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BRAZIL'S SECOND NATIONAL DEVELOPMENT PLAN AND ITS GROWTH-CUM-DEBT STRATEGY

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Brazil's Second National Development Plan
and its Growth-Cum-Debt Strategy^(*)



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INTRODUCTION

Brazil's Second National Development Plan (1975 - 1979), II NDP for short, was published in September of 1974 as the basic programme for the government which came into office in March 1974.

One of the central elements of the strategy proposed in the plan was the decision to maintain a rapid expansion of the gross domestic product projected to grow at 10 percent per year between 1974 and 1979, despite the quadrupling of the oil prices in 1973/74 and the fact that the industrial sector in Brazil was working at full capacity, with some branches showing signs of overheating. In order to sustain such a high rate of economic growth while maintaining external equilibrium, the II NDP emphasised the need to change the structure of the economy.

The preservation of rapid economic growth under deteriorating international conditions meant that the underlying external adjustment proposed in the II NDP was based on a medium or long-run strategy. In the first few years, current account deficits were expected to take place, and as result, the net foreign debt would rise. The counterpart of these deficits would be an inflow of foreign capital (both in the form of loans and direct investment) which would be used to finance the investment necessary to implement the desired change in the structure of the economy. This change would be designed to raise exports and reduce imports⁽¹⁾ so as to generate in the medium or long-term sufficient foreign exchange to service the debt and perhaps, eventually, to eliminate it.

In point of fact, helped by favourable changes in the terms of trade, the current account deficits showed a downward trend between 1974 and 1977. Borrowing in excess of what was required to finance the current account deficits in the 1976/78 period led to a rise in Brazil's international reserves, which reached the impressive figure of US\$12 billion (10⁹) by the

end of 1978. This suggests that as liquidity in world financial markets recovered in that period, the international banking community showed no lack of confidence in Brazil's growth-cum-debt strategy. On the other hand, the net foreign debt (excluding international reserves) increased from US\$6 billion at the end of 1973 to US\$32 billion at the end of 1978.

However, the second round of oil price increases in 1979/80, the sharp rise in interest rates and the drastic fall in the commodity prices have all contributed to Brazil's soaring foreign debt in the late 1970's and early 1980's. In 1982, lending from the commercial banking system was virtually interrupted and a chain of debtor countries, including Brazil, became unable to roll-over their debts triggering off what has become known as the '1982 debt crisis'.

In view of these facts, the plausibility of the II NDP underlying growth-cum-debt strategy, as a way of making the external adjustment of the economy after the first oil shock, has been very much questioned. Indeed, the II NDP strategy has time and again been seen as one of the main causes of Brazil's balance of payments difficulties in the early 1980's.

Along these lines, Roberto Campos, Minister in charge of economic affairs in the first government after the 1964 military coup d'état in Brazil and ambassador in London until 1982, has pointed out that:

"In 1974, after the first oil shock, and then in 1980, after the second shock, we entertained the illusion that we could be an 'Island of Prosperity' in a sea of recession. From this mirage the Second National Development Plan was born. While other countries were making a painful adjustment, we preferred to resort to financing. 'Financing rather than adjustment', that was our motto. Having being postponed, the adjustment now has to be bitter. The 'black September' of 1982 marked the end of the financing era and the

beginning of the adjustment era⁽²⁾.

On the occasion of the twentieth anniversary of the 1964 military coup, Roberto Campos added:

"...we have made timid and inadequate adjustment to the first oil crisis, with too ambitious programmes in some sectors (nuclear energy, steel, etc) and without the support of domestic savings while the morbid presence of the state grew".

"The refusal to adjust which was made possible by the easy access to the eurodollar market is at the roots of the collapse of our dream of becoming a large power⁽³⁾."

This view, though an extreme one, has been quite influential and has often been expressed in Brazilian newspapers in a variety of forms⁽⁴⁾. It was also put forward in a series of two articles for The Times on how Brazil spent the foreign loans that left it deep in debt:

"Trying to do too much, too quickly, in the years before the second oil price rise, led Brazil into its present financial difficulties⁽⁵⁾."

OBJECTIVE OF THE PAPER

The principal aim of this paper is to discuss the growth-cum-debt strategy set out in the II NDP and adopted in Brazil between 1974 and 1979, as a way of making the external adjustment of the economy. The period of analysis, however, is extended until 1982 in order to examine some of the effects of the investment decisions made between 1974 and 1979.

It is argued that, despite the mistakes made by the authorities in

Brazil on matters of economic policy and on certain investment decisions, the strategy set out in the II NDP and pursued over the period between 1974 and 1979 played, on the whole, a positive role in adjusting Brazil's external accounts in addition to sustaining economic growth.

The drastic deterioration in the international conditions which followed the second oil shock accounts for a gigantic part of the rise in Brazil's foreign debt since then, and ultimately led to the debt crisis in 1982.

The paper begins (1st section) with a very brief review of the 1968/1973 period, in which an attempt is made to provide a general picture of both the internal and external background conditions of the economy prior to the first oil shock.

In the second section the main aspects of the II NDP strategy are first examined. We look at the targets set in the plan for the expansion of the different sectors of the economy, for the rate of accumulation, for the allocation of investment resources and for the balance of payments and compare them with the results actually achieved. The institutional arrangement envisaged in the II NDP for the implementation of its strategy is also discussed in this section.

The third section compares the main projections with the results actually achieved in the capital goods sector and in the basic input industries. The fourth section deals with the projections and results in the energy sector and in the transportation and communication sectors.

The behaviour of the balance of payments is assessed in the fifth section and the performance of Brazil's exports is compared to that of a number of other oil importing countries.

Section six briefly sums up what in my view are the main positive and negative aspects of the II NDP strategy.

It must be stressed that this paper does not have the purpose of

assessing the II NDP strategy as a general strategy for development against all other possible alternatives.

(1) A Brief Review of the 1968/1973 Period⁽¹⁾

The economy of Brazil in the period from 1968 to 1973 is marked by an average annual growth-rate of GDP of 11.4% and for this reason is often referred to in the literature as the 'Brazilian economic miracle'.

This period of rapid economic expansion in Brazil was led by manufacturing industry which grew 13.2% on average per annum between 1968 and 1973 and, in particular, by the consumer durable goods sector which expanded at an impressive rate of 22.9% per year in the same period⁽²⁾. Indeed, until 1970 economic growth in Brazil could be characterised as a consumption-led-boom which took advantage of an existing high degree of spare capacity in industry in the mid-60's⁽³⁾. Nevertheless, investment in fixed capital picked up very rapidly from 21.4% of GNP in 1968 to 24.1 in 1970 and 26.0% in 1973⁽⁴⁾.

However, one essential feature of rapid economic expansion in Brazil in this period was the exceptionally favourable international condition which allowed a very sharp rise in Brazil's capacity to import⁽⁵⁾.

World imports (in US dollars) increased 17.5% per year between 1967 and 1973 compared to 7.1% in the 1953/1973 period. Brazil's exports (goods-fob-in US\$) responded to this upsurge in world trade with a 24.6% rise per annum between 1967 and 1973, after having been almost stagnant since 1953⁽⁶⁾.

The fact that the volume (quantity index) of Brazil's exports more than doubled between 1967 and 1973 coupled with a 20.2% improvement in the terms of trade of Brazil led to a rise of 151.0% in the purchasing power of exports between these two years. The volume of exports from Brazil was pushed by exports of mining products (mainly iron ore) and manufactures which increased 21.8% and 20.4% (in quantity), respectively, between 1968 and 1973, compared to a general increase of 12.7% in the total volume of

exports. As a consequence, the share of manufactures in total exports (in US\$) went up from 20.7% in 1967 to 31.3% in 1973. Exports of agricultural products also diversified with coffee losing its relative importance as other export crops such as soybeans experienced a very sharp rise⁽⁷⁾.

This most vigorous and continuous rise in export earnings, not witnessed in Brazil since the 1920's⁽⁸⁾, helped to sustain an extraordinary increase in imports. The volume of imports (quantity index) rose 18.5% between 1967 and 1973 while imports of goods in US dollars increased at the staggering rate of 27.5% per annum between these two years. The import coefficient (imports of goods and services over GNP) went up from 5.6% in 1967 to 9.6% in 1973⁽⁹⁾ as total imports of goods and services soared from US\$2153 millions in 1967 to US\$ 8857 millions in 1973.

As a result of imports being greater than exports, there were continuous and, since 1969, rising current account deficits from 1967 to 1973. This was made possible by the extraordinary liquidity of the international capital market⁽¹⁰⁾ which not only supplied Brazil with the necessary financing for the current account deficits, but allowed Brazil to increase its international reserves from 10% of total imports in 1968 to 142% of total imports in 1973⁽¹¹⁾. Consequently, the gross foreign debt rose from US\$3780 millions at the end of 1968 to US\$12571.5 millions at the end of 1973, but the net foreign debt (gross foreign debt less international reserves) increased much more modestly from US\$3523 millions to US\$6156.5 millions between these two years⁽¹²⁾.

It is perhaps important to stress at this point the euphoria which was generated in some quarters of the society by the so-called 'economic miracle'. Government propoganda seemed to have reflected as well as reinforced the belief of some groups (particularly among military men, government circles, entrepreneurs and middle class groups) that Brazil was rapidly becoming a world power. Economic success was likely to have been

regarded as the natural consequence of good management of the economy, political stability and discipline with no emphasis being placed on the exceptionally favourable conditions both domestically and internationally⁽¹³⁾.

However, despite the excellent growth performance of the economy and the euphoria it generated, there were already signs showing that those rates of growth could not be sustained for very long.

Indeed, the rapid expansion of the consumer durable goods sector relatively to that of the intermediate goods sector led to a marked increase in the volume of imports of intermediate goods⁽¹⁴⁾. By the end of 1973, it became clear that the domestic production of essential inputs such as oil, some ores, a variety of metals and chemicals were either missing altogether or were lagging terribly behind in Brazil's industrialisation process⁽¹⁵⁾.

