0.15	-0.28	-0.04	0.29	0.16
Net price: CS	-0.74	-0.71	-0.55	-0.56	-0.18	-0.28
NE	-0.37	-0.24	-0.14	-0.06	0.13	0.17
Money income: CS	-1.50	-1.00	-1.14	-0.80	-0.39	-0.41
NE	-0.73	-0.31	-0.26	-0.07	0.30	0.27
Output price: CS	-0.11	-0.11	0.01	0.01	0.43	0.32
NE	-0.24	-0.19	-0.07	-0.06	0.24	0.23
Real income: CS	-1.32	-0.89	-1.15	-0.81	-0.82	-0.73
NE	-0.49	-0.12	-0.19	-0.01	0.06	0.04

Table 4.4b

Percent changes in sectoral outputs in response to a 10% increase in the ICM rate in the Center-South

Sector and Region		Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
		C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr.	CS	-0.79	-0.30	-0.45	-0.18	-0.02	-0.01
	NE	-0.59	-0.19	-0.26	-0.07	0.17	0.10
2.Ext.	CS	0.09	0.04	0.02	0.01	0.85	0.37
	NE	0.06	0.03	0.02	0.00	0.57	0.24
3.N-m.m.	CS	-0.79	-0.16	-0.89	-0.19	-0.08	-0.04
	NE	0.10	0.02	0.03	0.00	0.60	0.10
4.Met.	CS	-1.09	-0.41	-1.18	-0.44	-0.37	-0.19
	NE	0.18	0.06	0.05	0.01	1.14	0.35
5.Leath.	CS	-1.10	-0.41	-0.98	-0.42	-0.24	-0.16
	NE	-0.29	-0.03	-0.21	-0.04	0.31	0.12
6.Chem.	CS	-0.45	-0.37	-0.53	-0.43	-0.23	-0.23
	NE	0.04	0.03	0.01	0.01	0.13	0.08
7.Text.	CS	-1.38	-0.68	-0.86	-0.49	-0.36	-0.28
	NE	-0.66	-0.18	-0.26	-0.01	0.14	0.09
8.Food	CS	-0.60	-0.25	-0.56	-0.26	-0.12	-0.10
	NE	-0.04	0.03	-0.00	0.01	0.48	0.20
9.Pap...	CS	-1.12	-0.44	-1.27	-0.49	-0.44	-0.22
	NE	0.14	0.05	0.03	0.01	0.61	0.19
10.El.en.	CS	-0.76	-0.25	-0.51	-0.17	-0.13	-0.06
	NE	-0.58	-0.15	-0.17	-0.03	0.28	0.10
11.Const.	CS	-0.46	-0.17	-0.14	-0.03	-0.04	-0.02
	NE	-0.42	-0.15	-0.11	-0.02	-0.02	-0.01
12.Serv.	CS	-0.77	-0.23	-0.32	-0.09	-0.06	-0.02
	NE	-0.63	-0.17	-0.16	-0.02	0.06	0.04

Table 4.5a

Percent changes in regional aggregates in response to a 10% increase in the ICM rate in the Northeast

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	-0.01	-0.00	-0.01	-0.00	0.03	0.02
NE	-0.15	-0.07	-0.16	-0.08	-0.11	-0.06
Employment: CS (total)	-0.01	-0.00	-0.02	-0.00	0.06	0.03
NE	-0.20	-0.10	-0.21	-0.10	-0.13	-0.07
Net price: CS	-0.01	-0.00	-0.01	-0.01	0.02	0.03
NE	-0.14	-0.18	-0.15	-0.19	-0.11	-0.14
Money income: CS	-0.02	-0.00	-0.02	-0.01	0.05	0.05
NE	-0.29	-0.25	-0.31	-0.27	-0.22	-0.20
Output price: CS	-0.01	-0.00	-0.01	-0.01	0.03	0.04
NE	0.08	0.05	0.07	0.07	0.11	0.08
Real income: CS	-0.01	0.00	-0.01	0.00	0.02	0.01
NE	-0.37	-0.30	-0.38	-0.34	-0.33	-0.28

Table 4.5b

Percent changes in sectoral outputs in response to a 10% increase in the ICM rate in the Northeast

Sector and Region	Case 1		Case 2		Case 3	
	Fixed Nom. Wage		Fixed Real Wage		Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr. CS	-0.02	-0.01	-0.02	-0.00	0.04	0.02
NE	-0.11	-0.05	-0.12	-0.06	-0.06	-0.04
2.Ext. CS	0.00	0.00	0.00	0.00	0.06	0.03
NE	-0.01	-0.00	-0.00	-0.00	0.03	0.02
3.N-m.m.CS	0.01	0.00	0.01	0.00	0.06	0.01
NE	-0.34	-0.06	-0.36	-0.07	-0.32	-0.06
4.Met. CS	0.00	0.00	0.00	0.00	0.06	0.02
NE	-0.84	-0.30	-0.90	-0.33	-0.83	-0.31
5.Leath.CS	-0.02	-0.00	-0.02	-0.00	0.04	0.02
NE	-0.26	-0.11	-0.28	-0.12	-0.24	-0.10
6.Chem. CS	0.00	0.00	0.00	0.00	0.02	0.01
NE	-0.11	-0.08	-0.12	-0.09	-0.11	-0.09
7.Text. CS	-0.03	-0.01	-0.03	-0.01	0.04	0.02
NE	-0.24	-0.15	-0.26	-0.17	-0.20	-0.14
8.Food CS	-0.01	-0.00	-0.01	-0.00	0.03	0.01
NE	-0.32	-0.15	-0.34	-0.17	-0.31	-0.16
9.Pap...CS	0.00	0.00	0.00	0.00	0.05	0.02
NE	-0.47	-0.17	-0.50	-0.19	-0.47	-0.18
10.El.en.CS	-0.01	-0.00	-0.01	-0.00	0.03	0.01
NE	-0.23	-0.09	-0.25	-0.10	-0.18	-0.07
11.Const.CS	-0.02	-0.01	-0.02	-0.00	0.01	0.01
NE	-0.03	-0.01	-0.03	-0.01	0.00	0.00
12.Serv. CS	-0.02	-0.01	-0.02	-0.00	0.03	0.01
NE	-0.08	-0.04	-0.08	-0.04	-0.03	-0.02

effectively prevailing in each region, in 1959) in C.South and Northeast, respectively. As it should be predictable, an equal rate increase for both regions penalizes much more the Center-South. This is consistent with the general conclusion of this study that taxes tend to reduce regional disparities. Due to the lower effective rates in the Northeast, it is in this region that the tax is less detrimental to the economy.

However, comparison of the two tables highlights the interregional asymmetry of the results. The cross-regional effects are very different according to the region of origin. For case 1 and Cobb-Douglas specification, while real income in the Northeast falls by 0.49% as a result of a 10% increase in C.South ICM rate, it falls only by 0.01% in the C.South as a consequence of 10% increase in the Northeast ICM rate.

In general, the sectoral results of Tables 4.4b and 4.5b show, as we should expect, more significant decreases in the more heavily taxed sectors 3-9, but general equilibrium repercussions in the real wage and in the structure of relative prices require declines even in non-taxed sectors 10 and 11. The sectors are obviously more penalized by the tax when this is imposed in their own regions.

4.5 Federal indirect tax

Federal indirect tax revenues in Brazil are almost totally produced by the "Impôsto sôbre Produtos Industrializados - IPI" (manufactured-commodity tax), which falls on industrial sectors 3-9. It is assessed on a value added basis at the wholesale level, when the commodity leaves the factory (the tax paid on purchases of raw materials is deducted from the tax calculated on sales of final goods). A selective rate schedule is adopted, in general according to essentiality. Although in 1959 it was called "Impôsto de Consumo" (federal consumption tax) with some differences in schedule and assessment procedures, here it will be treated as the manufactured-commodity tax.

According to the Ministry of Finance data presente in the last chapter for 1959, the actual IPI rates in the Northeast are only about a half of what they are in the Center-South, although the legal rates are the same between regions. The reason of this discrepancy lies again on different social and economic structures.

For simplication, here I will examine IPI effects only on regional industrial employment. The effects for the other aggregates follow a similar direction. This seems to be outstandingly relevant not only due to the serious

Table 4.6

Percent changes in industrial employment in response to an increase of 10% in all IPI rates in both regions

Region	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
CS	-1.98	-0.83	-1.89	-0.82	-0.97	-0.58
NE	-1.29	-0.34	-1.00	-0.37	-0.09	-0.15

unemployment problem specially in the Northeast but also because the tax falls only on industrial sectors 3-9.

As the Center-South is the predominant manufacturing area of the country, the industrial tax penalizes more that region. For case 1 and C.Douglas production functions - table 4.6 -, a 10% increase in all IPI rates (in both regions) causes a fall in industrial employment of 1.93% in the Center-South and 1.29% in the Northeast. The remaining cases give similar results. This points to the federal-tax effect of reducing regional disparities.

4.6 Labor tax

The potentialities of the Johansen-type general equilibrium model are illustrated in this study by its ability to deal simultaneously with a wide range of different problems of economic policy. In the present interregional applications, a labor (or payroll) tax is another instrument that can be investigated.

In Brazil there has been a serious concern about social security and many other labor charges, which have gone

Table 4.7a

Percent changes in regional aggregates in response to a 10% labor tax on all sectors in both regions, excluding agriculture, extractive industry, and services

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	- 5.84	- 2.23	- 4.07	- 1.75	- 1.20	- 0.83
NE	- 4.83	- 1.64	- 2.37	- 0.95	- 0.37	- 0.27
Employment (total): CS	- 9.04	- 2.96	- 4.53	- 1.61	- 0.19	- 0.11
NE	- 8.28	- 2.53	- 3.34	- 1.09	0.42	0.26
Net price: CS	- 5.70	- 5.40	- 3.66	- 3.64	- 1.03	- 1.50
NE	- 4.70	- 4.30	- 2.24	- 2.21	- 0.44	- 0.57
Money income: CS	-11.21	- 7.61	- 7.58	- 5.33	- 2.23	- 2.33
NE	- 9.35	- 5.87	- 4.56	- 3.14	- 0.81	- 0.84
Output price: CS	- 1.61	- 1.37	- 0.00	- 0.00	3.19	2.53
NE	- 1.96	- 1.63	0.00	0.04	2.46	2.09
Real income: CS	- 9.76	- 6.33	- 7.58	- 5.33	- 5.25	- 4.74
NE	- 7.54	- 4.31	- 4.56	- 3.10	- 3.27	- 2.93
Industrial employment: CS	-15.85	- 6.91	-15.20	- 6.86	- 5.63	- 3.85
NE	-15.47	- 6.23	-13.16	- 5.87	- 4.29	- 3.17

Table 4.7b

Percent changes in sectoral outputs in response to a 10% labor tax on all sectors in both regions, excluding agriculture, extractive industry, and services

Sector and Region		Case 1		Case 2		Case 3	
		Fixed Nom. Wage		Fixed Real Wage		Full-Employment	
		C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr.	CS	-5.22	-1.79	-2.19	-0.77	0.55	0.34
	NE	-5.15	-1.74	-2.13	-0.72	0.61	0.38
2.Ext.	CS	0.78	0.36	0.19	0.07	6.56	2.71
	NE	0.48	0.22	0.08	0.02	4.30	1.77
3.N-m.m.	CS	-8.57	-1.80	-9.47	-1.97	-3.21	-0.92
	NE	-6.03	-1.26	-6.68	-1.39	-2.27	-0.65
4.Met.	CS	-8.66	-3.28	-9.50	-3.57	-3.27	-1.68
	NE	-11.77	-4.45	-12.93	-4.86	-4.45	-2.29
5.Leath.	CS	-7.74	-2.84	-6.59	-2.93	-1.24	-1.02
	NE	-5.39	-1.68	-4.69	-1.76	-0.85	-0.60
6.Chem.	CS	-4.39	-3.59	-5.02	-4.09	-2.69	-2.59
	NE	-1.72	-1.41	-1.98	-1.61	-1.04	-1.01
7.Text.	CS	-10.37	-5.09	-5.67	-3.54	-2.67	-2.21
	NE	-8.14	-3.57	-4.60	-2.57	-2.10	-1.56
8.Food	CS	-3.81	-1.55	-3.47	-1.68	-0.23	-0.49
	NE	-4.21	-1.77	-3.85	-1.93	-0.27	-0.57
9.Pap...	CS	-7.15	-2.81	-8.50	-3.29	-1.97	-1.27
	NE	-4.89	-1.94	-5.90	-2.29	-1.36	-0.88
10.El.en.	CS	-6.51	-2.53	-4.31	-1.81	-1.72	-1.10
	NE	-8.09	-2.93	-4.43	-1.87	-1.62	-1.07
11.Const.	CS	-3.98	-1.70	-1.10	-0.55	-0.80	-0.62
	NE	-3.76	-1.65	-1.01	-0.54	-0.78	-0.62
12.Serv.	CS	-5.69	-1.62	-1.62	-0.38	-0.27	-0.01
	NE	-5.25	-1.48	-1.10	-0.22	-0.10	0.03

up to more than 45% of the wage bill. Bacha et al.(1972) is the most recent study on this problem.

With respect to the interpretation of the labor tax to be analyzed in this section, it should be pointed out that it could also be considered as an exogenous nominal wage increase resulting, for instance, from labor-union pressures. (It should be remembered that, in the present model, what is fixed for numéraire is the nominal wage rate net-of-tax)

For lack of good data, the labor tax will be assumed to be zero at the beginning. Furthermore, agriculture, extractive industry, and service sectors will be supposed not to be levied, given their peculiar nature that makes difficult the imposition of such a tax.

We can see from Table 4.7a the effect of introducing a 10% labor tax on sectors 3-11. It is interesting to note the regularity of the strongly netative effect in all cases and for all aggregate variables.

Following the conclusion drawn for the indirect taxes, the labor tax is an agent of reducing interregional disparities. For the fixed nominal wage case and Cobb-Douglas production functions (first column of table 4.7a), we see that a 10% payroll tax on sectors 3-11 causes decreases in real incomes of 9.76% in the Center-South and 7.54% in the Northeast. The effects on employment - either total or only

industrial (sectors 3-9) - are stronger but interregional differences are less pronounced, though in the same direction.

At the disaggregated level, sectors 3 to 9 follow the interregional differences indicated by their regional supply elasticities. The remaining sectors react between regions with minor differences dictated by relative price and wage effects.

The study by Bacha et al. (1972), at the national level, should be compared to the present one at the interregional level. The conclusion of the former is that sectoral employment is very sensitive to a labor tax or other labor charges. Using Bacha's results for elasticities of substitution in the CES cases[4], the present study has found that, interregionally, such a tax is conducive to decreasing disparities of employment and income between the Center-South and the Northeast.

4.7 Exogenous demand

The last instrument of government policy to be studied in its interregional implications is exogenous demand. This has been the main focus of many interregional models, on which I will make some comments and one rough empirical application.

4.7.1 Estimates with the Chenery model

One of the most popular interregional input-output models is the one presented in the so-called "Chenery report" for Italy in Chenery et al. (1953, ch. V). The explanation of the main features of that model does not meet the space constraints of this study, and the reader is referred to Chenery & Clark (1959, ch. 3 and 12) and Yan (1969, ch. 7). It has been used, among others, by Moses (1955) for the United States, Brodersohn (1965) for Argentina, and Hartwick (1969) for Canada. Serious criticisms on the application of this model to Brazilian conditions were presented by Haddad (1972), basically against the assumption of interregionally identical input-output coefficients. These were simulated, for illustrative purposes, by Haddad & Andrade (1973) in the analysis of 1967 State tax reform.

In an attempt to investigate how that type of model would predict changes for Brazil, I aggregated the Brazilian input-output table into 4 sectors, namely agriculture, industry,

services, and households (this last sector corresponds to the row of value added and to the column of consumption distribution by sectors of origin in the "closed" input-output table).[5] Then I built the interregional input-output table (of order 8x8) following a procedure similar to that explained in the last chapter (section 3.2), this time in a much more compact form. Regional consumption coefficients were taken by aggregating Fundação Getúlio Vargas (1962) budget studies, and are presented in Table 4.7.1a. From this table we can see that agriculture and services take smaller budget shares in the Center-South than in the Northeast. Also, total consumption coefficients for the regions are 72.22% and 84.94%, respectively.

The regional supply coefficients are presented in Table 4.7.1b, where we can observe, now in more aggregate form, the large asymmetry in interregional dependence, especially in the case of industrial goods. Services and households are tagged as "local" (or non-traded) sectors. Imports in this type of model are treated as non-competitive, i.e., as fixed proportions of sectoral outputs.

With the aggregated national input-output table (4 sectors) and using the regional supply coefficients, we can build the direct interregional input-output matrix - (Table 4.7.1c)-, whose inverse (Table 4.7.1d) contains the multipliers that serve to estimate the sectoral and regional effects of a

Table 4.7.1a

REGIONAL CONSUMPTION COEFFICIENTS

Sector	Center-South	Northeast
Agriculture	.1257	.1764
Industry	.2813	.2663
Services	.3152	.4067
Households	-	-

Source of original data: FGV (1962).

Table 4.7.1b

REGIONAL SUPPLY COEFFICIENTS
FOR THE CHENERY MODEL

Sector	Supply to C.South			Supply to Northeast		
	from CS	from NE	imports	from CS	from NE	imports
Agriculture	.951	.016	.032	.007	.964	.029
Industry	.896	.011	.092	.387	.572	.041
Services	1.000	-	-	-	1.000	-
Households	1.000	-	-	-	1.000	-

Sources of original data: IPEA (1967) and Goodman & Albuquerque (1971).

Table 4.7.1c

DIRECT INPUT-OUTPUT MATRIX FOR THE INTERREGIONAL MODEL = A

	N.Agr	N.Ind	N.Ser	N.Hhd	S.Agr	S.Ind	S.Ser	S.Hhd
N.Agr	.0722	.1199	.0008	.1752	.0012	.0021	-	.0021
N.Ind	.0324	.2393	.0825	.1587	.0007	.0052	.0018	.0037
N.Serv	.0200	.1080	.1050	.4067	-	-	-	-
N.Hhd	.8529	.3609	.7557	-	-	-	-	-
S.Agr	.0005	.0008	-	.0012	.0715	.1186	.0008	.1236
S.Ind	.0220	.1622	.0560	.1076	.0537	.3963	.1367	.2776
S.Serv	-	-	-	-	.0200	.1080	.1050	.3153
S.Hhd	-	-	-	-	.8529	.3609	.7557	-

Table 4.7.1d

INVERSE MATRIX = $(I-A)^{-1}$

	N.Agr	N.Ind	N.Serv	N.Hhd	S.Agr	S.Ind	S.Serv	S.Hhd
N.Ag	1.75293	.70792	.65337	.69082	.04301	.05191	.04275	.03050
N.Ind	.87010	1.99992	.90559	.84712	.06608	.08283	.06928	.06223
N.Ser	1.47159	1.30902	2.50219	1.49062	.05550	.06832	.05672	.05164
N.Hhd	2.92117	2.31478	2.77499	3.02139	.10247	.12579	.10432	.09518
S.Ag	.53019	.60724	.55024	.51565	1.81528	.93333	.75834	.72593
S.In	2.09895	2.40953	2.18285	2.04284	2.14691	3.73948	2.30281	2.04284
S.Ser	.94211	1.08090	.97927	.91676	1.52367	1.67351	2.63403	1.48938
S.Hhd	1.92167	2.20436	1.99712	1.86985	3.47451	3.41029	3.46841	3.48193

Table 4.7.1e

FEDERAL INVESTMENT PROGRAM FOR NORTHEAST

Initial increase in final demand
as a result of the investment program (Cr$ million of 1972)

	C.South	Northeast	Imports	Total
Agriculture	-	-	-	-
Industry	4,625	6,385	690	11,700
Services	-	2,500	-	2,500
Households	-	10,000	-	10,000
T o t a l	4,625	18,885	690	24,200

Table 4.7.1f

SOLUTION TO THE INTERREGIONAL MODEL

Increase in production (Cr$million)

	C.South	Northeast	Imports	Total
Agriculture	14,999.3	13,170.3	911.5	29,081.1
Industry	54,649.7	24,787.8	7,381.0	86,818.5
Services	26,743.8	30,424.9	-	57,168.7
Households	54,530.7	53,554.7	-	108,085.4
T o t a l	150,923.5	121,937.7	8,292.5	281,153.7

C.South shipments to Northeast(net) = 15,883.4
Northeastern imports (from abroad) = 2,160.5
18,043.9

Northeastern Marg.Prop.to import = 18,043.9/53,554.7 = 0.34

given change in exogenous demand. We should note that in the "household" rows of the inverse matrix are the income multipliers, the remaining rows being output multipliers.

For lack of data, sectoral distribution of initial exogenous expenditures was assumed to be structurally similar to Chenery's estimates for Italy. Such a distribution forms the column vector that will post-multiply the inverse matrix shown in Table 4.7.1d. For Brazil, the investment program presented in details by Hollanda (1972) refers to the planned application of resources by the federal government in the Northeast for the period 1972-1974, included in the First National Development Plan. Such a program was used here for an empirical illustration of the Chenery model. The Cr$24 billion plan was distributed as an initial increase in final demand and is presented in Table 4.7.1e, where we can see that 19% of the resources are initially channelled to the Center-South to buy industrial goods.

Using this rough statistical apparatus, the solution of the Chenery interregional model is shown in Table 4.7.1f, where we can note that, largely as a result of the consumption structure, the overall investment income multiplier is 108.1/24.2 = 4.46. Table 4.8 shows the interregional results obtained here with those estimated by Chenery for Italy and Moses for the United States.

Table 4.8

COMPARISON OF REGIONAL ANALYSES

(in percent)

Item	BRAZIL		ITALY (Chenery)		U.S. (Moses)	
	NE	CS	South	North	East	West
a. Initial division of income	15	85	25	75	42	58
b. Division of initial increase in final demand	81	19	63	37	..	..
c. Division of total income produced	50	50	55	45	66	34
d. Distribution of income produced by sectors:						
i) local	69	43	68	42	73	39
ii) non-local	31	57	32	58	27	61
e. Regional propensity to import	.34		.42		.30	

In summary, what Table 4.8 shows for Brazil, following the order of its items, is:

a) at the beginning of the investment program, Northeast and Center-South shared 15% and 85% of national income, respectively;

b) the direct resources of the program were initially applied in the two regions in the proportions of 81% and 19%, respectively;

c) the final effect of the program, despite intended primarily to benefit the Northeast, was to give equal income increases to both regions;

d) "local" sectors (i.e., those not sold inter-regionally and here including services and households) in the Northeast had 69% of the income produced in the region, the remaining 31% being generated in non-local sectors (agriculture and industry). For the Center-South the proportions were 43% and 57%, respectively;

e) from the income result of the program in the Northeast, 34% would be paid for imports into that region.

It is striking to observe the similarity between the Italian, the American, and the Brazilian cases. Because of the heavy dependence of the Northeast on the Center-South for the supply of industrial commodities, an investment program intended to help the poor region generates half of its benefits in the rich region. The Chenery-type model has produced similar results for all the cases studied, including Canada (Hartwick-1969). The less self-sufficient is the region, the larger are the leakages. The far-reaching political implications of these findings are easily perceived.

However, the Chenery model neglects many relevant points, such as price changes, factor constraints, endogenous demand, labor employment, and thus it is mainly in the nature of a Keynesian analysis of sectoral multipliers.[6] This is the reason for the rather illustrative purpose attached to this subsection, which has been presented mainly to compare its results with those to be obtained in the following subsection by using the Johansen general equilibrium framework.

4.7.2 Results of the multi-sectoral model

In order to assess the effects of exogenous demand under the model employed in this study, a comment should be made on price assumptions. As it was explained in Chapter II, prices of import sectors are directly determined by tariffs and exchange rate, and thus free from the influence of exogenous demand (except for case 3 - full employment -, where the exchange rate is endogenous). In contrast, non-traded sector prices are endogenous and export sector prices have an endogenous component represented by world prices. The consequence is that only for the last two classes of sectors is exogenous demand interesting for analysis.

A numerical investigation was made to see how the two regional economies react to a 10% increase in exogenous demand for non-traded and export sectors. Johansen's procedure of using exogenous demand changes in terms of sector's gross production (less own-sector deliveries) was adopted, since exogenous demand by its nature is a net concept and may be on both sides of zero (though not in the present case), thus not appropriate to serve as basis of proportional change analysis. Therefore, the interregional effects of an increase in exogenous demand equivalent to 10% of (gross production less own-sector deliveries) are presented in Table 4.9 when the increase occurs for C.South sectors, and in Table 4.10 when the increase is directed to Northeastern sectors.

As explained in section 2.8.2, no balanced-budget adjustment was made for the present case of increase in exogenous demand, considered here to be financed by foreign resources, thus preserving its purely exogenous character. Also, to save space and time I do not present the sectoral breakdown, such that only the aggregate results are discussed.

To interpret the solution of tables 4.9 and 4.10 we could ask, for example, why should an increase in exogenous demand in the Center-South cause a decrease in output, employment, and income in the Northeast? We can explain this result by noting that, in the demand-supply balance equation (2.5.1), an exogenous increase in Z (on the demand side) requires either an increase in the supply or a decrease in the other forms of demand (endogenous consumption, intermediate demand and exports), or both. The increase in supply of a sector in Center-South is only compatible with increase in the relative price ($p^{*\prime}$ positive) of the same sector - cf.supply function (2.6.1'). This means a decrease in relative prices of the remaining sectors and especially in the Northeast, which is related to output decrease in this region. The decrease in the other forms of demand, especially endogenous consumption (9.09% fall in total consumption in Brazil for Case 1-C.Douglas -not shown in Table 4.9) produces a strong negative income effect in the demand for Northeastern sectors, also consistent with output decrease.

Table 4.9

Percent changes in regional aggregates in response to a 10% increase* in exogenous demand for non-traded and export sectors in the Center-South.

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	1.94	1.20	0.93	0.61	0.75	0.49
NE	-3.41	-2.35	-4.83	-3.21	-4.56	-3.04
Employment: CS (total)	6.39	4.33	3.79	2.67	4.10	2.89
NE	-6.74	-4.91	-9.58	-6.93	-8.98	-6.32
Net price: CS	1.90	3.63	0.73	1.47	0.70	1.66
NE	-3.43	-7.09	-4.86	-9.71	-4.53	-8.98
Money income: CS	3.88	4.87	1.66	2.09	1.45	2.16
NE	-6.72	-9.27	-9.46	-12.61	-8.88	-11.75
Output price: CS	1.47	2.75	0.54	1.07	0.23	0.77
NE	-2.69	-5.50	-3.83	-7.57	-3.84	-7.39
Real income: CS	2.38	2.07	1.11	1.01	1.22	1.38
NE	-4.14	-3.99	-5.85	-5.45	-5.24	-4.71

*The increase is equal to 10% of (gross production less own-sector deliveries).

Table 4.10

Percent changes in regional aggregates in response to a 10% increase* in exogenous demand for non-traded and export sectors in the Northeast.

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	- 0.43	- 0.31	- 0.67	- 0.44	-2.14	-1.41
NE	5.94	4.01	5.60	3.80	4.30	2.92
Employment: (total) CS	- 1.04	- 0.77	- 1.66	- 1.16	-4.30	-3.01
NE	12.60	8.79	11.93	8.37	9.41	6.59
Net price: CS	- 0.48	- 1.03	- 0.76	- 1.44	-2.20	-4.10
NE	5.33	10.75	4.99	10.14	3.76	7.81
Money income: CS	- 0.91	- 1.34	- 1.43	- 1.88	-4.29	-5.15
NE	11.59	15.19	10.87	14.33	8.22	10.96
Output price: CS	- 0.33	- 0.70	- 0.55	- 1.10	-2.09	-3.79
NE	4.15	8.25	3.88	7.76	2.49	5.31
Real income: CS	- 0.58	- 0.64	- 0.88	- 0.78	-2.25	-1.41
NE	7.14	6.41	6.73	6.10	5.59	5.37

*The increase is equal to 10% of (gross production in each sector less own-sector deliveries).