Furthermore, since the industrial sector had reached full utilization of capacity by 1972/73, to maintain rapid economic growth would require phenomenal rates of accumulation. That, in turn, would tend to raise the marginal propensity to import capital goods above its average propensity. In fact, despite an annual growth-rate of 22.7% of the domestic capital goods sector between 1970 and 1973, the volume of imports of capital goods increased 24.7% per year in the same period⁽¹⁶⁾.

Therefore, although Brazil's current account deficits in this period may, by and large, be explained by the very high rates of economic growth coupled with a somewhat liberal approach to imports⁽¹⁷⁾, it seems that the structural nature of Brazil's unbalanced growth model was increasingly becoming a major factor in the rise of imports as well as in making imports less elastic with respect to a rise in their price. By structural nature of Brazil's unbalanced growth model I refer not only to the fact that the consumer durable goods sector was rising at a much faster rate than the

intermediate goods sector, but also to the relatively small size of the capital goods sector and of a number of essential intermediate goods industries.

If the rising trend in Brazil's current account deficits in 1969/73 was already an indication that a sizeable current account deficit was to be expected in 1974, even if the terms of trade was to remain constant at the rather favourable level of 1970, assuming no change in policy and in the growth pattern of the economy, the first oil shock drastically aggravated that prospect.

As a result of a rising use of oil per unit of output and of an almost stagnant domestic production of oil, imports of crude oil over domestic consumption (ignoring stock changes) increased from 61% in 1968 to 80% in 1973. New discoveries of oil in Brazil were roughly equal to the amount extracted so that the level of known oil reserves remained nearly constant from 1968 to 1971, showing a declining tendency thereafter. In point of fact, because oil production from the known oil reserves onshore was falling and bound to continue to fall due to exhaustion, and bearing in mind the inevitable lag between oil discovery and production, the short run prospects of the domestic oil supply in Brazil were not good at all, even after the offshore oil reserves became known in 1974.

What the analysis in this section suggests is that by 1974 Brazil's imports had become quite price inelastic in the short run and, given that the first oil shock led to both a drastic contraction in the economic expansion of the advanced economies and a fall in the volume of world trade, it would have been extremely difficult for Brazil to have significantly increased the rate of growth of the volume of exports, even if domestic absorption in Brazil was also to fall sharply. As demand in the advanced economies was declining competition for external markets must have been substantially intensified.

It should also be stressed that a fall in domestic absorption in Brazil's manufacturing industry at that time would have, by and large, freed the consumer durable goods sector which, despite the usual shape of the transformation curves in theoretical models, could hardly be expected to stop production of radios, Tv. sets, cars and refrigerators and start producing oil, steel, aluminium, fertilizers or ships. It would be also difficult, despite the usual shape of the availability envelope curves (i.e. the transformation curve which includes trade possibilities) to believe that those goods could have been shifted away from the domestic market and rapidly find the markets abroad at a time when most countries were already experiencing large current account deficits due to oil imports.

Therefore, given the deterioration of the terms of trade of Brazil due to the direct and indirect effects of the oil shock, it was reasonable to expect a sizeable current account deficit in 1974 unless there was a drastic fall in economic growth.

(2) The II NDP Strategy

(2.1) Economic Growth, Accumulation, Domestic and Foreign Savings

Central to the II NDP strategy was the decision to maintain a rapid expansion of the gross domestic product, projected to grow at 10 percent per year between 1974 and 1979. Nevertheless, the II NDP recognised the difficulties, under the circumstances, in sustaining such a high rate of economic growth:

"The government is aware of the difficulty of maintaining rates of growth of the order of 10 percent from 1975 onwards, mainly in view of the fact that the industrial sector has reached full utilization of capacity and due to the problems related to the energy crisis, the shortage of raw materials and their effects on the balance of payments.

Consequently, it will be necessary to keep a flexible attitude, assessing year by year the results achieved in order to make the proper adjustments. Nevertheless, the option of sustaining a high rate of growth was taken as a basic policy, since for a country which is still building up its entrepreneurship and industrial structure, a set back could mean a violent shock for its managerial organization and for the viability of its national development⁽¹⁾.

In order to sustain such a high rate of economic growth, while maintaining external equilibrium, the II NDP emphasised the need to change the structure of the economy.

"It is undeniable that from now on to grow at 10 percent with the same supply and demand structure of the previous phase would be difficult and not very rational. The reasons

are mainly that the industrial sector is already working at full capacity, with some branches showing signs of overheating, and that we are now facing a new world economic situation⁽²⁾.

Soon after its publication the II NDP strategy was criticized by Abreu and Malan⁽³⁾. They correctly pointed out that it was unrealistic to project into the future, rather mechanically, the excellent growth performance of the previous years, since that was a gross underestimation of the frictions which were bound to take place in the process of adjusting the economy to both the new and more difficult internal and external conditions⁽⁴⁾. They dismissed the possibility of any beneficial effect through the impact of such an optimistic prospect on the expectations of the private sector, arguing that the non-fulfillment of these expectations would shake the government's credibility and lead to a situation which would be worse than that which would occur in the absence of optimistic illusions about the future⁽⁵⁾. They also argued that unlike the 1930s the worsening of the world economic conditions would not have beneficial effect on the Brazilian economy.

"Prior to the 1929/30 crisis, as opposed to the situation in 1973/74, the Brazilian economy was stagnant and with considerable idle capacity in the industrial sector, and it was that which permitted the resumption of economic growth despite the difficulties related to the importation of capital goods. Furthermore, the present import substitution strategy requires inputs, particularly technology and skilled labour, whose internal supply is inelastic in the short and medium term⁽⁶⁾.

It should be stressed that the criticisms of Abreu and Malan focussed

on the inconsistency between the very high growth rate target and what they rightly saw as the necessary adjustment in the supply and demand structures of the economy⁽⁷⁾.

In order to achieve a 10 percent annual growth rate in the 1974/79 period, the II NDP estimated that the gross fixed capital formation would also grow at 10 percent per year, thus remaining constant at roughly 25 percent of total GDP.

Table (2.1.1) shows the break down of planned growth rates by sectors. Note that, according to the II NDP, economic growth would continue to be led by the industrial sector and, in particular, by manufacturing industry and that the rates of growth in these sectors would be only slightly below those achieved in the 1970/1974 period, which had benefited from both the favourable international conditions and the rise in the utilization of capacity. Growth in agriculture was projected to be slightly faster, while in the service sector it was to be slightly slower than it had been in the previous five years.

It can also be observed that the rates of growth actually achieved in the 1974/79 period were well below the target rates. Nonetheless, it should be emphasised that the actual rates of growth remained close to their historical average rates for Brazil since World War II and were considerably higher than the rates of economic expansion in the world economy in this period⁽⁸⁾.

It must also be stressed that the share of the gross fixed capital formation in GDP was well over the II NDP target - see last row in table (2.1.1). This is a clear evidence of the tremendous investment effort made in this period. Moreover, the rate of domestic savings rose from 22.8 percent in 1965/66 to 23.4 percent in 1967/73 and to 25.3 percent in the 1974/79 period⁽⁹⁾. This is in sharp contrast with the views expressed by Campos (quoted earlier in this paper) and by Furtado⁽¹⁰⁾.

Table (2.1.1): II NDP Projections and Actual Results for the Rates of Growth by Sectors and Investment Share in total GDP (in percentage)

	/ 1970/74 /		1974/79 /	
	Actual Figures	II NDP Projections	Actual Figures	
-Annual(Compound) Rates of Growth				
GDP	11.6	10.0	6.4	
Industrial Output	12.6	12.0	7.1	
Manufac. Industry	12.7	12.2	6.7	
Agriculture	6.7	6.9	4.3	
Services	12.0 ⁽¹⁾	9.0/10.0	6.3 ⁽¹⁾	
-Share of the Gross Fixed Capital Formation in GDP (at 1975 prices)	25.3 ⁽²⁾	25.0	27.9	

NOTES : (1) Computed as the rate of growth of the difference between total output and output of the industrial and agricultural sectors;

(2) Excluding 1974.

SOURCES : II NDP and Contas Nacionais do Brasil, IBRE/FGV, 1984.

(2.2) Allocation of Investment Resources

The II NDP investment strategy may be said to have been based on three major priority areas: (i) import substitution in the capital goods industry and in the basic input sector; (ii) import substitution in energy; and (iii) infra-structure development in transportation, communications and other sectors. A cursory examination of table (2.2.1) can provide some idea about the planned investment effort in these areas.

The share of investment in the basic industries (which comprise both the capital goods industries and the basic input industries) would be, according to the II NDP, significantly increased compared to its average in 1970/74⁽¹⁾, with large rises in the metal working industry and chemicals. The planned rise in the share of investment in these industries is even more impressive when it is realized that there had already been a tremendous increase in this share between 1970 and 1974, particularly in the metal working industry, mechanical engineering, electricals and chemicals.

The share of investment in both oil and electricity were literally expected to double. As far as investment in transportation is concerned, there was to be a reallocation of investment resources from highways to railways and shipping⁽²⁾. The share of investment in communications would also rise significantly.