It is interesting to note how different are these results from those obtained by using the Chenery-type model. Since now there are many general-equilibrium constraints to be met, increasing exogenous demand in one region leads to an increase in its real income but to a decrease in the overall endogenous consumption and reduction in real income of the other region. This did not happen in Chenery-type analysis, where those constraints did not exist and thus both regions had their real incomes increased merely as a a result of quantity consistency requirements.

It should be noted that in all cases the elasticities of real income of the Northeast with respect to exogenous demand in the same region (.0537 to .0714) are higher than the corresponding ones in the Center-South (.0101 to .0238). The reason is that, much more than in the C.South, the Northeast depends heavily on export and non-traded sectors, whose exogenous demands are increased in this case.

4.8 Interregional trade coefficients

Theoretically it is predictable, and with the present Johansen-type model it is measurable, how the positive

or negative effects of various policy instruments are interregionally transmitted through a changing pattern of trade.

A relevant question to be asked is to what extent would the results so far obtained be modified if there were some modification in the interregional input-output coefficients. Stability of these coefficients has been the most frequently criticized assumption of interregional input-output models. The question will not be solved here, but some suggestions can be given by looking at the general solution.

For the fixed-nominal-wage case and CES production function specification, I have recomputed the model by reducing all interregional coefficients by 10% and making the necessary upward adjustment in the regional coefficients. In other words, denoting by a_{ij}^{sn} the interregional input-output coefficient of sector i into sector j from the C.South to the Northeast, and by a_{ij}^{nn} the regional coefficient from the Northeast to itself, I have reduced a_{ij}^{sn} to $0.90a_{ij}^{sn}$ and increased a_{ij}^{nn} to $a_{ij}^{nn} + 0.10a_{ij}^{sn}$. The same procedure was followed with respect to a_{ij}^{ss} and a_{ij}^{ns} (from C.South and Northeast to C.South). Similar changes were made for the corresponding initial values of intermediate deliveries (X_{ij}) in the demand-supply balances.

The sensitivity of the model to this parameter change is presented in table 4.11 in the form of second-order elas-

Table 4.11

Elasticities of policy effects with respect to interregional input-output coefficients

Fixed Nominal Wage - CES specification

Aggregate	Elasticities of the effects of:			
	ICM-C.South	ICM-Northeast	Labor tax	Exch.rate
Output: CS	.0126	-.2247	.0069	-.0058
NE	-.1335	.0151	-.0563	.0378
Employ-ment: CS (total)	.0316	-.1456	.0280	-.0168
NE	-.1894	.0063	-.1240	.0665
Industrial employment CS	.0084	-.9494	.0021	-.0023
NE	-.3884	.0328	-.0086	.0076
Net price: CS	.0114	-.1609	.0066	-.0049
NE	-.1003	.0121	-.0494	.0313
Money income: CS	.0240	-.3494	.0135	-.0107
NE	-.2204	.0274	-.1029	.0325
Output price: CS	.0221	-.0721	.0126	-.0026
NE	-.0714	.0028	-.0721	.0188
Real income: CS	.0019	-.2988	.0009	-.0081
NE	-.1605	.0246	-.0332	.0134

Note: Positive (negative) elasticities indicate gain (loss) from stronger interregional dependence, i.e., from higher interregional input-output coefficients.

ticities. For instance, the first figure 0.0126 of table 4.11 indicates that the effect of increasing ICM-rate in the C.South on the output of that region (first element in second column of table 4.4a) would be .126% more negative (greater in absolute value) if interregional coefficients were 10% lower. In other words, had the C.South a more restricted possibility of selling its products in the Northeast, it would bear a higher burden of the tax. Correspondingly, the figure immediately below shows that the effect on the Northeast output would be 13.35% less negative (smaller in absolute value). In summary, positive (negative) elasticities in the the table indicate a gain (loss) from a stronger interregional dependence (i.e., from higher interregional input-output coefficients).

It is interesting to observe how significant is the elasticity of the cross-regional influence of the ICM, particularly on industrial employment. All the effects of the Northeast ICM on the C.South are more sensitive to inter-regional trade than the effects of the C.South ICM on the Northeast. It appears that this is due to the fact that the initial effects of the former are too low, even negligible (see table 4.5a), making any change seem proportionally high. The third column indicates that, as a labor tax has been shown to be more detrimental to the Center-South than to the Northeast - section 4.6 -, an increase in interregional trade tends to spread the loss to the Northeast. Similarly,

the last column shows that the gap-widening effect of an exchange rate increase tends to be weakened by a more intensive trade.

It should be pointed out that the evidence indicates that interregional commodity trade, after 1959, has grown essentially in only one way, i.e., from the Center-South to the Northeast - see Goodman & Albuquerque (1971, ch. 4). This has increased the deficit faced by the Northeast, financed by government transfers and expenditures. Thus, this new computation of the model, by supposing that all interregional trade coefficients change in the same proportion, tends to overestimate (in absolute values) the elasticities related to effects on the Northeast of actual policy changes undertaken in the Center-South and tends to underestimate the elasticities concerning the effects on the Center-South of actual policies adopted in the Northeast.

As it could be predicted, the conclusion so far is that a slight movement toward increasing interregional dependence, by easing the interstate transmission of the ICM, tends to reduce the burden of the tax on the region where it is imposed. Furthermore, a more intensive interregional trade tends to intensify the adverse Northeast-ICM effects on the Center-South, although the present levels of such

effects are almost negligible (table 4.5). As the evidence suggests that such a dependence has increased in the last decade - Goodman & Albuquerque (1971, ch. 4) -, this reinforces the general result of section 4.4 that state taxes (as well as the federal indirect tax - section 4.5) have contributed to reduce interregional inequalities.[7]

With respect to the labor-tax column of table 4.11, besides the fact that this tax tends to penalize more the Center-South than the Northeast (see section 4.6), the opposite-sign elasticities demonstrate that such a differential effect tends to be reduced with an increasing interregional trade. In other words, the negative effects of the tax, initially discriminating against the Center-South, tend to be transmitted more and more to the Northeast along with an increasing interregional trade.

Finally, the marginal analysis of table 4.11 illustrates how the exchange-rate interregional effect is modified with a changing trade. As the protection benefit of this policy instrument seems to have gone more to the Center-South as suggested in section 4.3, such benefits tend to "trickle down" to the Northeast with more intensive interregional relations. In other words, the discriminating effects of an exchange rate increase (due to economic-structure

differences) tend to be loosened by a more active trade.

The general solution of the model supplies data to analyze the sensitivity of any effect with respect to the interregional input-output coefficients, but in the space restrictions of this study only a small though relevant sample could be analyzed.

4.9 Conclusion

The numerical results so far discussed suggest several conclusions of high relevance for the assessment of interregional effects of government policies in Brazil:

a) tariff increases seem to have a tendency to discriminate against the Northeast and in favor of the Center-South, while export-subsidy effects give the opposite impression;

b) exchange rate increases would tend to aggravate interregional disparities;

c) taxes in general would be more detrimental to the Center-South;

d) as far as real income is concerned, the effect of increasing exogenous demand (e.g., through federal direct investments) for non-import sectors (agriculture, leather, textiles, food, electric energy, construction, and services) of one region gives more local benefits when such a demand increase occurs in the Northeast than in the Center-South;

e) the results have different degrees of sensitivity with respect to interregional input-output coefficients. With a more intensive interregional

trade, there is a tendency for a greater inter-regional spread of both negative tax effects and positive protectionist effects.

This could be summarized by saying that taxation and protection have played opposite roles in their effects on the Northeast-C.South economic disparities. Although the absolute numerical results demonstrate a high sensitivity to labor employment and production function assumptions, the relative interregional effects keep their signs through all cases (i.e., unemployment with fixed nominal wage and changing prices, unemployment with fixed real wages, and full employment, with both Cobb-Douglas and CES production functions for primary inputs).

Given the changing character of such policies and the existence of many others in post-war Brazil industrialization process, no attempt will be made here to assess the net effect of all these instruments. At any rate, the results suggest that government policies have strong potential consequences on the interregional imbalance. Not only natural, external, and historical factors influence the regional problem, but artificial elements are significantly responsible for the aggravation or dampness of the interregional duality. The next chapter will be devoted to evaluate a few policies actually adopted in the 1960's.

Chapter V

EFFECTS OF ECONOMIC POLICIES IN THE SIXTIES

5.1 Introduction

Some empirical applications of the model to actual policies of the 1960's will be made in this Chapter. For lack of good data, the numerical results that follow should be interpreted with caution and in the relative interregional sense.

Given the limitations of the data and of the model, I have chosen for analysis four relevant changes in government policy of the period 1960-70, with special emphasis on their interregional aspects: a) production subsidies, estimate from data related to the "34/18" mechanism, adopted since the early 1960's but significantly effective in the second half of the decade; b) the general tariff reduction of 1967; c) the export subsidies given mostly in the later sixties; and d) the "Fundo de Garantia de Tempo de Serviço - FGTS" (a special type of social security fund to be paid the employee upon his leaving the job) introduced in 1967.

It should be noted at the outset that these are not the only important instruments, adopted in the

1960's, that have affected interregional disparities. The final section of this chapter will discuss some other policies which, as the evidence suggests, have worked to worsen the regional problem.

Another comment that should be borne in mind is that the present model, like in most interregional studies, is static in nature. This means that no effect on the capital stock, no investment behavior, no saving determination, and no time lag are considered, what obviously restricts the scope of the model. Dynamic features could be incorporated if there were adequate empirical information. Hopefully, the static solution seems to give answers in the right direction, at least in the relative interregional sense.

5.2 Production subsidies

The present static model is inadequate to make a proper assessment of the government policy adopted through SUDENE since the early sixties to promote private investment projects in the Northeast. An appropriate treatment of such a policy would require a dynamic model with investment behavior. What I will do here is to take the data on the volume of resources allocated to that program in the period 1960-70 and treat part of them as indicators of a production subsidy policy.

The SUDENE (Superintendência do Desenvolvimento do Nordeste) program consists of promoting private and public investments in the Northeast. Adopted since 1959, its significant influence on the regional economy seems to have been felt after the first six or seven years of operation. Comprehensive analyses of the SUDENE program have recently been made, on the social and economic aspects, by Goodman (1972, 1974) and Goodman & Albuquerque (1974, 197-) and, on the political perspective, by Roett (1972). The brief description given here, as well as the empirical results of this section, should be complemented by these sources.

The incentive program is administered by SUDENE through the "34/18" scheme[1], according to which any private enterprise may reduce up to 50% of its income tax to apply the abated amount in investments "considered important for the economic development of the Northeast." The amount is deposited in a blocked account with the Banco do Nordeste do Brasil (BNB) to the order of SUDENE. Thus, instead of paying the whole corporation income tax to the Treasury, the firm uses half of it to become a shareholder in Northeastern concerns.

The typical 34/18 investment project, if approved by SUDENE, uses funds from three basic sources: a) the 34/18 resources of those shareholders who have opted to invest in that project, with light long-run commitments related to dividend payments. These resources have covered around 50%

of the total value of 34/18 investments, the percent among projects varying according to a complex point-system evaluation; b) loans granted by government banks and foreign agencies at low and usually negative real rates of interest. This has represented about 25% of the total value of projects; and c) the investor's own resources (around 25%).

The nature of the model used in this study, as already mentioned, makes it inappropriate to analyze the SUDENE program through changes in exogenous demand, as it was done in the last chapter by using a Chenery-type framework. Capital stocks are fixed and import-sector prices are given by international markets. So, any influence of changing exogenous demand for these sectors comes only from feedback effects, not significant per se, as observed from preliminary computing attempts. Furthermore, the treatment of SUDENE subsidies as capital incentives is inadequate to this model since, besides the assumption of fixed capital stocks, such subsidies are unable to change the gross residual rental rates. As a matter of fact, the nature of 34/18 system does not support the view that the funds are merely capital subsidies. For instance, 54% of 34/18 investment projects for capital goods sectors have been destined to finance working capital (Goodman & Albuquerque - 197-, table 8.11), and this type of expenditure is in good part related to labor payments. Additionally, priority to labor employment is

attached in all projects through a point-system evaluation adopted by SUDENE.

The alternative adopted in this section was, by contemplating the SUDENE program, to consider the existence of a production subsidy in the sixties, using part of the disbursed 34/18 funds for estimation purposes. A production subsidy scheme corresponds to giving capital and labor employed in the Northeast the same percentage of subsidy.

Unfortunately, this was a compromise that had to be made to turn an investment program amenable to treatment by a static model, and its limitations should be borne in mind when interpreting the results. As a matter of fact, the numerical solution of this section should be looked at more as a result of an estimated production subsidy program directed to the Northeast than of the specific 34/18 scheme. Though related to each other, they are not equivalent. At any rate, the procedure used here does not seem to be worse than the one usually adopted in static interregional input-output analysis that treats an investment program as exogenous demand increase (e.g., the Chenery model applied above).

To estimate the production subsidy percentages, all 34/18 disbursements for the 1960's (except for power, construction, and services) were reduced to 1959 prices. Lacking good data, forty percent of such disbursements were assumed to represent production subsidies, what amounts to around 10% of total resources committed to projects. This seems to be an underestimate. Wadsted (1968, p. 254) estimates a 45% reduction in capital cost in the short run. Taking into account the long-run commitments inherent to the 34/18 scheme and relevant for private decisions, his figure appears to be overestimated.

Working at the level of 1959 prices, the total value of subsidies was distributed by sectors according to the sectoral distribution of 34/18 projects up to 1970, and then divided by the 1959 gross production levels to give the percentage of subsidized production, as shown in table 3.8. These subsidy rates will be treated as negative indirect taxes.

The results of applying such a subsidy schedule to the Northeast are presented in table 5.1a, where we can note that the real income level of the region would have been increased by rates that vary from 10.4% to 17.3%, while the Center-South would have negligible effects. This should be

Table 5.1a

Percent changes in regional aggregates in response to production subsidies (estimated from SUDENE disbursements for private investments) in the sixties

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	0.61	0.17	0.11	-0.02	-1.23	-0.40
NE	8.76	3.55	8.04	3.39	7.02	3.09
Employment: (total) CS	1.39	0.19	0.07	-0.13	-2.19	-0.97
NE	8.35	3.23	6.93	2.95	4.75	2.07
Net price: CS	0.74	0.39	0.12	0.00	-1.23	-1.16
NE	7.95	8.17	7.24	7.70	6.21	6.61
Money income: CS	1.35	0.56	0.23	-0.02	-2.44	-1.56
NE	17.41	12.01	15.86	11.35	13.67	9.90
Output price: CS	0.51	0.32	0.07	0.01	-1.44	-1.21
NE	0.13	0.26	-0.50	-0.08	-1.73	-1.31
Real income: CS	0.84	0.24	0.16	-0.03	-1.00	-0.35
NE	17.28	11.77	16.36	11.43	15.66	10.36
Industrial employment: CS	0.57	0.24	0.37	0.24	-3.56	-1.02
NE	55.62	22.02	54.97	21.92	50.79	20.69

Table 5.1b

Percent changes in sectoral outputs in response to production subsidies (estimated from SUDENE disbursements for private investments) in the sixties

ector and Region		Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
		C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr.	CS	1.13	0.32	0.16	0.02	- 1.33	- 0.63
	NE	3.19	1.45	2.22	1.15	0.74	0.50
2.Ext.	CS	- 0.22	-0.09	- 0.03	- 0.00	- 2.68	- 1.14
	NE	21.88	11.18	22.01	11.24	20.25	10.48
3.N-m.m.	CS	- 0.32	-0.05	- 0.04	- 0.00	- 2.61	- 0.45
	NE	50.89	10.55	51.10	10.59	49.29	10.27
4.Met.	CS	- 0.30	-0.09	- 0.03	- 0.00	- 2.60	- 0.81
	NE	125.74	47.07	126.12	47.19	122.63	46.10
5.Leath.	CS	0.88	0.10	0.52	0.13	- 1.89	- 0.72
	NE	7.78	3.24	7.56	3.26	5.85	2.75
6.Chem.	CS	- 0.21	-0.15	- 0.01	- 0.00	- 0.94	- 0.60
	NE	6.19	5.01	6.27	5.07	5.90	4.83
7.Text.	CS	1.98	0.61	0.47	0.15	- 1.30	- 0.68
	NE	10.80	6.85	9.66	6.55	8.23	5.94
8.Food	CS	0.19	-0.03	0.08	0.02	- 1.33	- 0.50
	NE	5.95	2.90	5.83	2.95	4.27	2.36
9.Pap...	CS	- 0.30	-0.10	0.13	0.04	- 2.51	- 0.79
	NE	52.72	20.41	53.04	20.51	51.21	19.94
10.El.en.	CS	0.84	0.23	0.13	0.02	- 1.20	- 0.41
	NE	17.79	5.92	16.82	5.61	15.23	5.09
11.Const.	CS	1.04	0.35	0.12	0.01	- 0.31	- 0.13
	NE	1.17	0.36	0.29	0.04	- 0.10	- 0.10
12.Serv.	CS	1.48	0.39	0.17	0.02	- 0.82	- 0.32
	NE	3.22	0.87	1.89	0.50	1.03	0.20

interpreted in terms of the "internal" income of the regions. Obviously, since more than 80% of the resources invested in 34/18 projects belong to firms of the Center-South (Goodman-1972, p.241), the real income of this region should increase by the corresponding income flows not accounted for in this study. If such flows and residence status of the investors had been incorporated in this analysis, the final generated income might be greater for Center-South than for Northeast residents.

The sectoral breakdown provided in Table 5.1b reveals that variations among sectors are roughly in proportion to the levels of subsidies (Table 3.8) and to the supply elasticities derivable from labor shares and elasticities of substitution (Table 3.4). Inspection of the results shows that there is an approximate independence of the policy consequences with respect to the three labor-supply assumptions (especially in the first two cases). This is understandable if we note that: a) the real wage effect of equation (2.6.1'a - p.83) is very weak (the general price level for Brazil changing by less than 0.5% in case 1 and not changing in case 2); and b) the weight of the Northeastern sectors in the intermediate supply to the Center-South is generally low and so the relative price effect (for non-subsidized sectors) is also weak. This makes the subsidies affect essentially the net prices p_i^*-s in the Northeast, with small interregional linkages.

Despite the uncertainty about the final direction of the resultant income (e.g., reinvestments contribute to keep the income in the Northeast), the model suggests that the effects of the total subsidy program on Northeastern employment would range from 2 to around 8% increases in total and from 21 to 56% in industrial employment. Data supplied by SUDENE, relative to new projects only (modernization projects do not seem to contribute significantly to increase employment), show that a 39% increase in industrial employment has been observed up to 1970 (over 1959 levels) - cf. SUDENE (1972b). This report confirmed that over 90% of the employment increase planned in projects have been realized.[2]

5.3 Tariff reform

A drastic cut in all tariff rates was undertaken effective March, 1967, following the government intention to bring the economy closer to the competitive level.

According to Bergsman's (1970) estimates and after the appropriate aggregation, the tariff changes for import sectors are presented in table 3.7. The effect of this change on the regional economies is presented in table 5.2a.

As it could be predicted from the general analysis of the last chapter, the tariff cut tended to reduce inter-regional economic differences. Numerically, the six different model specifications indicate that the Northeast would have had its real income increased in the range of 1.36%-4.21% in terms of C.South real income (differences between the real-incor rows of table 5.2a). The most important effects are on industrial labor employment (sectors 3-9) even in case 3 (overall full employment).

The sectoral solutions (Table 5.2b) show that the hardest hit sectors (3.N-m.min., 4.Met., 9.Paper,misc.) are those with the sharpest reductions in their tariff protection. An interesting case is that of 6.Chemicals, where output contraction is the smallest, even when compared to export and

Table 5.2a

Percent changes in regional aggregates in response to the tariff reductions of March, 1967.

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	- 5.61	- 1.76	0.40	0.00	-1.09	-0.43
NE	- 4.38	- 1.27	4.00	1.33	-0.03	-0.03
Employ-ment: CS (total)	- 8.90	- 2.80	6.46	2.17	-0.26	-0.12
NE	- 7.92	- 2.40	8.91	3.02	0.56	0.25
Net price: CS	- 5.74	- 5.22	1.21	1.25	-1.18	-1.53
NE	- 4.31	- 3.79	4.10	4.08	-0.16	-0.26
Money income: CS	-11.03	- 6.89	1.61	1.25	-2.27	-1.98
NE	- 8.50	- 5.01	8.26	5.49	-0.19	-0.29
Output price: CS	- 5.76	- 5.33	-0.29	-0.28	-1.08	-1.04
NE	- 4.68	- 4.23	2.03	1.97	-0.36	-0.71
Real income: CS	- 5.59	- 1.65	1.90	1.53	-1.20	-0.94
NE	- 4.01	- 0.71	6.11	3.45	0.17	0.42
Industrial employment CS	-15.44	- 5.12	-13.21	-4.97	-5.48	-2.22
NE	- 9.98	- 2.23	- 2.38	-0.99	-0.08	0.56

Table 5.2b

Percent changes in sectoral outputs in response to the tariff reductions of March, 1967

Sector and Region		Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
		C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
1.Agr.	CS	- 4.15	- 1.30	5.36	1.89	1.00	0.37
	NE	- 4.11	- 1.28	5.35	1.89	1.02	0.38
2.Ext.	CS	- 1.20	- 0.68	- 3.07	-1.59	3.95	1.17
	NE	- 0.83	- 0.46	- 2.10	-1.08	2.57	0.76
3.N-m.m.	CS	-18.83	- 3.94	-21.62	-4.49	-14.05	-3.25
	NE	-13.18	- 2.76	-15.23	-3.15	- 9.84	-2.27
4.Met.	CS	-12.80	- 4.85	-15.42	-5.79	- 7.99	-3.60
	NE	-17.01	- 6.44	-20.66	-7.74	-10.49	-4.75
5.Leath.	CS	- 0.67	0.60	2.94	0.34	5.12	2.04
	NE	- 0.36	0.37	1.83	0.14	3.69	1.22
6.Chem.	CS	- 0.25	- 0.30	- 2.22	-1.84	1.27	0.49
	NE	- 0.02	- 0.05	- 0.81	-0.67	0.59	2.67
7.Text.	CS	- 6.37	- 1.75	8.39	3.09	0.50	5.14
	NE	- 4.86	- 1.17	6.25	1.96	0.52	4.11
8.Food	CS	0.29	0.54	1.37	0.11	3.49	1.37
	NE	0.29	0.59	1.44	0.09	3.81	1.53
9.Pap...	CS	- 8.18	- 3.31	-12.40	-4.80	- 3.56	-2.10
	NE	- 5.67	- 2.31	- 8.81	-3.38	- 2.52	-1.48
10.El.en.	CS	- 6.19	- 1.82	0.70	0.43	- 1.93	-0.70
	NE	- 7.04	- 1.89	4.43	1.45	- 1.27	-0.43
11.Const.	CS	- 3.10	- 0.67	5.93	2.91	- 0.27	0.18
	NE	- 2.86	- 0.62	5.78	2.84	- 0.20	0.19
12.Serv.	CS	- 6.08	- 1.67	6.69	2.22	- 1.25	-0.44
	NE	- 5.59	- 1.55	7.43	2.41	- 1.00	-0.36

non-traded sectors. The reason is that chemical imports decrease sharply as a consequence of trade liberalization, a case similar to Johnson (1959) paradox in international trade theory. These chemical imports are highly sensitive to what happens in the remaining sectors. For example, the elasticities of chemical imports (in C.South) with respect to forces-of-tariffs in sectors 3, 4, and 9 (in C.South) were found to be, respectively, 0.5371, 1.6627, and 1.7508. The chemical sector is a basic supplier of raw materials (a good part coming from imports) to these sectors, which are the most severely struck by the tariff cut. Thus, though the chemical sector has been slightly pushed toward trade liberalization (-3.3% in the force-of-tariff), the strong reductions in protection suffered by sectors 3, 4, and 9 were very significantly reflected in chemical goods imports, making internal production of chemicals only slightly hurt by the policy.

The interregional changes, at the sectoral levels (Table 5.2b), can again be explained roughly in terms of differences between regional supply elasticities.

5.4 Export incentives

Export promotion has been a major concern of Brazilian government since the later 1960's. A study by Mendonça et al. (1973) has estimated sectoral export subsidy rates for 1971. The heavy protection given exporters, for the export sectors used in this study, is shown in table 3.7. These subsidies consist essentially of exemptions and tax credits relative to the IPI (federal indirect tax) and ICM (state tax).

The subsidy rates presented in table 3.7 seem to be overestimated due to the fact that I have used the official exchange rate for basis. There is reason to believe that these rates are artificially low because of the overall protectionist regime in Brazil. The overestimation comes from the fact that the initial subsidy data are provided in cruzeiro per dollar, and the dollar was converted to cruzeiro at the official exchange rate.

Also, as I am interested only in the 1960-70 decade and as the export subsidies have been increasing since 1967 due to new export promotion policies, the level of subsidies prevailing in the 1960's, on the average, was lower.

Given these remarks and due to the rather illustrative purpose of this Chapter, I have treated the export subsidies for the sixties as if they represented only 40% of the levels shown in Table 3.7. Because of the linear nature of the model, any (proportional) correction can be made by mere scale adjustment.

Using the 40% adjustment mentioned above, Table 5.3a shows the aggregate results of the insertion. It confirms the predictable consequence of export incentives with respect to interregional effects. The evidence supports the hypothesis that such a policy tends to reduce disparities.

At the sectoral level (Table 5.3b), the output reactions are roughly proportional to the export subsidy rates of Table 3.7. Interregional differences between the results of all tradable sectors are due in large part to different supply elasticities. Furthermore, we should note that, for the first ten sectors, when we move successively from case 1 to cases 2 and 3, there is a gradual decline in their responses to the subsidy increases, directly related to the gradual decline in the real wage effect: in case 1 the real wage that firms must pay falls by rates that vary in the range 3.3%-5.6%, in case 2 it is unchanged, and in case 3 it rises in the range 1.3%-2.9% (output-price rows of Table 5.3a).

Table 5.3a

Percent changes in regional aggregates in response to the export subsidies adopted for traditional sectors in the sixties

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	4.20	2.12	0.56	0.52	-1.31	-0.59
NE	5.46	2.74	0.38	0.39	0.17	0.11
Employ-ment: CS (total)	10.17	5.31	0.86	0.80	-0.34	-0.14
NE	11.08	.5.69	0.87	0.78	0.75	0.33
Net price: CS	4.03	5.65	-0.20	-0.28	-1.53	-1.87
NE	4.90	7.00	-0.18	-0.18	-0.15	-0.20
Money income: CS	8.50	7.89	0.36	0.24	-2.82	-2.46
NE	10.63	9.93	0.20	0.21	0.02	-0.09
Output price: CS	3.32	4.61	0.00	0.00	-2.37	-2.93
NE	4.00	5.61	-0.02	-0.04	-1.26	-1.56
Real income: CS	5.01	3.14	0.36	0.24	-0.45	0.47
NE	6.38	4.09	0.22	0.25	1.24	1.47
Industrial employment: CS	7.27	4.19	6.02	4.04	-4.74	-1.73
NE	16.99	8.50	12.32	7.34	4.16	2.71

Table 5.3b

Percent changes in sectoral outputs in response to the export subsidies adopted for traditional sectors in the sixties

Sector and Region		Case 1 Fixed Nom. Wage C.D.	Case 1 Fixed Nom. Wage C.E.S.	Case 2 Fixed Real Wage C.D.	Case 2 Fixed Real Wage C.E.S.	Case 3 Full-Employment C.D.	Case 3 Full-Employment C.E.S.
1.Agr.	CS	7.68	4.15	1.73	1.10	1.03	0.39
	NE	7.72	4.14	1.80	1.12	1.09	0.41
2.Ext.	CS	-0.71	-0.53	0.46	0.34	-7.36	-4.67
	NE	-0.49	-0.36	0.31	0.23	-4.89	-3.10
3.N-m.m.	CS	-1.08	-0.32	0.67	0.20	-7.25	-1.87
	NE	-0.80	-0.24	0.47	0.14	-5.13	-1.32
4.Met.	CS	-1.04	-0.56	0.60	0.33	-7.25	-3.38
	NE	-1.45	-0.78	0.84	0.46	-9.87	-4.59
5.Leath.	CS	29.39	13.55	27.14	13.79	21.90	10.31
	NE	20.96	8.11	19.59	8.34	15.74	6.20
6.Chem.	CS	-0.94	-1.15	0.29	0.32	-2.90	-2.92
	NE	-0.38	-0.46	0.11	0.12	-1.17	-1.18
7.Text.	CS	14.21	9.41	4.98	4.79	5.34	4.33
	NE	11.66	6.88	4.71	3.89	4.70	3.32
8.Food	CS	7.92	3.36	7.24	3.77	3.79	1.49
	NE	8.67	3.77	7.96	4.25	4.12	1.66
9.Pap...	CS	-2.44	-1.38	0.20	0.04	-8.41	-4.10
	NE	-1.89	-1.03	0.07	-0.00	-5.97	-2.90
10.El.en.	CS	3.74	1.87	-0.57	-0.27	-1.77	-0.65
	NE	6.93	3.18	-0.23	-0.00	-0.51	-0.11
11.Const.	CS	3.18	1.93	-2.46	-1.49	-0.48	0.03
	NE	3.05	1.87	-2.35	-1.43	-0.39	0.05
12.Serv.	CS	4.72	2.19	-3.26	-1.52	-1.51	-0.58
	NE	4.79	2.21	-3.34	-1.57	-1.14	-0.46

It should be remembered that the recent successful promotion of manufacturing exports would show opposite inter-regional effects, since the industrial economy of the Center-South tends to get more benefits from such a policy than the Northeast. Unfortunately, the present model was not designed in a way appropriate to handle this question. The policy analyzed here is related only to the promotion of traditional export sectors. In fact, export sectors (1, 5, 7, and 8), in the present study, correspond roughly to the traditional sectors of the Brazilian economy. Thus, the export promotion policy analyzed here should be considered only as part of the overall policy adopted in the sixties, which benefited also the sectors here classified as import-competing.