Therefore, underlying this strategy there were two major aims: (i) to increase the capacity of production of tradeables (with emphasis on both intermediate goods, including energy resources⁽³⁾, and capital goods); and (ii) to change the demand structure of the economy towards higher consumption of electricity. This would be done through the reallocation of resources towards industries which were intensive in consumption of electricity (such as the metal working, paper and cellulose industries) and

Table (2.2.1) : Investments by Sectors as a Percentage of the Gross Fixed Capital Formation (in %)

Year	1970	1971	1972	1973	1974	1970/1974 (1)	1975/1979 II NDP (1)	1975	1976	1977	1978	1979	1975/1979 (1)
-Industry	13.9	...	19.6	20.6	18.8	18.6	PROJECTIONS	15.2	19.7	19.1	17.5	17.4	17.8
Basic Industries	7.4	...	11.8	11.4	10.4	10.5	22.8	8.8	11.8	11.7	10.8	10.0	10.7
Steel & Metallurgy	1.4	...	2.4	2.4	2.9	2.4	6.8	2.9	2.4	3.2	2.9	2.2	2.7
Transport Equipment	1.3	...	2.4	2.4	2.0	1.8	2.3	0.8	3.2	1.2	0.9	1.2	1.5
Mech. Eng. & Electricals	1.4	...	1.5	2.4	2.4	2.0	2.7	2.1	2.5	2.9	2.8	2.1	2.5
Chemicals	1.4	...	3.5	2.3	2.1	2.4	4.5	1.6	1.6	3.0	2.6	2.3	2.2
NonMet. Min. Paper & Cel.	1.9	...	2.0	2.3	1.6	2.0	2.0	1.4	2.1	1.4	1.6	2.2	1.8
Others	6.5	...	7.8	9.2	8.4	8.1	3.5	6.4	7.9	7.4	6.7	7.4	7.2
-Energy													
Oil (2)	1.3	0.9	1.0	1.0	1.1	1.1	2.0	1.2	1.4	1.6	1.9	2.3	1.7
Coal & Gas	...	...	...	...	...	...	2.4	...	...	...	...	...	...
Electricity (3)	8.0	7.6	7.8	7.1	6.6	7.3	15.0	7.1	7.7	8.6	9.3	9.2	8.4
-Transportation													
Railways	1.6	1.9	2.2	2.4	1.9	2.0	2.1	2.8	3.0	2.4	1.9	1.6	2.3
Shipping	0.8	1.2	1.3	1.1	0.9	1.1	1.7	1.4	1.2	1.5	1.2	1.2	1.3
Highways (4)	6.4	6.7	5.8	6.1	6.1	6.2	2.5	3.7	3.8	3.7	3.9	3.0	3.6
Ports (incl. Waterways)	0.5	0.7	0.9	0.8	0.7	0.7	0.7	0.4	0.3	0.4	0.4	0.4	0.4
Airports	0.2	0.4	0.8	0.6	0.8	0.6	0.6	0.7	0.5	0.3	0.2	0.2	0.4
Others (incl. Urban Tran.) (5)	0.6	0.9	1.0	1.1	1.2	1.0	2.6	1.6	1.5	1.3	1.6	1.0	1.4
-Communications (6)	...	1.9	2.6	4.4	3.1	3.1	3.8	3.5	4.2	3.8	3.1	2.8	3.5

NOTES : (1) Based on 1975 prices; (2) Excluding investments made under 'contracts of risk' which amounted to US\$ 132 millions between 1976 and 1979; (3) Including investments by Nuclebrás; (4) Investment in infra-structure only, by the federal, state and municipal governments;

(5) Including investments in underground systems (São Paulo and Rio), in pipelines and in urban transport by the state and municipal governments; (6) Including investments by ECT and Telebrás.

SOURCES : Contas Nacionais do Brasil - IBRE/FGV, 1984; II NDP; Industrial Census, 1970 and 1975; Industrial Surveys - FIBGE, 1972 to 1979; Anuário Estatístico dos Transportes; Estatísticas Econômicas do Governo Estadual e Municipal - FIBGE; Empresas Telefônicas - FIBGE; Annual Reports of Petrobrás, Eletrobrás, Nuclebrás, RFFSA, FEPASA, CVRD, SUNAM, TAM, DNER, Metro SP, Metro RJ, ECT and Telebrás.

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through a programme of electrification of the existing railways, the use of electricity in the new railway and underground projects and the electrification of the rural areas⁽⁴⁾. In fact, the importance of hydroelectricity as a substitute for imported sources of energy permits us to treat electricity as a tradeable good in the Brazilian context.

Now, when we look at the actual results achieved in 1975/79 in table (2.2.1), it is clear that they tended to be below the II NDP projections⁽⁵⁾, except in railways and highways. However, it should be noted that in all sectors in which the share of investment was expected to increase, and therefore should be considered the II NDP priorities, did so, except in the transport equipment industry and in chemicals, though even in these industries the shares of investment were kept above the levels observed in 1970⁽⁶⁾.

Therefore, it could be said that not only the overall rate of accumulation was higher than expected but that the desired direction of the reallocation of resources was, by and large, successfully achieved.

(2.3) The Balance of Payments

On the external front, exports of goods (in nominal US dollars) were estimated to rise from US\$ 8 billion (10⁹) in 1974 to US\$ 20 billion in 1979, thus increasing at 20% per year⁽¹⁾, while imports of goods would rise at a rate "slightly less than that"⁽²⁾ in the same period.

Given that a large current account deficit in 1974 was already predictable at the time the II NDP was worked out, the implication of the projected rates of growth of exports and imports was an accumulated current account deficit of over US\$ 30 billion in the period between 1974 and 1979⁽³⁾. However, as Abreu and Malan pointed out, the II NDP did not give any hint as to how such large current account deficits would be financed via

the capital account, nor how the planned investment programme would be affected if the necessary inflow of foreign savings could not be made available⁽⁴⁾.

In point of fact, the II NDP showed some signs of optimism with regard to the position of Brazil as compared to other countries and to the prospects of the world economy following the rise in oil prices⁽⁵⁾.

The policy of raising the oil price was considered to be constrained by the long-run self-interest of the oil exporting countries.

"It would be against their interest to maintain the international financial system in crisis or to shake permanently the advanced economies or to frustrate the underdeveloped countries, which make up the majority of the international community, since they (the oil exporting countries) would also have to bear the consequences⁽⁶⁾."

The II NDP stressed the necessity of access by the oil importing developing countries to the financial centres of Europe and the United States in order to finance those countries commercial deficits⁽⁷⁾.

Finally, the II NDP stated some guidelines for the current account deficits and foreign indebtedness⁽⁸⁾:

(i) the former would be limited to a maximum of 20% of the gross capital formation⁽⁹⁾;

(ii) the latter would be conducted so as to maintain an "adequate ratio between the net foreign debt and exports and a prudent debt profile"⁽¹⁰⁾;

(iii) international reserves would be kept at high levels so as to preserve the country creditworthiness and to protect the balance of payments against unforeseen accidents in the behaviour of world trade or international financial markets⁽¹¹⁾.

(2.4) The Institutional Instruments of the Strategy

The II NDP stressed its commitment to what it called "a modern model of market economy" in which "the strategy of development is actively conducted by the government"⁽¹⁾. In fact, the II NDP pledged to be aiming at "an equilibrium" between the participation of the state and of the private sector in the economy and between national and foreign enterprises within the private sector⁽²⁾.

However, despite the political lobbies against the state intervention in the economy, the II NDP made clear the areas in which responsibility would fall with the government.

"In addition to being responsible for the strategy and public functions such as security, justice, etc., the government considers the following its own areas of action: (i) Infra-structure sectors such as energy, transportation and communications. The production of equipment and materials for these sectors is, nonetheless, the responsibility of the private sector; (ii) The areas of social development (often in conjunction with the private sector) such as education, health and social services (housing is a special case since contracting is the private sector's responsibility)⁽³⁾."

Bearing in mind the importance of the projected share of the investments in infra-structure in the total gross fixed capital formation and the very relevant part which the government was expected to play as a direct producer, especially in mining and in the steel industry, and in the financing of enterprises in the capital goods sector and in the basic input industries⁽⁴⁾, it seems clear that, the authorities rhetoric notwithstanding, no reduction in the state intervention was envisaged by the II NDP.

The notion of 'equilibrium' would seem to imply the strengthening of the participation of the national entrepreneurship in the economy, since that was regarded as the weakest group. For this objective the government would act through its official financial institutions in order to promote and finance: (i) projects of large national private corporations; (ii) the participation of national groups in large enterprises, especially in basic sectors and in high-tech industries, including the formation of joint ventures; (iii) merging of national enterprises in sectors where their atomization reduces their competitiveness as against foreign companies; (iv) formation of national private conglomerates merging financial, industrial and services activities; and (v) acquisition of technology and management capacity⁽⁵⁾.

As to the foreign enterprises the II NDP had the following to say:

"Foreign enterprises in Brazil are now expected to perform the following functions: (i) to develop new export markets mainly in non-traditional manufactures; (ii) to contribute to the development of technological research in Brazil, with their own research funds, and to contract engineering from enterprises installed in the country; and (iii) to refrain from practices of control of the market and from the absorption of competitors⁽⁶⁾.

The II NDP strategy also aimed at diversifying the origin of foreign investments in Brazil so as to avoid concentration of investments from one particular country or area. All these objectives would be pursued through the use of economic instruments - incentives and disincentives, financial and fiscal - with no use of restrictive legislation and the stability of the rules would be maintained⁽⁷⁾.

As regards the results actually achieved the existing evidence⁽⁸⁾ suggests that indeed the share of government investment (including those of

state-owned enterprises) in the total gross fixed capital formation tended to increase in the 1974/79 period. As to the participation of the national private entrepreneurship in the economy, to the best of my knowledge, no clear-cut evidence has yet been produced.

The institutional instruments of the II NDP strategy came under attack in Lessa's ex-post analysis of the 1974/1976 period⁽⁹⁾. Lessa's main critical point seems to have been the supposed "failure of the authoritarian regime to alter the pattern of industrialization in Brazil"⁽¹⁰⁾ which was one of the main goals of the II NDP. He argued that the state-owned enterprises, chosen to be the central agents of the II NDP, could not "for structural reasons, in the downturn of an economic cycle, carry out the strategy"⁽¹¹⁾.

Delays in some investment projects, the government incapacity to sustain the projected high levels of aggregate demand and the political friction between the state and some Brazilian entrepreneurs (particularly from the capital goods sector) were pointed out by Lessa as evidence of the 'collapse' of the II NDP strategy⁽¹²⁾.

Lessa's central criticism is rather misleading. It is undeniable that the military regime was authoritarian. It is beyond any doubt that a major change in the structure of the economy (or in the pattern of industrialization) would inevitably generate political friction among the different interests from different sectors of the economy, especially at a time when economic growth was slowing down. However, there seems to be no reasoning behind the idea that the state-owned enterprises, because of their own nature, could not carry out the strategy. In fact, given the circumstances, they were quite successful in sustaining what, by all standards, should be considered very high rates of economic growth (probably even too high rates), as well as in making fundamental changes in the structure of the economy, as will be demonstrated in this paper.