5.5 Social security charges

The "fundo de garantia de tempo de serviço - FGTS", adopted since January of 1967 (created by Law nº 5107, of 9-13-1966), is a special social security fund that the employee receives when he is fired from the job. It is compounded by monthly deposits, at the employer's expense, of 8% of the wage bill, to the order of the social security ministry (Ministério da Previdência Social). Its potential effects on output and employment was part of the analysis by Bacha et al. (1972) relative to labor charges in Brazil.

In order to have an idea of the potential effects of such a social security charge on regional income differentials, Table 5.4 shows the effect of inserting the FGTS as an 8% labor tax applied to both regions and, to be consistent with the analysis of section 4.6, it was excluded from agriculture, extractive industry, and services (it should be noted that figures in Table 5.4 are equal to 4/5 of the figures in Table 4.7a).

The detrimental effects of the FGTS on both regional economies is evident from this table, especially against the Center-South. In the relative sense, inspection of the real-income rows indicates that the Northeastern real income, in terms of C.South real income, would have risen

Table 5.4

Percent changes in regional aggregates in response to the "Fundo de Garantia de Tempo de Serviço" established in 1967

Aggregate	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
Output: CS	-4.67	-1.78	-3.26	-1.40	-0.96	-0.66
NE	-3.90	-1.31	-1.90	-0.76	-0.30	-0.22
Employment: (total) CS	-7.23	-2.37	-3.62	-1.29	-0.15	-0.09
NE	-6.62	-2.02	-2.67	-0.87	0.34	0.21
Net price: CS	-4.56	-4.32	-2.93	-2.91	-0.82	-1.20
NE	-3.76	-3.44	-1.79	-1.77	-0.35	-0.46
Money income: CS	-8.99	-6.11	-6.06	-4.26	-1.78	-1.86
NE	-7.48	-4.70	-3.65	-2.51	-0.65	-0.67
Output price: CS	-1.29	-1.10	-0.00	-0.00	-2.55	-2.02
NE	-1.57	-1.30	0.00	0.03	-1.97	-1.67
Real income: CS	-7.81	-5.06	-6.06	-4.26	-4.20	-3.79
NE	-6.03	-3.45	-3.65	-2.48	-2.62	-2.34
Industrial employment: CS	-12.68	-5.53	-12.16	-5.49	-4.50	-3.08
NE	-12.38	-4.98	-10.53	-4.70	-3.43	-2.54

in the range of 1.45%-2.41%, pointing to the role of the tax in reducing interregional disparities. This will be reinforced by considering some progressiveness in the "fundo", due to the less industrialized structure of the Northeastern economy and the more difficult tax administration observed in the region as compared to the Center-South.

The analysis at the disaggregated level is similar to that related to a labor tax in general (section 4.6).

5.6 Conclusion

The changes in government policy occurred in the 1960's and analyzed in this chapter seem to have contributed to reduce the Northeast-C.South economic differences. If unchecked, those four instruments would have determined an increase in the real income of the Northeast, in terms of C.South real income, that would range between 15% and 23% - table 5.5 (differences between the two rows).

However, it is highly important to notice that those were not the only relevant instruments for interregional income movements. Besides historical causes implied by i) divergent foreign trade conditions observed in the nineteen century - as argued by Leff (1972) -, ii) the unequal endowment of natural resources and the droughts that, like in 1970, have plagued the Northeast, the following elements directly or indirectly linked to government policies should be mentioned, in addition to those listed in Table 1.2:

a) foreign capital inflows that have gone basically to industrial concerns in the Center-South;

b) private capital outflows from Northeast to Center-South in response to opportunities of higher

Table 5.5

Combined percent changes in real regional incomes in response to production subsidies, tariff reform, export subsidies, and FGTS, adopted in the sixties.

Region	Case 1 Fixed Nom. Wage		Case 2 Fixed Real Wage		Case 3 Full-Employment	
	C.D.	C.E.S.	C.D.	C.E.S.	C.D.	C.E.S.
CS	- 7.55	- 3.33	- 3.64	- 2.52	- 6.85	- 4.61
NE	13.62	11.70	19.04	12.65	14.45	9.91

return in the more developed region. The static nature of the present model disregarded this factor;

c) operations of other government agencies that have benefited the more industrialized structure of the Center-South. For instance, in the period 1965-68, only 6.5% of BNDE (Banco Nacional do Desenvolvimento Econômico, a major federal development bank) loans were distributed to Northeastern firms (BNB Relatório 1972, p.61);

d) other development agencies competing with SUDENE began operating outside the Northeast in the second half of the sixties: SUDAM (for the Amazonian region), SUDEPE (for fishing), EMBRATUR (for tourism), and IBDF (reforestation) took 43.6% of tax-credit funds that would have gone to SUDENE according to the previous legal pattern (Ministry of Finance, Anuário Econômico Fiscal 1970, p. 83);

e) incentives for the development of capital market, as basic instruments that have operated in favor of Brazil's economic growth since 1965. These seem to have benefited the Center-South much more than the Northeast, due to the inherent

structural differences between the backward Northeast and the modern Center-South that make them react distinctly to such instruments;

f) the promotion of manufacturing exports, basically since 1967, has tended to benefit more the industrialized Center-South. The specific effects of such a policy were not accounted for by this study;

g) the exchange rate gradual devaluations, though primarily intended to stimulate exports, work, according to the last chapter - section 4.3 -, in the direction of increasing interregional disparities;

h) the pattern of migration from the Northeast to the Center-South, indirectly related to the unequal economic growth between regions. For the period 1950-60, this tendency was analyzed by Graham (1970), pointing to the positive response of migration to industrial development, "with high income states attracting in-migrants and low-income states losing out-migrants". Observation of some ongoing research projects in the Northeast indicated to me that the outmigrants are the younger and better trained workers of the

region. The 1970 Census pointed to a continued migration from the Northeast in the sixties, leading to the reduction in the region's share in Brazilian population (34.6%, 31.6%, and 30.4% in 1950, 1960, and 1970, respectively). The migration pattern referred to by Hirschman (1958) seems to have been effective in generating further spatial inequalities.

The analysis of these factors would require several additional theses. Yet, the evidence suggests that they have tended to neutralize the redistributional effects of the four instruments of public policy studied in this Chapter. Data for 1949, 1959, and 1968 indicate that the share of the Northeast in the Brazilian internal income has remained unchanged - i.e., 14.4%, even less than in 1939 (16.7%) - cf. Fundação Getúlio Vargas national accounts (1971). Observing the large share of C.South residents in the income generated by SUDENE investments, it is plausible the conclusion that the share of Northeasterners in the Brazilian internal income has decreased in the last decades. Makler (1974, p.7) concluded, for instance, that in Bahia more than 50% of the new industrial elite is composed by executives from the Center-South and from foreign countries.

The fact that a large part of SUDENE projects,

financed in the sixties, will begin operating only in the present decade does not seem to promise a better perspective on the interregional imbalance. A recent and comprehensive research undertaken by BNB, relative to the Northeastern development perspectives up to 1980, emphasized the challenge faced by the region, that must grow at least at 10% per annum to avoid deterioration of its relative position in the present decade of fast economic growth for the country as a whole.

As pointed out in the introductory Chapter, a good deal of additional research would be needed to quantify how much of the neutralization process is due to government policies and how much is caused by external, historical, and natural phenomena. Anyway, the empirical results of this study suggest that government policies play a highly important rôle in the process of creating positive and negative effects on the interregional imbalance. For this reason, it is misleading to look only at the so-called "aid to the Northeast" if the actual net "aid" is to be assessed. The net result of all "regional" and "national" policies (this labelling being meaningless on general equilibrium grounds) may fall on either side of zero.

Chapter VI

CONCLUDING REMARKS AND POLICY IMPLICATIONS

The primary purpose of this research has been the investigation of the influence of some government policies on interregional disparities of income, employment, and other economic variables, between the Northeast and the Center-South of Brazil. The last two chapters lent support to the conclusio that the influence is indeed strong. Tariffs would tend to aggravate the interregional duality, export protection and taxes would tend to damp it. Additionally, the more intensive the interregional trade, the more benefits or losses from policy changes would tend to be transmitted between regions.

The analysis of a few policies adopted in the sixties (production subsidy program, general tariff cut, export incentives, and an increase in social security charges) revealed that their joint effect was to increase the (internal) real income of the Northeast in terms of the Center-South by 15% to 23%. As for ex-post empirical verification, it was mentioned earlier that SUDENE data have shown that only the new industrial projects (excluding modernization projects) approved up to 1970 generated industrial employment increase of 39% over the 1959 level. Similar results are predicted for other aggregates. In fact,

taking into account that the industrial investments brought about by 34/18 scheme in the sixties represent around 228% of the regional industrial capital stock estimated for 1959[1], it is not difficult to infer the profound economic implications of such a program, if taken isolatedly.

Yet a closer look at the overall picture suggests that other instruments operate on the opposite way. It was said earlier that a recent BNB research report[2] pointed to the hard challenge faced by the Northeast, which will have to grow at least at 10% per annum in order to avoid the worsening of its relative regional economic position, what is not a modest target.

Among the neutralizing instruments are natural and external factors, as well as public policies. Although many of these instruments are out of the scope of this study, it can be inferred from previous results obtained from the general solution that government policies, in general, play a substantial role. The persistence of Northeast's modest relative economic situation after a long period of "regional" development policies suggests that the net interregional effects of all public policies, taken together, have been important only on the structural side but negligible on the aggregate side.

The implication of these conclusions is that a closer look should be taken at the interregional effects not only of the "regional development" policies but of all polici As a consequence, if interregional disparities are to be redu not only the specific appropriate policies for this purpose should be adopted, but planning authorities should provide the necessary compensation for unequal interregional effects of other operative policies approved for the country as a whole. It is hardly necessary to add that such a compensation (given the region whose relative position is damaged by the policies) should be destined to the creation of productive capacity under comparative advantage criteria and not in the old assistential form.

A feeling of disappointment seems to involve those in charge of assessing the SUDENE program, perhaps misled by the fallacy of composition. In short, the evaluation of one policy has been made according to the effects of many concurr policies, an evident methodological mistake related to the identification problem in social sciences. On the basis of such types of evaluation, the resources that would normally keep flowing to SUDENE have been cut by fifty percent by 1970, instead of reinforcing and improving the mechanism by eliminating its obvious defects such as the neglect of agriculture and regional complementarity of projects.

The model and the statistical basis applied in this study are crude and subject to many obvious objections. Nevertheless, the preoccupation of previous writers with man-made policies, as quoted in the introductory chapter, seems to be supported by theoretical and empirical foundations. Not only in Brazil has this problem been noticed. In the United States, for instance, Hughes (1961) studied the manner in which the American economic system tends to perpetuate interregional income differentials once they come into existence. He mentions that "the rather general failure of American leaders to understand certain basic causes for such differentials, even as they persist in this country, leads to confusion in the formulation of domestic public policy and in international relations." After arguing that "free trade is not an unmixed blessing for all parts involved," he concluded that "the lion's share of such (economic growth) gains are captured by the developed regions. As a matter of justice, the less developed regions might reasonably claim the right to (1) selective regulation of trade and/or (2) income transfers from developed areas." - Hughes (1961, p. 45).

My hope is that other research projects will be undertaken in the near future to permit analyzing the problem on a better data basis and a more comprehensive scope.

FOOTNOTES

Chapter I

1. See, for instance, Baer (1966), Barrett (1972), Castro (1971), CODENO (1959), Goodman & Albuquerque (1971, 197-), Graham (1970), Haddad (ed.) (1972), Hirschman (1963, 1968), Leff (1972), Robock (1963), Singer (1964), Williamson (1965), Haddad & Andrade (1973), and Gauthier & Semple (1972).

2. Cf. Goodman & Albuquerque (197-, p. 3).

3. Good and detailed descriptions and criticisms of the regional discrepancies and policies are presented by Hirschman (1963, Part I, ch. 1) and Goodman & Albuquerque (197-).

4. For the analysis of the political environment involving the creation of SUDENE in 1959, see Hirschman (1963, ch. 1), and Robock (1963), and Roett (1972).

5. I am very grateful to José Roberto Mendonça de Barros for having brought Barrett's work to my attention.

6. Banco do Nordeste (1969).

Chapter III

1. For discussion of this method, its advantages, limitations, and application to different contexts, the reader is referred to Chenery (1953, 1959), Moses (1955), Hartwick (1969), Brodersohn (1965), and Haddad-ed.(1972).

2. I am very grateful to David Goodman and Hamilton Tolosa of IPEA for having made available to me the original draft of Goodman & Albuquerque's book yet to be published.

3. The 5% depreciation rate used by Fundação Getúlio Vargas is not exactly based on (VTI-misc.expenses), but on GDP at market prices which, in the part related to the industrial sector, is higher than the present estimate. The 1959 national accounts register Cr$98.7 million for depreciation, Cr$367.8 million for gross investment, and Cr$1,614.0 million for net domestic product at factor cost. As around 50% of this NDP is estimated to be paid as capital income, according to the procedure of this section, it means that depreciation represents only 11% of gross remuneration of capital, which is a very low figure when compared to international standards (around 24% for the United States). The abnormally low figure is caused by two factors: i) the low depreciation percentage

of 5% applied on GDP (in the U.S. it is about 8.5%); and ii) the high share of capital in national income (50%, against about 33% for developed countries) based partly on the high capital rates of return in Brazil and partly on deficient statistical data that seem to overestimate that share. A capital/output ratio of 3 applied on the GDP value at market prices (Cr$1,987.6 million in 1959) leads to a gross rate of return to capital of 15.2% (excluding sales taxes). It should be mentioned that the rate estimated by Bacha (1971, p.110) for the 500 largest Brazilian corporations was 15.1% and that obtained by Langoni (1970) was around 14-15%. We can compare these figures with that estimated by Jenkins (1972) for Canada (around 10% for the gross rate of return - excluding sales taxes).

4. Another checking method which could be used, as suggested by Lance Taylor, could be to use marginal productivity theory and take as capital share the result of multipying the gross rate of return by the average capital/output ratio.

Chapter IV

1. It should be noted that the employment changes depend not only on the overall growth of output but also on the changing distribution of this output among sectors with different labor/output ratios. The same is true for other aggregates.
2. In this study no analysis will be made of the 1967 State

tax reform - see Araújo et al.(1973). In the context of an altered fiscal federalism system, its essential relevance refers to the centralization of budgetary decisions inherent to the recent Brazilian economic planning experience.

3. On the problem of dependence of the efficiency of tax administration on the degree of economic development, see Kaldor (1966, section VIII).

4. On the problem of interpreting Bacha's elasticities, see Macedo (1974, ch. 3).

5. By closing the Leontief model, the introduction of households to account for the value added row and for the consumption column of the input-output table, the model becomes essentially a Keynesian disaggregate multiplier model.

6. On the applicability of the Chenery model for Brazilian regional conditions, see Haddad-ed.(1972, ch.III, and 1973).

7. The tax burden in Brazil, especially with respect to state taxes and federal indirect taxes, has increased substantially since 1947. - See Fundação Getúlio Vargas (1969) and Goodman & Albuquerque (1971, ch.2).

Chapter V

1. The denomination "34/18" represents the numbers of the principal articles of the two basic laws that approved the first two SUDENE Master Plans (art. 34 - Law 3995 - 12.14.1961 and art. 18 - Law 4239 - 6.27.1963).

2. As for the average cost of US$14,000 per job created in new projects - Goodman (1972, p. 256) -, it should be noted that this is not a high figure when compared to regional development programs adopted in other countries. In Canada, for instance, the combined subsidies for the RDIA program amounted to US$30,000 per job, which was the maximum limit accepted by government and was considered to be a barrier by the firms. See Springate (1972).

Chapter VI

1. The industrial capital stock for 1959 was estimated by assuming a capital-output ratio = 3 applied on the industrial internal income for that year. The above relationship

between the 34/18 industrial investments and the estimated capital stock was obtained after reducing the components of both total values to 1968 prices.

2. Banco do Nordeste do Brasil (1973, p. 19).

APPENDIX A

The 32-sector input-output table for Brazil, 1959

Sectors	1	2	3	4	5	6	7	8	9	10	11	12
1 Vegetable product	12,982	20,720	0	0	300	0	11,205	0	11	3	560	8
2 Animal product	24	0	0	0	345	0	0	0	0	1	4	0
3 Electric energy	200	102	3,772	1,200	913	0	0	0	70	636	1,523	147
4 Commerce	800	231	0	0	1,717	0	15,362	3,444	184	1,670	1,646	506
5 Services	6,375	1,875	1,886	47,436	16,708	0	0	0	977	3,338	6,974	2,293
6 Wastes	0	0	0	0	0	0	0	0	0	71	3,862	51
7 Fuels	1,000	0	2,037	2,000	2,000	0	0	0	340	4,794	4,462	315
8 Packaging	3,084	0	0	0	0	0	0	0	55	1,828	755	169
9 Extractive industry	0	0	0	0	0	0	4,682	0	1,387	2,354	3,795	30
10 Nonmetallic minerals	0	0	0	0	350	85	0	3,201	0	3,666	125	80
11 Metallurgy	3,000	1,831	0	0	182	5,225	0	6,879	48	400	40,340	11,151
12 Machine tools	0	0	0	0	200	0	0	0	0	2	17	368
13 Electrical goods	0	0	0	0	200	0	0	0	3	58	102	979
14 Transportation goods	200	0	0	0	997	0	0	0	0	0	1	6
15 Wood	0	0	0	0	150	0	0	3,743	2	30	246	282
16 Furniture	0	0	0	0	0	0	0	0	0	0	0	165
17 Paper	0	0	0	0	50	1,614	0	10,555	0	25	124	2
18 Rubber	0	0	0	0	0	85	0	684	0	5	32	56
19 Leather	0	0	0	0	836	0	0	0	0	4	1	20
20 Chemical industry	8,712	3,145	0	1,000	1,000	935	42,813	0	116	1,390	1,598	208
21 Pharmaceuticals	0	239	0	0	4,652	0	0	0	0	0	0	0
22 Perfumery	0	0	0	479	687	0	0	0	0	0	3	0
23 Plastics	0	0	0	0	30	0	0	0	1	5	51	22
24 Textiles	0	0	0	0	1,332	679	0	7,981	0	26	161	32
25 Clothing	0	0	0	74	1,000	0	0	0	0	0	0	0
26 Food	0	1,302	0	0	1,600	0	0	0	0	4	45	0
27 Beverages	0	0	0	0	2,629	0	0	0	0	1	3	0
28 Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
29 Publishing	0	0	0	3,000	4,768	0	0	0	89	286	245	123
30 Miscellaneous	0	0	0	0	2,425	0	0	0	0	0	13	0
31 Construction	2,423	0	0	0	25,000	0	0	0	0	0	0	0
32 Transportation	0	0	0	9,343	807	0	0	0	469	1,716	1,310	284
Σ	38,800	29,465	7,695	64,532	69,678	8,623	74,062	36,487	3,752	22,313	68,208	17,237
Gross Returns to capital	215,695	84,936	9,970	160,398	227,579	0	0	0	7,346	19,113	36,223	8,564
Wages, salaries, and social security	80,302	15,000	1,197	55,418	86,864	0	0	0	4,130	11,448	19,821	7,829
Value Added	295,997	99,936	11,167	215,816	314,443	0	0	0	11,476	30,561	56,044	16,393
Gross product	334,797	129,401	18,862	280,348	384,121	8,623	74,062	36,487	15,228	52,874	124,252	33,630

BRAZIL: INPUT-OUTPUT TABLE, 1959–*(Continued)*

Sectors	13	14	15	16	17	18	19	20	21	22	23	24
1 Vegetable product	70	52	7,387	225	514	4,427	311	9,141	23	495	3	19,432
2 Animal product	3	0	6	8	0	0	2,085	829	4	390	0	680
3 Electric energy	164	219	170	118	412	122	66	731	64	36	40	1,141
4 Commerce	1,278	712	220	672	350	259	647	1,518	466	807	104	3,121
5 Services	3,145	6,503	1,448	1,418	1,894	1,451	679	4,111	2,878	1,509	720	7,501
6 Wastes	10	285	58	17	1,486	1,493	3	18	2	0	2	588
7 Fuels	183	571	459	55	910	239	107	2,217	121	153	31	1,714
8 Packaging	493	152	104	162	295	183	53	3,225	2,942	1,670	111	1,356
9 Extractive industry	37	56	6	6	23	3	19	16,001	0	9	1	30
10 Nonmetallic minerals	632	355	52	187	76	21	61	276	2	42	8	22
11 Metallurgy	14,095	18,441	197	1,506	71	346	104	522	1	0	37	18
12 Machine tools	1,454	254	1	3	0	0	0	0	0	0	114	24
13 Electrical goods	3,759	1,472	0	12	0	0	0	32	0	0	1	0
14 Transportation goods	11	12,165	0	0	0	0	4	0	0	0	0	11
15 Wood	132	626	4,581	4,660	173	1	36	106	0	4	5	0
16 Furniture	464	12	0	20	0	0	0	0	0	0	0	0
17 Paper	78	88	19	9	12,613	1	54	573	0	0	167	4
18 Rubber	57	1,765	5	28	17	3,581	0	35	0	0	7	24
19 Leather	1	24	2	59	1	12	2,083	0	0	0	83	35
20 Chemical industry	824	531	219	390	1,550	1,118	1,007	22,355	5,552	6,727	2,106	12,087
21 Pharmaceuticals	24	0	0	0	0	0	0	0	53	0	0	0
22 Perfumery	3	0	0	0	0	0	8	5	3	37	0	31
23 Plastics	913	265	0	414	4	7	32	1	0	0	331	1
24 Textiles	176	172	37	1,194	443	1,988	123	508	0	0	275	36,751
25 Clothing	0	2	0	0	0	0	0	0	0	5	0	0
26 Food	6	8	17	4	30	0	3	275	103	18	0	83
27 Beverages	1	1	1	22	3	0	1	363	64	75	10	6
28 Tobacco	0	0	0	0	0	0	0	0	0	0	0	0
29 Publishing	178	211	163	134	60	49	44	266	125	62	28	278
30 Miscellaneous	11	0	0	0	0	0	10	0	0	0	0	0
31 Construction	0	0	0	0	0	0	0	0	0	0	0	0
32 Transportation	241	432	1,448	337	498	258	198	1,155	272	223	51	1,189
Σ	28,443	45,357	16,600	11,660	21,453	15,559	7,738	64,263	12,675	12,172	4,235	86,157
Gross Returns to capital	11,328	23,714	9,057	5,090	9,558	11,569	3,092	31,626	6,544	4,329	2,619	35,561
Wages, salaries, and social security	7,158	11,026	5,546	4,964	4,097	2,714	1,935	9,886	3,814	1,472	1,134	26,291
Value added	18,486	34,740	14,603	10,054	13,655	14,283	5,027	41,512	10,358	5,801	3,753	61,852
Gross product	46,929	80,097	31,203	21,714	35,108	29,842	12,765	105,775	23,033	17,973	7,988	148,009

BRAZIL: INPUT-OUTPUT TABLE, 1959-*(Continued)*

Sectors	25	26	27	28	29	30	31	32	Σ	CF	CC
1 Vegetable product	11	82,401	2,748	1,867	0	98	0	0	174,904	156,130	160
2 Animal product	100	54,000	27	1	0	78	0	0	55,585	59,619	500
3 Electric energy	107	1,304	131	20	130	73	0	755	14,366	13,289	1,207
4 Commerce	1,418	2,430	430	102	620	254	26,914	2,744	70,946	164,197	1,423
5 Services	2,727	10,285	2,179	492	2,043	1,335	7,903	4,586	152,669	231,452	0
6 Wastes	17	1	0	0	0	636	0	0	8,620	0	0
7 Fuels	67	3,215	450	39	74	66	2,160	32,500	62,309	8,421	3,246
8 Packaging	735	13,784	3,330	1,466	117	358	0	0	36,487	0	0
9 Extractive industry	2	1,019	0	0	1	116	0	0	29,487	0	457
10 Nonmetallic minerals	143	190	2	0	1	183	36,370	0	46,130	6,352	2,203
11 Metallurgy	254	1	0	0	247	923	24,835	0	130,654	5,102	5,175
12 Machine tools	0	0	0	0	0	0	0	0	2,417	3,913	3,251
13 Electrical goods	0	0	0	0	0	55	3,759	0	10,452	22,715	1,000
14 Transportation goods	0	0	0	0	0	15	1,663	10,597	25,070	9,533	3,565
15 Wood	261	2	0	0	13	455	14,162	0	29,670	1,089	432
16 Furniture	0	0	0	0	0	0	647	0	1,248	16,569	0
17 Paper	247	1	0	279	8,260	247	0	0	35,010	1,344	850
18 Rubber	1,592	0	1	0	0	64	0	9,689	17,730	11,927	303
19 Leather	6,082	0	0	0	7	94	0	0	9,344	1,378	30
20 Chemical industry	219	5,234	849	27	1,086	774	1,331	1,150	126,053	3,479	2,590
21 Pharmaceuticals	0	1	0	0	0	0	0	0	4,969	19,385	684
22 Perfumery	0	0	0	0	0	3	0	0	1,259	16,202	698
23 Plastics	214	0	0	0	2	117	327	0	2,737	5,187	74
24 Textiles	8,998	4	0	0	95	417	0	0	61,392	85,255	892
25 Clothing	75	1	0	0	0	0	0	0	1,157	38,605	512
26 Food	2	31,638	3,122	9	1	2	0	0	37,672	187,699	2,012
27 Beverages	3	53	1,097	1	1	4	0	0	3,739	24,914	1
28 Tobacco	0	0	0	2,282	0	0	0	0	2,282	10,752	0
29 Publishing	138	659	135	22	461	70	0	0	11,594	15,059	1,307
30 Miscellaneous	54	0	0	0	24	175	0	0	2,712	12,778	140
31 Construction	0	0	0	0	0	0	0	2,000	29,423	30,000	10,000
32 Transportation	284	5,828	701	112	299	126	4,595	3,304	35,480	87,196	25,000
Σ	23,750	212,051	15,202	6,719	13,482	6,788	124,066	67,325	1,236,547	1,239,879	68,932
Gross Returns to capital	9,337	53,640	8,435	5,176	6,917	4,873	32,357	9,707	1,054,353		
Wages, salaries and social security	7,185	19,296	4,313	1,272	6,555	3,615	23,000	83,422	510,704	45,923	105,589
Value added	16,522	72,936	12,748	6,448	13,472	8,488	55,357	93,129		45,923	105,589
Gross product	40,272	284,987	27,950	13,167	26,954	15,276	179,423	160,454	2,801,604	1,285,802	174,528