(3) The Capital Goods Sector and The Basic Input Industries

As the projected allocation of investment resources has shown, the II NDP strategy made clear its two main priority areas: the energy sector and the basic sector, comprising the capital goods sector and the basic input industries⁽¹⁾.

The adjustment in the economic structure of Brazil which is necessary in view of the oil crisis and the new stage of its industrial development implies in great emphasis to the Basic Industries, especially the capital goods sector and heavy electronics as well as the Basic Input Industries, in order to substitute imports and, if possible, open up new exports⁽²⁾.

In the next section the energy sector will be examined. The next two subsections deal with the impact of the investment projects on the structures of production and demand of the capital goods sector and the basic input industries.

(3.1) The Capital Goods Sector

Table (3.1.1) gives the targets which were set for this sector by the II NDP. Table (3.1.2) brings out the actual results for the domestic production of capital goods in the transport equipment industry. It can be observed that the production of ships in 1979 surpassed its target. The production of all other transport equipment underwent a tremendous expansion until about 1976/77, suggesting that their capacities of production were likely to have reached levels very close to their targets. Output, however, has tended to decline since then as a result of a fall in demand.

Table (3.1.1): II NDP Projections for the Capital Goods Industry

Growth-Rate	Planned Output		Annual
	1974	1979	(in percentage)
-Total Output(10 ³ tonnes)	2000	3400	11.2
Mech.Eng.&Elec.Equip.(10 ³ tonnes)	898	1603	12.3
Tractors (1000 unities)	44	84	13.8
Shipbuilding (1000 DWT)	410	1140	22.7
Railway Equipment (10 ³ tonnes)	122	214	11.9

SOURCE: II NDP.

Table (3.1.2) Capital Goods - Domestic Production of Transport Equipments

Year	Ships	Locomo-	Train	Aiplanes	Tractors	Lorries	Buses
	(10 ³ DWT)	tives (unity)	Coaches (unity)	(unity)	(unity)	(unity)	(unity)
1970	120.6	11	1808	52	16707	38388	4058
1971	188.3	60	1935	61	25448	38868	4393
1972	313.6	36	1496	67	34549	53557	5230
1973	260.5	56	3406	111	44211	69202	6362
1974	320.4	77	3576	105	52741	79413	8262
1975	466.2	107	5025	279	65666	78688	10126
1976	700.5	106	4479	515	71713	83891	12059
1977	511.6	110	2538	550	59419	101338	13828
1978	601.0	42	3053	221	55874	86269	14340
1979	1401.5	47	2513	279	64511	93051	12832

SOURCES: Conjuntura Económica, FIBGE, Anuário Estatístico dos Transportes and Estudos Especiais Nº 1 IBRE-FGV, 1979.

The import substitution and export promotion efforts in these industries can be seen in table (3.1.3). Note that a very sharp rise in the export coefficient of each of these industries can be observed. The aggregated import coefficient for these industries shows a clear downward trend in this period, except for 1978, due exclusively to a big increase in imports of ships. In fact, the railway equipment industry and the shipbuilding industry do not show a clear trend as regards their import coefficients.

When the capital goods sector is broken down into machines 'made on order' and those 'made in series' (1) in table (3.1.4), again it can be observed a steep rise in the export coefficients. The sharp fall in the import coefficient of capital goods 'made on order' in the 1969/73 and 1976/79 periods, and the fact that this coefficient remained roughly constant between 1973 and 1976, despite the extremely high rates of accumulation in this period, reveal a marked import substitution process in this sector throughout the 1970's. Import substitution in capital goods produced 'in series' is not so evident.

The series of domestic output, imports and exports for the capital goods sector as a whole in table (3.1.5) also reveal a rising export coefficient. The import coefficient rises in 1975 but falls sharply in 1976/77, staying then well below the levels of the early 1970's.

Therefore, the above statistics consistently demonstrate that the capital goods sector in Brazil has undergone a very significant import substitution process and a dramatic increase of its exports.

(3.2) The Basic Input Industries

The effects of the investments on the expansion of the basic input industries can be examined in table (3.2.1). Note that, as far as the steel

Table (3.1.3) : Import and Export Coefficients for The Capital Goods Industry - Transport Equipment and Capital Goods for Agriculture (in percentage)

Year	Railway Equipment		Aerospace Industry		Shipbuilding		Lorries & Buses		Capital Goods for Agriculture		Total	
	Import Coeff.	Export Coeff.	Import Coeff.	Export Coeff.	Import Coeff.	Export Coeff.	Import Coeff.	Export Coeff.	Import Coeff.	Export Coeff.	Import Coeff.	Export Coeff.
1974	24.9	1.7	83.1	8.6	3.9	0.7	2.0	6.0	8.8	2.3	15.8	3.7
1975	12.9	1.6	67.5	10.0	15.9	0.7	1.8	8.9	7.5	1.9	12.3	4.1
1976	28.5	1.9	49.6	14.3	9.4	4.8	2.2	6.6	4.0	1.3	8.9	4.2
1977	35.1	3.8	46.5	18.6	11.0	4.3	0.8	7.0	3.6	4.3	8.4	5.6
1978	25.8	8.8	24.0	12.6	23.4	10.7	0.7	8.9	3.3	5.5	10.2	8.8
1979	23.9	7.5	41.6	45.5	10.5	14.2	0.4	14.4	3.3	6.5	6.7	12.5

NOTES: (1) Coefficients based on values at current prices; (2) Import coefficient = imports + (domestic production + imports - exports)
 (3) Export coefficient = exports + domestic production; (4) Imports were in Cr\$ CIF and exports in Cr\$ FOB except capital goods for agriculture whose values were in US\$ FOB and the annual average exchange rate was used;

SOURCES : Industrial Census of 1975, Industrial Surveys - FIBGE, from 1974 to 1979, CIEF and CACEX.

Table (3.1.4) : Import and Export Coefficients of Capital Goods Made 'on Order' and 'in Series' (In percentage)

Year	Capital Goods Import Coefficient	'on order' Export Coefficient	Capital Goods Import Coefficient	'in series' Export Coefficient	Capital Goods Import Coefficient	Total Export Coefficient
1969	55.7	3.1	...	...	...	...
1970	53.1	4.3	...	...	...	...
1971	48.1	4.6	24.7	4.3	31.4	4.3
1972	50.8	5.3	...	...	...	...
1973	40.1	2.3	...	...	...	...
1974	39.8	3.0	...	...	...	...
1975	40.2	3.2	27.0	7.0	29.1	6.4
1976	40.3	5.1	27.9	8.8	30.4	7.9
1977	32.3	4.6	22.8	7.8	26.4	7.4
1978	37.9	8.9	21.4	12.4	24.2	10.7
1979	29.1	10.7	20.5	14.3	25.1	13.1
1980	37.1	15.9	24.8	18.7	26.1	16.6
			24.9	23.1	28.2	21.5

SOURCES: Política Industrial e Exportação de Manufaturados do Brasil, FGV/Banco Mundial, 1983 (Tables 11.15 and 11.20) and CACEX.

Table (3.1.5): Rates of Growth of Output, Exports and Import and Export Coefficients of the Capital Goods Industry (in percentages) (based on quantity indexes - base year = 1970)

Year	Real Rates of Growth Domestic Output	Exports	Import Coefficient	Export Coefficient
1970	...	...	...	...
1971	12.7	9.1	24.1	3.0
1972	20.9	42.0	27.9	2.9
1973	35.6	20.0	29.4	3.4
1974	15.7	104.5	25.0	3.0
1975	5.1	24.7	28.8	5.3
1976	14.9	0.4	32.1	6.3
1977	-4.5	40.8	23.4	5.5
1978	5.9	28.0	19.7	8.1
1979	5.7	31.6	21.0	9.7
1980	6.6	28.6	19.0	12.1
1981	-18.7	11.4	19.9	14.6
1982	-10.9	-27.2	22.0	20.1
1983	-20.2	-7.6	19.2	16.4
			17.3	19.0

NOTES: (1) Domestic Output in 1970 as in Serra (1981) or Malan and Bonelli (1976);
 (2) Exports and imports in 1970 calculated from values in US\$ FOB by using the average exchange rate (sale price for imports and purchase price for exports)

SOURCES: Conjuntura Econômica, Bonelli and Werneck (1978), Serra (1981), Annual Report of the Central Bank and FIBGE.

industry is concerned, although the actual rates of growth of output were not as high as planned, they were still very high and higher than the rates observed in the 1970/74 period⁽¹⁾. Actual domestic output of both aluminium and zinc in 1979 outmatched the capacities of production projected for that year⁽²⁾. Production of copper (primary metal only), on the other hand, did not start until 1982 but output in 1983 was 63 thousand tonnes, thus greater than the capacity of production projected in the II NDP for 1979.

For all the other products, but sulphuric acid, synthetic elastomers and ammonia, the actual growth-rates of output were higher than those projected by the II NDP for the capacity of production. In point of fact, synthetic elastomers are not included simply because the capacity of production in 1974 was underestimated (below actual output), but the target for 1979 was certainly achieved since output was only 6% below the capacity planned for that year. It should also be noted that both for fertilizers and paper actual output in 1979 was higher than the projected capacity of production for that year.

The impact of the rise in the domestic production of steel on the import and export coefficients of this industry is depicted in table (3.2.2). Indeed, this impact is quite phenomenal. The import coefficient of rolled steel, having increased from 14.1% in 1970 to 39.3% in 1974, dropped then continuously to reach 3.5% in 1979 and only 1.0% in 1983. The figures for flat rolled products were 15.5% in 1970, 53.8% in 1974, 7.3% in 1979 and only 0.9% in 1983. Although exports of steel showed a downward trend relatively to the domestic production until 1976/77, from then onwards, exports experienced phenomenal rates of growth and, by the early eighties, they already accounted for a quite substantial share in domestic output.