BRAZIL: INPUT-OUTPUT TABLE, 1959-(*Continued*)

Sectors	*I*	E	—*M*	*PB*
1 Vegetable product	6,555	11,884	—14,836	334,797
2 Animal product	10,445	391	—139	129,401
3 Electric energy	0	0	0	18,862
4 Commerce	22,730	21,052	0	280,348
5 Services	0	0	0	384,121
6 Wastes	0	3	0	8,623
7 Fuels	0	86	0	74,062
8 Packaging	0	0	0	36,487
9 Extractive industry	0	2,604	—17,320	15,228
10 Nonmetallic minerals	0	203	—2,014	52,874
11 Metallurgy	6,152	17	—22,848	124,252
12 Machine tools	41,216	151	—17,318	33,630
13 Electrical goods	20,161	11	—8,328	46,929
14 Transportation goods	61,346	91	—19,788	80,097
15 Wood	0	78	—76	31,203
16 Furniture	3,873	0	—6	21,714
17 Paper	0	0	—2,096	35,108
18 Rubber	0	35	—153	29,842
19 Leather	0	2,062	—49	12,765
20 Chemical industry	0	6,583	—33,230	105,775
21 Pharmaceuticals	0	58	—2,063	23,033
22 Perfumery	0	1	—187	17,973
23 Plastics	0	2	—12	7,988
24 Textiles	0	924	—454	148,009
25 Clothing	0	29	—31	40,272
26 Food	0	63,043	—5,439	284,987
27 Beverages	0	15	—719	27,950
28 Tobacco	0	133	0	13,167
29 Publishing	0	76	—1,082	26,954
30 Miscellaneous	1,301	56	—1,711	15,276
31 Construction	110,000	0	0	179,423
32 Transportation	0	12,778	0	160,454
Σ	283,779	122,366	—149,899	2,801,604
Gross Returns to capital				1,054,353
Wages, salaries and social security				662,216
Value added				1,716,569
Gross product	283,779	122,366	—149,899	4,518,173

Source. IPEA (1967)

APPENDIX B

The 12-sector input-output table for Brazil, 1959 (Cr$1,000)

Sector	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.Agric.	33,726	11	4	697	2,396	22,000	20,223	139,176	14,611	0
2.Ext.ind.	0	1,387	2,354	3,828	19	20,693	32	1,019	155	0
3.N-m.min.	0	0	3,666	1,192	61	328	165	192	3,806	0
4.Met.	5,031	51	460	104,595	108	707	307	1	15,480	0
5.Leather	0	0	4	46	2,083	83	6,117	0	175	0
6.Chemic.	13,096	463	6,189	9,973	1,154	82,505	14,333	9,748	8,518	2,037
7.Text.	0	0	26	543	123	788	45,824	5	12,834	0
8.Food	1,302	0	5	64	4	903	94	35,910	95	0
9.Paper,..	3,084	140	2,245	10,630	200	9,348	5,324	17,913	61,572	0
10.Elect.	302	70	636	2,053	66	871	1,248	1,435	1,045	3,772
11.Constr.	2,423	0	0	0	0	0	0	0	0	0
12.Servic.	9,301	1,630	6,724	25,624	1,524	29,176	16,240	21,853	19,080	1,886
Int.total	68,265	3,752	22,313	159,245	7,738	167,407	109,907	227,252	137,371	7,695
Cap.income	300,631	7,346	19,113	79,829	3,092	45,123	44,898	62,076	52,234	9,970
Lab.income	95,302	4,130	11,448	45,834	1,935	16,306	33,476	23,609	28,763	1,197
V. added	395,933	11,476	30,561	125,663	5,027	61,429	78,374	85,685	80,997	11,167
Gross prod.	464,198	15,228	52,874	284,908	12,765	228,836	188,281	312,937	218,368	18,862

Source: Appendix A

APPENDIX B - cont'd

Sector	11.	12.	Int.total	C_h	$Z=C_g+I$	E	-M	Gross.prod.
1.Agr.	0	645	233,489	215,749	17,660	12,275	- 14,975	464,198
2.Ext.ind.	0	0	29,487	0	457	2,604	- 17,320	15,828
3.N-m.min.	36,370	350	46,130	6,352	2,203	203	- 2,014	52,874
4.Met.	29,657	12,176	168,573	41,561	142,786	270	- 68,282	284,908
5.Leather	0	836	9,344	1,378	30	2,062	- 49	12,765
6.Chem.	3,818	45,498	197,332	52,674	7,592	6,730	- 35,492	228,836
7.Text.	0	2,406	62,549	123,860	1,404	953	- 485	188,281
8.Food	0	3,029	41,411	212,613	2,013	63,058	- 6,158	312,937
9.Paper..	14,809	20,082	145,347	69,558	8,206	381	- 5,124	218,368
10.Electr.	0	2,868	14,366	3,289	1,207	0	0	18,862
11.Constr.	0	27,000	29,423	30,000	120,000	0	0	179,423
12.Serv.	39,412	86,645	259,095	482,845	49,153	33,830	0	824,923
Int.total	124,066	201,535	1,236,546	1,239,879	352,711	122,366	-149,899	2,801,603
Cap.inc.	32,357	397,684	1,054,353					1,054,353
Lab.inc.	23,000	225,704	510,704	45,923	105,589			662,216
V. Added	55,357	623,388	1,565,057	45,923	105,589			1,716,569
Gross pr.	179,423	824,923	2,801,603	1,285,802	458,300	122,366	-149,899	4,518,172

Source: Appendix A.

NOTE TO APPENDIX C

The following table was estimated by using the procedures presented in Chapter III, i.e., based on three steps. The first two steps seem to have been clearly explained in the text. The third step - readjustment in the coefficients to reflect intersectoral relations found by Goodman & Albuquerque (197-) for the Northeast - required some changes in the composition (not in the total) of the cclumns related to sectors 4, 6, and 7 in the Northeast. This led to some changes in the composition (not in the total) of the column of intermediate totals in the interregional input-output table. Such changes were compensated mostly by changing the composition of the exogenous demand column (Z) to preserve the initial regional totals of sectoral gross production. This did not interfere with the empirical results of the model (we should recall that what was used as basis of exogenous demand change in the simulation relative to Tables 4.9-4.10 was the gross production less own-sector deliveries, not the levels Z_i-s).

APPENDIX C

Interregional input-output table, 1959 (Cr$1,000)

Sectors	Center-South					
	1.	2.	3.	4.	5.	6.
Center-South						
1.Agriculture	26645	9	3	551	1893	17380
2.Extr.industry	0	1179	2001	3254	16	17590
3.Non-met.min.	0	0	3308	1085	53	289
4.Metallurgy	3974	43	417	98514	95	622
5.Leather	0	0	4	41	1644	66
6.Chemicals	9324	353	5026	8505	902	64684
7.Text.,cloth.	0	0	23	463	101	650
8.Food,bev.	1028	0	4	58	4	791
9.Paper,tobacco..	2436	119	2054	10255	175	8226
10.Electric energy	239	60	582	1983	58	766
11.Construction	1914	0	0	0	0	0
12.Services	7348	1386	6154	24753	1335	25675
Northeast						
1.Agriculture	0	0	1	122	206	1980
2.Extr.industry	0	0	153	444	1	620
3.Non-met.min.	0	0	47	66	0	0
4.Metallurgy	0	0	4	2525	0	0
5.Leather	0	0	0	3	181	7
6.Chemicals	1021	41	638	1129	109	7920
7.Text.,cloth.	0	0	1	62	7	43
8.Food, bev.	0	0	0	4	0	8
9.Paper,tobacco..	0	0	0	14	0	0
10.Electric energy	0	0	0	0	0	0
11.Construction	0	0	0	0	0	0
12.Services	0	0	0	0	0	0
Interm.total	53974	3196	20435	153776	6784	147369
Capital income	237464	6239	17476	77150	2705	39671
Labor income	75278	3509	10469	44295	1693	14336
Value added	312742	9748	27945	121445	4398	54007
Gross production	366716	12944	48380	275221	11182	201376

APPENDIX C - continued

Sectors	Center-South 7.	8.	9.	10.	11.	12.
Center-South						
1.Agric.	15976	109949	11343	0	0	510
2.Extr.ind.	28	866	132	0	0	0
3.Non-met.min.	142	172	3472	0	30296	303
4.Metallurgy	265	1	14733	0	24704	10544
5.Leather	4771	0	152	0	0	654
6.Chemicals	11042	7798	7360	1813	2849	35160
7.Text.,cloth.	37537	4	10794	0	0	1973
8.Food,bev.	81	31457	86	0	0	2623
9.Paper,tob...	4594	16122	59774	0	12336	17391
10.Electric en.	1077	1292	1024	3542	0	2484
11.Construction	0	0	0	0	0	23382
12.Services	14015	19668	18698	1771	32830	75035
Northeast						
1.Agric.	1476	15309	2776	0	0	49
2.Extr.ind.	0	51	20	0	0	0
3.N.m.min.	0	1	258	0	0	0
4.Met.	0	0	437	0	0	0
5.Leather	508	0	20	0	0	70
6.Chemicals	1327	975	928	100	331	4241
7.Text.,cloth.	2009	0	1583	0	0	111
8.Food,bev.	0	862	7	0	0	0
9.Paper,tob....	0	0	567	0	0	0
10.Electric en.	0	0	0	0	0	0
11.Construction	0	0	0	0	0	0
12.Services	0	0	0	0	0	0
Interm.total	94943	204582	134667	7226	103346	174739
Capital income	38694	55828	51159	9361	26954	344243
Labor income	28850	21233	28175	1124	19159	195401
Value added	67544	77061	79334	10485	46113	539644
Gross production	162487	281643	214001	17711	149459	714383

APPENDIX C - continued

Sectors	Northeast 1.	2.	3.	4.	5.	6.
Center-South						
1.Agric.	0	0	0	0	0	0
2.Ext.ind.	0	0	0	0	0	0
3.N.met.min.	0	0	47	6	3	11
4.Metall.	886	7	28	2695	10	833
5.Leather	0	0	0	0	181	7
6.Chemicals	2200	55	420	159	114	7006
7.Text.,cl.	0	0	0	0	5	41
8.Food,bev.	143	0	1	0	0	27
9.Paper,tob.	585	19	145	170	22	959
10.Electric en.	0	0	0	0	0	0
11.Construction	0	0	0	0	0	0
12.Services	0	0	0	0	0	0
Northeast						
1.Agric.	7083	2	0	24	297	2640
2.Ext.ind.	0	208	200	130	2	2483
3.N.met.min.	0	0	264	37	5	29
4.Metall.	171	1	11	1072	3	328
5.Leather	0	0	0	2	77	3
6.Chemicals	550	14	105	40	29	1751
7.Text.,cl.	0	0	2	0	10	89
8.Food,bev.	130	0	0	2	0	85
9.Paper,tob.	62	2	45	206	3	192
10.Electric en.	63	10	54	70	8	105
11.Construction	509	0	0	0	0	0
12.Services	1953	244	570	871	189	3501
Interm.total	14290	554	1877	5469	954	20048
Capital income	63164	1112	1634	2679	388	5453
Labor income	20028	618	983	1539	241	1959
Value added	83192	1730	2617	4218	629	7412
Gross production	97482	2284	4494	9687	1583	27460

APPENDIX C - continued

Sectors	Northeast					
	7.	8.	9.	10.	11.	12.
Center-South						
1.Agric.	0	0	0	0	0	0
2.Ext.ind.	0	0	0	0	0	0
3.N.met.min.	5	3	11	0	2983	17
4.Metall.	13	0	220	0	3945	1219
5.Leather	357	0	2	0	0	78
6.Chemicals	1656	780	136	99	510	4878
7.Text.,cloth.	2184	1	82	0	0	103
8.Food, bev.	3	862	0	0	0	103
9.Paper,tob.	379	1433	566	0	2177	2289
10.Electric en.	0	0	0	0	0	0
11.Construction	0	0	0	0	0	0
12.Services	0	0	0	0	0	0
Northeast						
1.Agric.	2771	13918	292	0	0	86
2.Extr.ind.	4	102	3	0	0	0
3.N.met.min.	9	16	65	0	3091	30
4.Metall.	4	0	90	0	1008	413
5.Leather	153	0	1	0	0	34
6.Chemicals	414	195	34	25	128	1219
7.Text.,cl.	4642	0	175	0	0	219
8.Food, bev.	5	2729	2	0	0	303
9.Paper, tob.	65	358	665	0	296	402
10.Electric en.	171	143	21	230	0	384
11.Construction	0	0	0	0	0	3618
12.Services	2225	2185	382	115	6582	11610
Interm.total	14965	22670	2790	469	20720	26796
Capital income	6202	6248	1017	609	5403	53424
Labor income	4627	2376	560	73	3841	30320
Value added	10829	8624	1577	682	9244	83744
Gross production	25794	31294	4367	1151	29964	110540

APPENDIX C - continued

Sectors	Int.tot.	C_h	$Z=C_g+I$	E	-M	Gr.Pr.
Center-South						
1.Agric.	184456	170442	13951	9697	-11830	366716
2.Extr.ind.	25064	0	389	2213	-14722	12944
3.N.met.min.	42205	5812	2020	186	- 1843	48380
4.Metallurgy	163270	40148	137502	261	-65960	275221
5.Leather	7955	1207	256	1806	- 42	11182
6.Chemicals	172829	46353	7504	5922	-31232	201376
7.Text.,cl.	54160	106891	1032	822	- 418	162487
8.Food, bev.	37270	191352	1812	56752	- 5542	281643
9.Paper,tob.	142227	68167	8255	373	- 5021	214001
10.Electr.	13107	3088	1516	0	0	17711
11.Constr.	25296	24990	99173	0	0	149459
12.Services	228668	418144	38274	29297	0	714383
Northeast						
1.Agric.	49033	45307	3769	2518	- 3145	97482
2.Extr.ind.	4423	0	69	391	- 2597	2284
3.Non.met.min.	3919	541	188	17	- 171	4494
4.Metall.	6070	1413	4518	9	- 2323	9687
5.Leather	1061	171	102	256	- 7	1583
6.Chemicals	23313	6568	1030	808	- 4259	27460
7.Text.,cl.	3953	16535	192	130	- 66	25794
8.Food,bev.	4139	21261	203	6306	- 615	31294
9.Paper,tob.	2878	1391	193	8	- 103	4367
10.Electr.	876	201	74	0	0	1151
11.Constr.	4127	5010	20827	0	0	29964
12.Services	30427	64701	10879	4533	0	110540
Interm.total	1236546	1239879	352711	122366	-149899	2801603
Capital inc.	1054353					1054353
Labor income	510704	45923	105589			662216
Value added	1565057	45923	105589			1716569
Gross prod.	2801603	1285802	458300	122366	-149899	4518172