The import substitution effect and the export drive in ferroalloys and refractories are shown in table (3.2.3). Note that significant falls in the

Table (3.2.1): Basic Input Industries - II NDP Projections and Actual Figures

Year	Actual Output (1000tonnes)		Actual Annual Growth-Rate (%)	II NDP Planned Capacities of Production (1000tonnes)		Planned Annual Growth-Rate (%)	Actual Output (1000tonnes)	Actual Annual Growth-Rate (%)
	1970	1974	1970/1974	1974	1979	1974/1979	1979	1974/1979
-Industries								
.Steel&Metal Working								
steel ingots	5390	7507	8.6	8600	22300	21.0	13891	13.1
flat-rolled steel (1)	1968	2923	10.4	4100	13100	26.2	6853	18.6
non-flat rolled steel (2)	2436	3402	8.7	4600	8300	12.5	5261	9.1
aluminium (3)	56	114	19.4	120	190	9.6	238	15.9
copper (3)	...	3	...	10	60	43.1	0	0.0
zinc (3)	...	31	...	33	58	11.9	63	15.2
.Chemicals								
sulphuric acid	561	925	13.3	986	3388	28.0	1924	15.8
caustic soda	147	214	9.8	273	700	20.7	645	24.7
chlorine	133	140	1.3	212	593	22.8	587	33.2
fertilizers	189	531	29.5	585	1199	15.4	1533	23.6
thermoplastic resins	101	344	35.8	408	891	16.9	851	19.9
artificial&synthetic fibers	44	114	26.9	176	253	7.5	214	13.4
synthetic elastomers	75	155	19.9	144	239	10.7	224	7.6
detergent	...	...	...	27	75	22.7	...	...
ethylene	33	269	69.0	343	718	15.9	631	18.6
ammonia	...	198	...	268	577	16.6	353	12.3
.Non-metallic interm.goods								
cement	9002	14919	13.5	17130	26190	8.9	24871	10.8
cellulose	685	1130	13.3	1547	2860	13.1	2780	19.7
paper	1136	1853	13.0	2267	2900	5.0	2979	10.0

NOTES: (1) Including heavy shapes; (2) Including special steel; (3) Primary metal only.

SOURCES: II NDP, Anuário Estatístico do Brasil - FIBGE, Consider, Abiquim, Superintendência da Borracha, Associação Br. de Prod. de Fibras Artificiais e Sintéticas, Banco do Brasil and Industrial Surveys - FIBGE

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Table (3.2.2): The Steel Industry - rates of growth and import and export coefficients (in percentages)

Year	Flat Rolled Steel				Non-Flat Rolled Steel				Total Rolled Steel			
	Rate of Domestic Output	Growth Exports	Import Coefficient	Export Coefficient	Rate of Domestic Output	Growth Exports	Import Coefficient	Export Coefficient	Rate of Domestic Output	Growth Exports	Import Coefficient	Export Coefficient
1970	...	...	15.5	8.4	...	...	12.8	18.4	...	...	14.1	13.9
1971	18.3	-56.3	20.6	3.1	8.8	-75.9	11.5	4.1	13.1	-70.6	16.0	3.6
1972	14.8	247.8	17.9	9.4	9.9	70.6	17.5	6.3	12.2	142.1	17.7	7.8
1973	7.4	-50.4	30.6	4.3	17.6	-35.6	13.6	3.4	12.7	-44.2	22.3	3.9
1974	-4.8	-73.9	53.5	1.2	8.3	-6.3	20.6	3.0	2.3	-41.1	39.1	2.2
1975	17.6	38.7	33.9	1.4	4.2	-55.2	13.8	1.3	9.9	-33.8	24.2	1.3
1976	10.5	-14.0	17.7	1.1	9.1	119.1	8.0	2.6	9.7	55.6	12.7	1.9
1977	32.5	-59.5	11.9	0.3	1.2	101.0	4.8	5.1	15.6	58.6	8.7	2.6
1978	15.1	893.3	6.7	2.9	16.4	84.5	4.5	8.1	15.1	139.2	5.7	5.4
1979	16.8	198.7	4.4	7.4	9.9	10.5	2.2	8.1	14.1	63.3	3.4	7.7
1980	14.6	67.2	4.4	10.8	3.8	-37.9	3.0	4.9	9.6	16.0	3.8	8.2
1981	-17.7	4.0	7.6	13.6	-5.4	176.7	3.4	14.2	-12.4	49.0	6.0	13.9
1982	8.3	81.7	3.0	22.8	-6.4	-4.0	1.8	14.6	1.3	40.2	2.4	19.2
1983	16.5	114.1	0.9	41.5	0.5	114.4	1.2	28.5	6.7	114.2	1.0	37.8

NOTE: Based on volumes in tonnes

SOURCE: Anuário Estatístico do Brasil - FIBGE, several issues, and Consider.

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Table (3.2.3) : Ferroalloys and Refractories (in percentages)

Year	Ferroalloys			Refractories		
	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.
1970	...	6.2	17.7	...	...	...
1971	37.1	18.9	20.0	...	...	...
1972	10.7	8.8	31.2	...	...	...
1973	22.7	5.1	26.0	...	...	...
1974	27.8	7.5	20.1	...	...	...
1975	17.3	2.9	23.7	...	25.3	8.4
1976	19.9	0.9	28.3	11.8	9.3	7.4
1977	19.5	6.1	31.0	4.7	7.5	5.9
1978	10.2	1.2	36.5	-8.1	6.1	9.5
1979	18.6	0.3	34.1	6.2	4.8	10.1
1980	12.7	0.6	30.4	15.8	8.3	19.1
1981	2.5	2.0	45.6	24.1	7.8	12.9
1982	0.0	0.4	40.7	-23.6	14.9	17.6
1983	3.6	0.2	60.4	-23.6	10.1	22.3
				-7.1	5.1	17.1

NOTE : Based on volumes in tonnes

SOURCE : CONSIDER - MIC

Table (3.2.4) : Non-Ferrous Metals (in percentages)

Year	Aluminium			Copper			Zinc		
	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.
1974	...	50.4	1.6	...	...	...	...	...	...
1975	14.8	40.1	1.3	-37.7	72.2	2.5	...	64.2	0.0
1976	15.9	36.0	1.1	17.9	80.1	2.8	10.6	56.3	0.2
1977	20.9	36.9	1.5	17.0	79.8	1.4	33.7	50.7	0.1
1978	7.3	26.3	2.0	-2.1	80.8	3.9	5.7	51.3	0.2
1979	33.7	23.0	3.4	18.0	80.0	11.8	22.6	49.7	0.1
1980	6.9	18.8	4.0	18.6	80.6	13.0	15.4	43.3	0.2
1981	-5.9	12.0	8.2	-28.6	78.3	7.1	21.8	40.1	0.3
1982	18.1	4.4	6.4	37.4	79.2	27.2	15.4	21.7	10.6
1983	28.5	2.3	40.0	66.6	80.2	17.5	-0.4	6.5	2.3
					40.4	15.9	0.5	3.3	1.9

Year	Silicon			Tin		
	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.	Rate of Growth of Domestic Output	Import Coeff.	Export Coeff.
1974	...	94.2	46.1	...	...	...
1975	72.7	81.2	35.6	...	0.3	42.2
1976	653.8	9.1	50.1	2.7	1.2	53.7
1977	-7.4	0.6	25.8	-1.5	0.8	28.9
1978	17.9	0.5	31.9	19.7	0.2	33.9
1979	-2.3	0.2	26.7	21.1	0.4	46.5
1980	101.7	0.3	52.0	8.9	0.3	46.7
1981	42.5	0.0	71.2	-13.2	0.7	43.4
1982	-5.5	1.8	66.0	-11.4	0.4	63.4
1983	15.0	0.0	70.3	19.4	0.3	47.5
				37.0	0.2	68.5

NOTES : Including primary and secondary metal but excluding scrap imports for secondary production

SOURCE : CONSIDER - MIC

import coefficients can be observed after 1974, while the export coefficients reveal a quite clear and steep upward trend.

As far as the main non-ferrous metals are concerned, Table (3.2.4) provides a clear picture. Dramatic import substitution effects occurred in the aluminium, zinc and silicon industries. In all these three industries, Brazil was highly dependent upon imports in 1974. Since the early 1980's in the case of aluminium and zinc, and since 1977, in the case of silicon, Brazil has practically become self-sufficient in these metals and has managed to place substantial shares of its domestic production in the markets abroad, particularly in the case of aluminium and silicon⁽³⁾. The copper import coefficient remained roughly constant at around 80% until 1982. The start of production of primary copper by Caraíba Metais in 1983 brought this coefficient down to 40%. Exports of tin fell in 1976/77 relatively to domestic production, but showed a pronounced recovery thereafter. Imports of tin remained negligible throughout the 1974/83 period.

Table (3.2.5) brings out the fact that Brazil has moved from a position of being highly dependent on imports of caustic soda in the 1970/1974 period to a position of self-sufficiency in the early 1980's. This table also shows the drastic reductions in the import coefficients of fertilizers based on nitrogen and phosphate.

The picture that emerges from table (3.2.6), which examines the performance of petrochemicals, is also one in which the ratio of imports to consumption falls drastically (imports of basic products, intermediate products, thermoplastics resins and synthetic fibers have all become negligible in the early 1980's) and the shares of exports in the domestic production rises significantly, especially after 1977/78.

Import substitution has also been very important in the paper and cellulose industries as can be observed in table (3.2.7). In point of fact,

Table (3.2.5) : Caustic Soda and Fertilizers (In percentages)

Year	/___Caustic Soda___/			/___Fertilizers (2)___/		
	/___Nitrogen Base___/			/___Phosphate Base___/		
	Rate of Growth of Domestic Output	Import Coeff.	Rate of Growth of Domestic Output	Import Coeff.	Rate of Growth of Domestic Output	Import Coeff.
1970	...	52.7	...	92.8	...	59.4
1971	5.4	52.6	245.0	75.2	43.8	54.7
1972	27.1	46.9	27.5	78.6	19.3	66.9
1973	14.2	46.7	29.5	67.1	14.8	58.6
1974	-4.9	53.1	26.3	63.1	16.2	57.7
1975	12.6	43.0	11.8	60.3	32.8	49.3
1976	7.5	42.1	24.2	58.4	70.2	31.9
1977	35.5	32.4	15.5	66.3	24.8	30.4
1978	64.4	6.5	14.7	62.3	3.8	26.0
1979	11.8	2.9	6.8	63.7	10.3	25.8
1980	7.1	1.7	35.3	57.7	26.4	20.8
1981	9.8	1.8	-8.9	47.8	-27.2	12.8
1982	0.1	0.1	13.8	38.4	-4.8	8.6

NOTES : (1) Based on volumes in tonnes; (2) Based on volumes in tonnes of nutrients

SOURCE : Anuário Estatístico do Brasil - FIBGE, several years.

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Table (3.2.6) : Petrochemicals (in percentages)

Year	/___Basic Products___/ (1)			/Intermediate Products/ (2)			/Thermoplastic Resins/ (3)			/___Synthetic Fibers___/			/___Synthetic Elastomers___/		
	Rate of growth domestic output	Import coeff.	Export coeff.	Rate of growth domestic output	Import coeff.	Export coeff.	Rate of growth domestic output	Import coeff.	Export coeff.	Rate of growth domestic output	Import coeff.	Export coeff.	Rate of growth domestic output	Import coeff.	Export coeff.
1970	...	31.0	0.0	...	40.0	0.2	...	47.0	0.0	...	22.4	0.0	...	17.9	5.0
1971	-9.9	42.0	0.0	25.8	37.0	0.2	27.2	52.0	0.0	19.0	15.4	1.0	3.6	26.1	0.0
1972	23.8	49.0	0.0	29.8	43.0	0.3	26.7	47.0	1.0	45.6	12.4	0.0	21.0	23.4	0.5
1973	252.0	22.0	0.0	34.6	44.0	0.2	100.7	21.0	2.0	23.8	24.9	0.4	32.8	29.1	0.7
1974	43.2	14.0	0.0	18.2	41.0	1.9	5.3	35.0	2.0	21.9	21.6	1.3	23.5	20.7	0.7
1975	4.4	7.0	0.0	3.4	41.0	0.6	9.5	18.0	2.0	9.9	9.3	1.7	-17.0	17.5	1.6
1976	25.6	12.0	0.0	11.9	49.0	0.1	24.5	29.0	1.0	23.5	6.1	0.6	27.6	12.2	0.6
1977	14.7	10.0	0.0	27.2	35.0	0.0	6.6	22.0	1.0	3.2	5.9	0.6	14.5	11.9	0.2
1978	7.0	11.0	0.0	47.3	22.0	4.9	12.9	22.0	2.0	12.5	10.2	2.2	9.5	13.7	3.3
1979	48.6	7.0	0.4	31.6	18.0	3.6	50.7	14.0	2.0	18.9	5.1	5.0	8.6	14.0	6.1
1980	12.7	6.0	1.4	27.9	14.0	4.2	20.1	6.0	4.0	7.9	6.0	4.8	11.3	16.3	5.4
1981	6.8	0.4	8.3	-8.6	6.0	14.6	-9.3	2.0	17.0	-15.6	5.0	12.3	-10.5	11.3	12.7
1982	5.2	0.5	2.8	25.4	6.0	7.3	12.6	2.0	15.0	29.4	2.1	6.7	29.3	16.0	16.0
1983	44.9	0.3	12.3	-8.2	2.0	12.2	20.5	1.0	30.0	-26.7	1.1	9.6	-23.3	16.0	18.1

NOTES : (1) Including ethylene, propane, butane, benzene, xylene and toluene

(2) They include sixteen intermediate products

(3) Including polyethylene of high and low density, polystyrene, PVC, and polypropileno.

SOURCES : Abiquim, Associação Brasileira de Produtos de Fibras Artificiais e Sintéticas and Superintendência da Borracha - MIC.

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Table (3.2.7) : Paper and Cellulose (in percentages)

Year	Paper				Cellulose			
	Rate of Growth Domestic Output	Rate of Growth Exports	Import Coefficient	Export Coefficient	Rate of Growth Domestic Output	Rate of Growth Exports	Import Coefficient	Export Coefficient
1970	..	..	14.1	0.2	..	..	4.1	4.1
1971	8.9	72.2	14.8	0.3	8.6	-21.4	8.7	3.0
1972	8.7	222.6	16.5	0.7	24.5	509.1	17.5	14.5
1973	18.1	330.0	18.3	2.7	8.2	41.0	13.0	18.9
1974	16.7	-27.9	20.4	1.7	12.8	-29.6	16.6	11.8
1975	-8.9	-58.1	10.9	0.8	5.3	14.3	8.9	12.8
1976	21.2	153.8	11.5	1.6	5.4	-8.6	5.7	11.1
1977	9.2	27.3	11.3	1.9	19.8	-33.1	4.6	6.2
1978	13.4	142.9	9.8	4.0	20.8	188.2	4.4	14.8
1979	17.5	38.2	10.4	4.7	53.3	117.2	3.4	20.9
1980	12.8	35.5	7.5	5.7	16.0	53.1	2.8	27.6
1981	-7.7	72.8	7.8	10.6	-5.0	7.0	1.0	31.1
1982	7.3	-22.7	7.6	7.7	3.7	-7.9	0.8	27.7

NOTE : Percentages based on volumes in tonnes.

SOURCE : Anuário Estatístico do Brasil - FIBGE, several years.

Brazil has not only achieved self-sufficiency in cellulose, but has also been exporting significant shares of the domestic production of both paper and cellulose, particularly since 1978.

Therefore, as far as the basic industries are concerned, it should be beyond any doubt that a major import substitution process has taken place and that, whilst 'adjustment' policies in the 1980's seem to have been crucial to export success, so were the investments made in the 1974/79 period.

(4) The Infrastructure Sectors

(4.1) The Energy Sector

The composition of consumption of primary energy in Brazil in the 1970's and early 1980's is displayed in table (4.1.1). Note that in 1973 petroleum accounted for 42.8% of the total consumption of primary energy in Brazil. Although this was not a very high share by world standards, domestic production of petroleum in 1973 supplied only 20% of total consumption, making Brazil quite dependent on petroleum imports to satisfy its energy needs. The quadrupling of oil prices in 1973/74 had a dramatic impact on Brazil's current account position as imports of crude oil jumped from 9.8% of total imports of goods (fob) in 1973 to 20.2% of total imports of goods (fob) in 1974.

The II NDP regarded the energy sector as crucial for the success of its strategy:

"It would not be viable to grow rapidly without accelerating the expansion of energy supply. Hence, it is necessary to reduce the dependence of the energy sector on petroleum replacing it by electricity, as far as possible, and for coal which is abundant in the market though partly imported⁽¹⁾.

As it was seen in section (2.2) table (2.2.1) of this paper, the II NDP strategy envisaged a massive programme of investments in oil exploration and production and in electricity generating (basically hydroelectricity), transmission and distribution. The plan also mentioned the development of the shale programme, the production of alcohol to be mixed with gasoline, and an increase in the use of coal in industry.

The substitution of electricity for petroleum would take place through a programme of electrification of the existing railways, the use of

Table (4.1.1) Consumption of Primary Energy in Brazil (in percentages)

Year	Petroleum	Hydroelectricity	Natural Gas	Steam Coal	Metallurgical Coal	Uranium	Firewood	Sugar Cane	Others
1970	37.6	17.3	0.3	0.9	2.6		33.2	8.0	0.1
1973	42.8	19.0	0.3	0.7	2.1		27.0	8.0	0.1
1974	42.2	20.2	0.5	0.7	1.9		26.9	7.5	0.1
1975	43.2	20.6	0.6	0.6	2.2		26.4	6.3	0.1
1976	42.7	22.0	0.6	0.5	2.6		24.9	6.6	0.1
1977	41.1	23.3	0.9	0.6	2.9		23.0	8.1	0.1
1978	42.6	23.7	0.7	0.9	2.7		21.1	8.1	0.2
1979	41.6	25.0	0.7	0.8	2.9		20.4	8.4	0.2
1980	38.9	26.9	0.8	0.9	2.9		20.5	8.9	0.2
1981	37.8	27.3	0.8	1.3	2.6		20.2	9.7	0.3
1982	35.7	28.2	1.0	1.5	2.6	0.8	19.7	10.2	0.3
1983	33.6	28.8	1.3	1.4	2.9		19.3	12.4	0.3

Source: Balanço Energético Nacional

electricity in the new railway and underground projects and the electrification of the rural areas⁽²⁾. The tremendous expansion projected for the intensive electricity consuming industries such as the metal working, chemical, paper and cellulose industries would also tend to raise the share of electricity in total energy consumption⁽³⁾.

The increasing use of hydroelectricity for industrial purposes was also regarded as a major contribution to the import substitution process and, especially, to the export drive of the intensive electricity consuming industries in view of the comparative advantage stemming from the low cost and large potential of hydro-power in Brazil⁽⁴⁾.

Table (4.1.1) reveals that the share of petroleum in total consumption of primary energy remained roughly unchanged until 1978 but has fallen very significantly since then. The share of hydroelectricity has risen steadily from 19.0% in 1973 to 25.0% in 1979 and to 28.8% in 1983. The shares of other indigenous sources of energy such as natural gas, steam coal and sugar cane have also shown a pronounced upward trend. The share of firewood, on the other hand, has fallen quite drastically though consumption in absolute terms has risen steadily since 1970⁽⁵⁾.

In the next subsections the energy sector is examined in more detail, emphasis again is placed on comparing the actual results achieved with the projections made in the II NDP.