APPENDIX D

Direct and cross price elasticities of demand (multiplied by -10^4)

Elasticity of \ With respect to price of	Center-South								
	1.	2.	3.	4.	5.	6.	7.	8.	9.
Center-South									
1.Agriculture	5052	0	9	62	4	166	317	952	241
2.Extr.industry	781	5050	10	72	4	191	366	1099	278
3.Non-met.minerals	1207	0	7816	111	7	296	566	1698	429
4.Metallurgy	1208	0	16	7911	7	297	566	1698	429
5.Leather	892	0	12	82	5771	218	418	1255	317
6.Chemicals	763	0	10	70	4	5121	359	1074	271
7.Text.,cloth.	896	0	12	83	5	220	6214	1261	319
8.Food, bev.	457	0	6	42	3	112	214	3594	162
9.Paper,tob.,misc.	774	0	10	71	5	189	363	1088	5275
10.Electric energy	763	0	10	70	4	187	359	1074	271
11.Construction	1499	0	20	138	8	368	703	2110	533
12.Services	837	0	11	77	4	205	393	1178	298
Northeast									
1.Agric.	677	0	9	62	4	166	317	952	241
2.Extr.ind.	781	0	10	72	4	191	366	1099	278
3.Non-met.minerals	1207	0	16	111	7	296	566	1698	429
4.Metallurgy	1207	0	16	111	7	296	566	1698	429
5.Leather	892	0	12	82	5	218	418	1255	317
6.Chemicals	763	0	10	70	4	187	359	1074	271
7.Text.,cloth.	896	0	12	83	5	220	420	1261	319
8.Food, bev.	457	0	6	42	3	112	214	642	162
9.Paper,tob.,misc.	774	0	10	71	5	189	363	1088	275
10.Electric energy	763	0	10	70	4	187	359	1074	271
11.Construction	1499	0	20	138	8	367	703	2109	533
12.Services	837	0	11	77	4	205	393	1178	298

APPENDIX D - continued

Direct and cross price elasticities of demand (multiplied by -10^4)

Elasticity of \ With respect to price of	C.South			Northeast					
	10.	11.	12.	1.	2.	3.	4.	5.	6.
Center-South									
1.Agric.	11	5	1353	180	0	1	2	0	23
2.Extr.ind.	13	6	1562	207	0	0	2	2	26
3.N.met.min.	20	10	2412	320	0	1	4	0	40
4.Metallurgy	20	10	2412	320	0	1	4	0	40
5.Leather	15	7	1783	237	0	1	3	0	30
6.Chemicals	12	6	1526	203	0	1	2	0	25
7.Text.,cl.	15	7	1792	238	0	1	3	0	30
8.Food, bev.	7	4	913	121	0	1	2	0	15
9.Paper,tob.,misc.	13	6	1546	205	0	1	2	0	26
10.Electric energy	4946	6	1526	203	0	1	2	0	25
11.Construction	25	9702	2996	398	0	2	5	1	50
12.Services	14	7	7088	222	0	1	2	0	28
Northeast									
1.Agric.	11	5	1353	4555	0	1	2	0	23
2.Extr.ind.	13	6	1562	207	5050	0	2	2	26
3.Non-met.min.	20	10	2412	320	0	7801	4	0	40
4.Metallurgy	20	10	2412	320	0	1	7804	0	40
5.Leather	15	7	1783	237	0	1	3	5766	30
6.Chemicals	12	6	1526	203	0	1	2	0	4959
7.Text.,cl.	15	7	1792	238	0	1	3	0	30
8.Food, bev.	7	4	913	121	0	1	2	0	15
9.Paper,tob.,misc.	13	6	1546	205	0	1	2	0	26
10.Electric energy	12	6	1526	203	0	1	2	0	25
11.Construction	25	12	2996	398	0	2	5	1	50
12.Services	14	7	1674	222	0	1	2	0	28

APPENDIX D - continued

Direct and cross price elasticities of demand (multiplied by -10^4)

Elasticity of \ With respect to price of	Northeast					
	7.	8.	9.	10.	11.	12.
Center-South						
1.Agric.	50	106	5	1	1	209
2.Ext.ind.	58	123	5	1	1	242
3.Non-met.min.	89	189	9	2	2	372
4.Metallurgy	89	189	9	2	2	372
5.Leather	66	140	6	1	1	276
6.Chemicals	56	120	5	1	1	237
7.Text.,cloth.	66	140	6	1	1	278
8.Food, bev.	34	72	3	1	1	141
9.Paper,tob.,misc.	57	121	6	1	1	239
10.Electric energy	56	120	5	1	1	237
11.Construction	111	235	11	2	2	464
12.Services	62	131	6	1	1	259
Northeast						
1.Agric.	50	106	5	1	1	209
2.Ext.ind.	58	123	5	1	1	242
3.Non-met.min.	89	189	9	2	2	372
4.Metallurgy	89	189	9	2	2	372
5.Leather	66	140	6	1	1	276
6.Chemicals	56	120	5	1	1	237
7.Text.,cloth.	5860	140	6	1	1	278
8.Food, bev.	34	3024	3	1	1	141
9.Paper,tob.,misc.	57	121	5006	1	1	239
10.Electric energy	56	120	5	4935	1	237
11.Construction	111	235	11	2	9692	464
12.Services	62	131	6	1	1	5673

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INTERREGIONAL EFFECTS OF ECONOMIC POLICIES: MULTI-SECTORAL GENERAL EQUILIBRIUM ESTIMATES FOR BRAZIL

by Osmundo E. Rebouças

S U M M A R Y

The aim of this study is the analysis of the differential effects of some government policies on the interregional economic disparities between the backward Northeast and the relatively developed Center-South of Brazil. As of 1970 and in relation to the Center-South, the Northeast, with its 28.3 million people, represented 43.6% of the population but only 17.5% of the gross domestic product.

Policy-makers in postwar Brazil have promoted a multiplicity of development policies for sectors and regions, whose isolated consequences can not be adequately evaluated in the absence of some general equilibrium framework. But it has been suspected by some writers, although without using appropriate analytical apparatus for empirical estimates, that there have been government policies whose effects have operated in various directions with respect to the politically and socially dangerous regional income concentration in Brazil. The usual arguments have focused on two major points:

a) since the Center-South is the more industrialized region, it has tended to get most of the benefits from industrialization policies; and

b) based more on statistical data related to effects than on reasoning related to causes, conclusions have been drawn pointing to the rôle of taxes in reducing interregional disparities.

When regions differ in social and economic structures, they respond differently to government policies. Yet the differential regional impacts of such instruments have not been adequately analyzed in the literature. The trade-off between regional and national growth has been the object of some works using linear-programming (LP) models*, but such an approach is not very appropriate when we are interested in the interregional effects of economic policies, since in those optimizing LP models: a) full-employment of labor is usually assumed, which restricts the realism of the analysis for most underdeveloped countries; b) in general, fixed coefficients for primary inputs are assumed, leading in some cases to extreme and unacceptable solutions for lack of substitution possibilities; c) sectoral composition of consumption is usually supposed to be fixed, neglecting the different endogenous reactions of sectors to price and income changes; and d) trade-off analysis is not the main focus of the present study.

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*For Pakistan and under unemployment conditions using the two-gap approach, see MacEwan, A., "Problems of interregional and intersectoral allocation: the case of Pakistan," in Chenery, H.B.(ed.), Studies in Development Planning (Cambridge, Massachusetts, Harvard Univ.Press, 1971), and Stern, J.J., "Growth, development, and regional equity in Pakistan," in Falcon, W.P. & Papanek, G.F., Development Policy II - The Pakistan Experience (Cambridge,Harvard U.Press, 1971).

The model used in this study for the investigation of interregional effects of government policies in Brazil is based on the Johansen's general equilibrium approach, adapted for commercial policy in Chile by Taylor & Black, and here adjusted on the basis of an interregional input-output table estimated essentially from a national table and trade data between regions. Cobb-Douglas and CES production functions are alternatively used. Unshiftable capital stocks are assumed. Two unemployment cases (one with variable real wage manipulated by economic policy and other with fixed real wage), as well as a full-employment situation are studied for sensitivity analysis. All imports are assumed to be competitive. For each region, 12 sectors are analyzed: 5 import-competing sectors, 4 export goods, and 3 non-traded. Consumers' utility functions are supposed to be additive, a necessary condition for the use of Frisch scheme to compute all direct and cross price elasticities of demand. Imports are in perfectly elastic supply, but exports have finite demand elasticities. Balanced-budget adjustments were made in government's exogenous demand to compensate for changes in revenue consequent upon the adoption of some policy instruments.

The empirical application of the model to some simulated policy changes provides numerical results that support the following conclusions, for all six cases studied (three labor-market assumptions for C.Douglas and CES production functions): a) uniform increases in forces-of-tariffs tend to aggravate the interregional disparities in real income, employment, etc., by

protecting more heavily the sectors classified in this study as import-competing (extractive industry, non-metallic minerals, metallurgy, chemicals, paper, and kindred products), that predominate in the Center-South;

b) the promotion of traditional-sector exports (agriculture, leather, textiles, food, and related products), by giving protection to those sectors predominating in the Northeast, tends to benefit more this region, thus reducing the interregional duality. This simulated policy is not to be confused with the recent Brazilian pattern of export promotion, that has tended to protect also the exports of the sectors here classified as import-competing and possibly benefiting more the Center-South;

c) exchange rate increases tend to reflect more their import-substitution effect than their export-promotion effect (due to imperfectly elastic export demands), thus widening the regional gap;

d) the State sales tax (ICM) tends obviously to be borne more significantly by the region where it is imposed. However, due to the pronounced asymmetry in interregional trade (the Northeast depends heavily on the Center-South in terms of industrial goods), the tax levied in the Center-South is more detrimental to the Northeast than vice-versa. This is also related to the low efficacy of tax administration in the backward Northeast.

e) a similar conclusion is drawn from the empirical results with respect to the federal indirect tax (IPI) and to a labor tax (or alternatively an exogenous increase in nominal wage

under labor-union pressures). This points to the opposite rôles played by taxes and promotion of traditional-sector exports, on one side, and industrial protection, on the other side;

f) under the assumptions of the model, an increase in exogenous demand for export and non-traded sectors tends to generate a higher income multiplier when such an increase occurs in the Northeast than in the Center-South, mainly because those sectors predominate in the former region. Also, the resulting real-income increase in one region is always accompanied by a real-income decrease in the other region, due largely to relative-price and supply-demand constraints. This is in sharp contrast with the results obtained by using the Chenery interregional input-output model, that neglects many important changes in endogenous variables; and

g) the analysis of the model sensitivity to a changing pattern of interregional trade (varying interregional input-output coefficients) has shown the extent to which the interregional transmission of policy effects (both negative and positive) tends to be strenghtened when trade tends to be more intensive.

The next step was the empirical application of the model to four policies actually adopted in the sixties, whose numerical results show that:

a) as a consequence of a policy of production subsidies estimated from data on disbursements related to the program of regional investment incentives (SUDENE), the real income of the Northeast would have increased between 11% and 17% in

terms of the Center-Southern real income;

b) the trade liberalization implemented through tariff reduction adopted in March 1967 would have caused an increase in the Northeastern real income in the range of 1.36%-4.20% in terms of real income of the Center-South;

c) the export promotion of traditional sectors would also have benefited more the Northeast (real-income increase of 0.01%-1.69% in terms of the Center-South); and

d) the increase in social security charge (FGTS) adopted in 1967 would have been borne mostly by the Center-South (increase in the Northeastern real income in the range of 1.45%-2.41% in terms of Center-Southern real income).

If unchecked, the above four gap-narrowing policies would have increased the relative Northeastern real income in the range of 15-23% (some part of this effect will come out in the seventies). However, national accounts data show that the two regional incomes have kept the same relationship, not only in the sixties, but in the last 3 decades. The (residual) conclusion is that many other instruments have neutralized such effects. As Stern pointed out (op.cit., p.8), "Although it is relatively simple to posit a variety of causes leading to spatial income inequalities, it is more difficult to explain their persistence" and "...possibly internal factor flows do not occur rapidly enough to offset the dynamic conditions which further increase spatial inequalities." In the present Brazilian case this is especially pertinent, given the set of

government policies adopted in the sixties to remedy the regional disparity. It is suggested here that the main neutralizing causes (against the four above policies) are:

a) historical economic factors, i.e., divergent foreign trade conditions observed in the nineteen century (as argued by Leff), favoring export goods produced in the Center-South (coffee) as against the Northeast (cotton and sugar);

b) the unequal endowment of natural resources (unfavorable land fertility conditions, droughts, etc.) that put the Northeast in relative disadvantage;

plus the following elements directly related to economic policies

c) foreign capital inflows into the Center-South;

d) private capital outflows from the Northeast to the Center-South looking for opportunities of higher return;

e) operation of several government agencies and special policy incentives, designed in such a way that their effects are more beneficial to the Center-South;

f) promotion of manufacturing exports, benefiting more the industrialized C.South, besides exchange rate devaluations; and

g) the pattern of migration from the Northeast to the Center-South, that seems to worsen the quality of the unemployed labor force in the region of origin*.

See Eckaus, R.S., "The North-South differential in Italian economic development," Journal of Economic History, Sept.1961; Graham, D.H., "Divergent and convergent regional economic growth and internal migration in Brazil-1940/60", Economic Development & Cultural Change, April 1970; and Hirschman, A.O., The Strategy of Economic Development, (New Haven: Yale U.Press, 1958), Chapter 10.