(4.1.1) Petroleum

The results of the substantial increase in investment in oil exploration and production after 1973⁽¹⁾ can be examined in table (4.1.1.1). It can be seen that the domestic production of oil remained roughly constant throughout the 1970's. Basically, two major factors account for that: (i) due to the exhaustion of the known oil wells onshore, total reserves of oil in Brazil fell significantly between 1970/71 and 1973/74 and the domestic

Table (4.1.1.1): Oil and Natural Gas - Domestic production and reserves

Year	Domestic Oil Production			Domestic reserves of oil	Domestic production of natural gas	Domestic reserves of natural gas
	Onshore (1)	Offshore	Total			
	in thousands of cubic meters			in millions of cubic meters		
1970	9660	26	9686	136	1264	26200
1971	10118	...	10118	136	1177	26200
1972	9399	551	9950	126	1260	26200
1973	9317	789	10106	123	1180	25900
1974	9587	978	10565	124	1488	26300
1975	8685	1601	10286	125	1625	25900
1976	8690	1315	10005	139	1642	34000
1977	7429	2227	9656	177	1809	39400
1978	7123	2514	9637	181	1933	44400
1979	6627	3301	9928	201	1899	45000
1980	6544	4346	10890	213	2205	52500
1981	6959	5811	12770	237	2474	60200
1982	7342	8189	15531	276	3030	72300

Note: (1) including liquid of natural gas

Sources: FIBGE, Petrobrás Annual Reports, Balanço Energético Nacional and Conjuntura Econômica

Table (4.1.1.2): Structure of Oil Refining and Consumption of Oil Derivatives (in percentages based on tonnes of petroleum equivalent)

Year	Gasoline		Fuel-Oil		Diesel	
	production	consumption	production	consumption	production	consumption
1970	29.5	30.1	33.8	31.0	22.6	22.6
1973	26.4	28.1	33.5	31.0	22.5	22.0
1974	25.6	26.7	32.8	31.3	23.5	22.3
1975	25.5	25.7	32.2	31.4	23.7	23.5
1976	24.0	23.3	32.2	32.6	25.4	24.7
1977	21.4	21.2	32.2	32.7	27.3	26.0
1978	20.8	19.8	31.8	32.6	27.0	26.0
1979	18.9	18.1	30.6	31.7	26.9	26.5
1980	16.0	15.9	30.1	31.5	30.2	29.0
1981	16.9	16.3	28.6	27.1	29.2	30.6
1982	17.3	15.7	25.6	23.8	31.0	31.5
1983	16.0	14.1	23.1	21.9	31.6	32.7

Table (4.1.1.3): Rates of growth of crude oil and oil derivatives consumption in Brazil (Compound annual rates in percentages based on values in cubic meters)

Period	Crude Oil	Gasoline	Fuel-Oil	Diesel
1970/1973	14.7	12.7	15.3	14.2
1973/1976	6.5	2.1	9.3	12.4
1976/1980	3.8	-5.8	2.5	8.0
1980/1983	-2.3	-8.7	-14.8	-0.5

Source: Balanço Energético Nacional - 1984

production of oil onshore dropped continuously until 1980 when it reached a level 32.3% below the 1970 level; (ii) although new discoveries were being made offshore, as the sharp rise in oil reserves after 1975 demonstrate (compared to 1973 reserves doubled before 1982 - see column 5), there is an inevitable lag between discovery and production of oil (particularly in deep offshore wells)⁽²⁾.

Note, however, that the domestic supply of oil doubled between 1979 and 1983 and the daily average production by the end of 1984 was more than three times higher than the 1979 average⁽³⁾. It must be stressed that the investments made in oil exploration in 1974/79 were absolutely essential for the production results achieved in 1979/84.

Domestic production and reserves of natural gas rose much more rapidly in this period. Compared to the 1973 level, production was up 87% by 1980 and was more than four times higher by 1984, while reserves doubled by 1980 and were more than three times higher by 1984.

Another important change in the structure of supply occurred in the oil refining profile⁽⁴⁾. As table (4.1.1.2) shows, the share of diesel in the total production of oil derivatives and natural gas increased at the expense of a fall in the share of motor gasoline, and to a much lesser extent, in the share of fuel oil. The objective of this change was to accommodate the oil refining profile to the structure of consumption of oil derivatives in Brazil shown in the same table. Note that, until 1975 consumption of crude oil was determined by the consumption of gasoline because 'the shares in consumption' were greater than the 'shares in production'. From 1976 to 1980 this role was played by fuel oil, and from 1981 to 1983 by diesel. Indeed, Brazil was clearly a net exporter of diesel up to 1979, of fuel-oil until 1975, and again after 1980, and of gasoline after 1976.

Consumption of crude oil rose 6.2% per year between 1973 and 1979 and fell -2.3% annually from 1979 to 1983. As a consequence, the import

coefficient of crude oil increased from 80.1% in 1973 to 85.9% in 1979, falling thereafter to 71.8% in 1983 and to 50.0% in 1984⁽⁵⁾.

The observation of the fact that the domestic prices of the main oil derivatives in Brazil (gasoline, fuel and diesel) did not rise in line with the import price of crude oil, measured in domestic currency (by using the actual exchange rate), after the first oil shock, has led to the argument that price induced substitution possibilities were underestimated⁽⁶⁾, and had Brazil adopted a more aggressive price policy, consumption of crude oil per unit of output could have been significantly reduced. Although it is very likely that such an underestimation actually occurred⁽⁷⁾, it is difficult to assess how important the price induced substitution could have been if a severe drop in economic growth and/or a dramatic increase in inflation were to be avoided.

It should also be stressed that consumption of crude oil per unit of GDP, after having increased 6.9% from 1970 to 1973, was kept below the 1973 level throughout the 1974/1979 period⁽⁸⁾, and then, in 1980/1983, it dropped to a level about 15% lower than that of 1973. Furthermore, table (4.1.1.3) shows that the ratios of growth of the main oil derivatives were severely reduced (via prices or otherwise) in the years in which they became determinants of the total consumption of crude oil. Therefore, although it is likely that there was scope for further reductions in the consumption of crude oil per unit of output, it should be recognized that some short-run adjustments were made, and that further adjustments via price would have increasingly sharpened the trade-off between price induced substitution and inflation for given rates of growth.

(4.1.2) Electricity

As mentioned earlier in this paper, the II NDP gave great priority to the production of electricity, especially hydroelectricity, as a substitute

for imported sources of energy. According to the II NDP, installed capacity of generating electricity was expected to increase to 28 millions of KW by 1979 while consumption would reach 107 billions (10⁹) of KWh by the same year⁽¹⁾. Both projections were slightly below actual figures: capacity went up to 30 millions of KW and consumption reached 109 billions of KWh in 1979⁽²⁾. It is interesting to note that consumption of electricity was greater than expected despite the fact that economic growth was much lower than planned, which implies that the expected substitution effect was actually underestimated over this period.

The objective of changing the demand structure of the economy towards the consumption of electricity can be broadly assessed by the figures in table (4.1.2.1). Columns (1) and (2) show a tremendous increase in both the consumption of electricity per unit of GDP and in the industrial consumption of electricity per unit of industrial output. The share of hydroelectricity in the total gross production of electricity also rose from 89% in 1973 to 92% in 1979 and to 94% in 1983⁽³⁾.

Table (4.1.2.2) shows that the share of electricity in the total consumption of energy by the industrial sector increased continuously and very sharply from 31.8% in 1973 to 38.2% in 1979 and to 45.8% in 1983. The share of fuel oil, on the other hand, fell from 30.2% in 1973 to 27.7% in 1979 and to 14.4% in 1983⁽⁴⁾.

Therefore, there should be no doubt that as far as the demand for energy in the industrial sector is concerned a major structural change has taken place. Furthermore, bearing in mind the relatively low price paid for electricity by the industrial sector in Brazil⁽⁵⁾, this move towards higher consumption of hydroelectricity is likely to have significantly contributed, as planned, to Brazil's competitiveness in this period, particularly in the metal working industries, chemicals and in the paper and cellulose industries which are heavy consumers of electricity and, as seen earlier in

Table (4.1.2.1): Consumption of Electricity per unit of Output

Year	(1970 = 100.0)	
	Total consumption over GDP	Industrial consumption over Industrial output
1970	100.0	100.0
1971	110.3	101.8
1972	101.0	102.2
1973	101.8	102.7
1974	104.2	106.6
1975	109.3	111.0
1976	113.3	114.5
1977	120.2	124.3
1978	127.9	131.2
1979	135.1	140.2
1980	139.3	143.8
1981	145.4	151.1
1982	152.5	156.5
1983	169.8	178.9

Table (4.1.2.2): Consumption of energy by the industrial sector (in percentages based on tonnes of petroleum equivalent)

Year	Electricity	Fuel-Oil
1970	30.6	27.3
1973	31.8	30.2
1974	32.7	29.9
1975	33.3	29.4
1976	33.8	30.2
1977	34.4	28.4
1978	36.3	28.9
1979	38.2	27.7
1980	39.7	25.7
1981	42.8	20.9
1982	44.8	15.9
1983	45.8	14.4

Sources: Balanço Energético Nacional

Sources: Eletrobrás Annual Reports and Contas Nacionais, IBRE/FGV 1984

this paper, were among the most dynamic tradeable sectors in Brazil. Electricity is also important for the textile industry.

The share of electricity in the total consumption of energy in the agricultural and residential sectors also increased very significantly. However, in these two sectors, the rise in electricity consumption corresponded to a fall in the relative consumption of firewood⁽⁶⁾. A discussion on the use of energy by the transport sector is left to section (4.2).

Although the consumption of electricity has played such an important part in changing the structure of the demand for energy in the Brazilian economy, the investments made in this sector require a closer examination⁽⁷⁾.

Firstly, it is important to realize that the sharp rise in investment in electricity generating in the 1974/79 period was largely due to decisions made in this period but concerning investment projects that were designed to satisfy the projected rise in the demand for electricity in the 1980's, since these projects require a lengthy period of construction. Indeed, at the end of 1979 the total capacity under construction was equal to 26 millions of KW, which is equivalent to almost 90% of the capacity in operation at the time⁽⁸⁾. By the end of 1984, these new projects would have added 17 millions of KW to the existing capacity in 1979⁽⁹⁾.

The investment decisions made in the 1974/79 period were largely based on a study in which the demand for electricity in the South, South-East and Centre-West regions of Brazil was forecast until the year 1990⁽¹⁰⁾. This study accepted the projections made in the II NDP and made two projections for the 1979/1990 period. According to the most optimistic projection (hypothesis I), GDP would grow at 11% per year after 1979, while the more conservative one (hypothesis II) projected GDP growth at 8% per year in the 1979/90 period. Nonetheless, the demand for electricity was

estimated to rise at 11.4% and 8.7% per annum, respectively, between 1979 and 1990, since the correlation between the demand for electricity and economic expansion was based on historical data, and hence, did not initially take into account the substitution of electricity for petroleum that was expected to occur.

When estimates of this substitution effect⁽¹¹⁾ were added to the projections made under hypothesis II, the forecasts for the consumption of electricity in 1985 and 1990 were about 9% greater than those projected under hypothesis I. Bearing this in mind, the programme for the expansion of the capacity of generating electricity recommended by the study was based on the most optimistic hypothesis concerning the growth of demand⁽¹²⁾. Therefore, the final estimates of the demand for electricity did take into account the planned substitution of electricity for petroleum.

It is worth noting that, given the most economical hydro potentials which were considered in that study, even when the most optimistic hypothesis was assumed, the study concluded that nuclear power stations would become necessary only in 1988⁽¹³⁾. If hypothesis II was taken as a more plausible projection then, no nuclear energy could be economically justified at least before 1990. Nevertheless, in view of the fact that the first nuclear power plant (Angra I) was already under construction, the study recommended that on the grounds of "maintaining technological activities in this sector"⁽¹⁴⁾, at least one nuclear power station should always be under construction, which would mean the existence of four nuclear stations in operation by 1990.

Therefore, not even the most ambitious projection of the demand for electricity could have lent support to the nuclear cooperation programme signed between Brazil and the Federal Republic of Germany in 1975, which predicted the construction of eight nuclear power plants of 1300 MW each by 1990, two of which (Angra II and Angra III) would start being constructed

in 1976. In fact, construction of Angra III only began in 1980, but because of delays in Angra I due to technical difficulties, three nuclear power plants were simultaneously being constructed in Brazil in the early 1980's⁽¹⁵⁾.

In 1979 new projections were made concerning the future demand for electricity. It was estimated that consumption of electricity would grow at about 12.8% until 1985, though economic growth was then expected to maintain a rate between 6 and 7 percent per year⁽¹⁶⁾. Consumption of electricity would slow down to 8.3% between 1985 and 1990 and to 7.4% in the 1990/95 period.

Economic growth in Brazil averaged 0.8% per annum between 1979 and 1983, falling -1.6% in 1981/80 and -3.2% in 1983/82. Consumption of electricity, nonetheless, grew on average 6.7% annually between 1979 and 1983. As a consequence, the sector has experienced some excess capacity⁽¹⁷⁾ and the pace in which new capacity was being added has slowed down quite considerably. In fact, total capacity in 1984, which was projected to be 45717 MW according to the schedule of 1979, was reduced to 41194 according to the schedule of 1983⁽¹⁸⁾.

Because of Brazil's balance of payments problems and rising inflation rate, the electricity sector has had to borrow heavily from international commercial banks while the average tariff rate has tended to decline in real terms⁽¹⁹⁾. The combination of rising interest rates (both internationally and domestically), excess capacity of generating electricity⁽²⁰⁾ and falling prices for electricity have meant that the electricity sector has had to face quite serious difficulties to finance its investment programme.

However, if the nuclear programme is left aside, then, although the investment programme in hydroelectricity was undoubtedly very ambitious, had it not been for the severity of the recession in Brazil in the early eighties, consumption of electricity would not have been very far from the projections made⁽²¹⁾. To the extent that the recession could not possibly

have been predicted in the mid-70's, then it cannot be the basis for condemning the investment decisions taken at that time and which were designed to increase the capacity of generating electricity in Brazil in the early and mid-1980's.

In point of fact, the rise in the production of hydroelectricity in Brazil, as shown before, has brought in vital economic contributions both in directly substituting for imported oil and in promoting exports and import substitution in the industrial sector. The financial difficulties of the sector are, by and large, a reflection of the country overall economic problems, perhaps somewhat magnified by the tendency of the state to overprotect the private sector in Brazil and to bear the bulk of the adjustment costs.

As to the future, the question lies on the level of the rate of interest and on the rate of growth of the demand for electricity. With high capital requirements, lengthy periods of construction, very low operational costs and life expectancy over 40 years, the cost of hydroelectric power plants are very sensitive to both interest rates and load factor. The longer the combination of recession with high interest rates remains the smaller Brazil's competitive advantage in hydro-electricity will become.

To illustrate this point the figures below are an attempt to estimate the cost of electricity in Brazil and its sensitivity to changes in some key parameters. The cost of electricity can be broken down into three main parts: (i) operating and maintenance costs, (ii) depreciation and (iii) capital costs. These are shown below for 1982⁽²²⁾:

	in US\$/MWh
(i) operating and maintenance costs:	19.33
(ii) depreciation	3.93
(iii) capital costs (rate of return: 10 to 12%):	<u>16.47 to 18.84</u>
TOTAL	39.73 to 42.10

Note that capital costs (including depreciation) represent over 50% of the total cost, and for this reason, the latter is very sensitive to the rate of return applied to compute the capital costs. The average tariff rate for electricity in Brazil in 1982 was US\$ 42.67 per MWh which leaves a margin of between 2% and 6% above total costs.

However, capital costs can increase quite dramatically as interest rate rises, construction delays and the load factor falls. If the cost of a power plant is estimated to be US\$ 800 per KW, and that this cost is spread equally over the period of construction, the figures below show how the total cost, including interests during construction, will vary with the period of construction and interest rates:

Total cost at the end of construction (US\$/KW)		
Interest rate	10%	12%
Period of constr.		
8 years	1144	1230
10 years	1275	1404
12 years	1426	1609

Assuming that a hydroelectricity power plant has 40 years of life, the capital costs of generating electricity of a power plant which costs US\$ 1200 per KW (plant I) or US\$ 1500 per KW (plant II) can be computed for different load factors and discount rates⁽²³⁾:

discount rate	costs in US\$/MWh			
	plant I		plant II	
	10%	12%	10%	12%
load factor				
60%	23.35	27.69	29.18	34.62
50%	28.02	33.23	35.02	41.54
40%	35.02	41.54	43.78	51.93

Note that the capital costs of generating electricity can more than double between the two extreme scenarios considered above.

(4.2) Transportation and Communications

In view of the II NDP objective of shifting emphasis away from road transportation and towards transport by rail and sea, the results achieved can be considered among the main failures of the II NDP strategy.

Table (4.2.1) gives the participation of each type of transportation in the total transport of load in Brazil. Note that, except for a slight increase in the shares of air and pipeline transportation, no significant change can be observed. As regards the transport of passengers, shown in table (4.2.2), it can be seen that highway transportation accounts for a lion's share in the total transport of passengers and, in fact, showed an upward trend until 1980. The inauguration of underground systems in the two most densely populated towns in Brazil (São Paulo and Rio de Janeiro) coupled with a slowdown in the rate of growth of passengers transportation (in passengers-Km) have helped to prevent yet further increases in the share of road transportation.

Therefore, although the reallocation of investment resources away from road transportation and towards railways was quite successful, as seen in section (2.2), the actual results did not correspond to the investments made.

One of the main reasons for that was the total failure of the 'Steel Railway Project', 'Ferrovia do Aço', which was to link Belo Horizonte to São Paulo carrying 50 million tonnes of iron and steel. Construction began on April, 30th 1975 and according to the authorities it would finish in 1000 days. By the end of 1982, the project had been reduced from about 800 Km to 319 Km, of which the following had been completed: 51.3 Km of tunnels (or

Table (4.2.1): Load Carried by way of Transportation
(in percentages based on tonnes-kilometers)

Year	Air	Pipeline	Railways	Sea (1)	Highways (2)
1973	0.21	2.70	22.85	13.43	60.82
1974	0.21	2.53	25.28	14.22	57.76
1975	0.22	2.66	24.87	14.01	58.24
1976	0.26	2.74	24.61	13.29	59.10
1977	0.25	3.06	22.02	13.54	61.11
1978	0.27	3.71	21.42	13.86	60.74
1979	0.28	3.47	22.61	14.27	59.37
1980	0.29	3.36	24.28	13.42	58.66
1981	0.31	3.23	23.19	13.51	59.76
1982	0.34	3.17	22.09	14.22	60.17

Notes: (1) including coastal shipping and inland waterways shipping.

The latter was estimated for the 1973/75 period on the basis of data for load carried in tonnes times a factor equal to the average ratio of the value in tonnes to the value in tonnes-km in 1976/82;

(2) the values between 1973 and 1976 were estimated on the basis of the rates of growth applied to the value in 1977, in order to make the whole series compatible with the data from 1977 to 1982.

Source: Anuário Estatístico dos Transportes

Table (4.2.2): Transport of Passengers by way of Transportation
(in percentages based on passengers-km)

Year	Air (1)	Railway	Underground	Sea (2)	Highways (4)
1972	1.95	6.91	...	0.01	91.12
1973	2.18	6.01	...	0.02	91.80
1974	2.26	5.32	...	0.01	92.40
1975	2.25	4.68	...	0.00	93.07
1976	2.33	4.50	...	0.00	93.17
1977	2.24	3.88	...	0.00	93.77
1978	2.28	3.55	0.40	0.01	93.77
1979	2.31	2.99	0.36	0.01	94.33
1980	2.20	2.85	0.35	...	94.59
1981	2.21	2.91	0.40	0.05 (3)	94.44
1982	2.29	2.82	0.44	0.05 (3)	94.38

Notes: (1) only domestic flights;

(2) coastal shipping until 1979;

(3) inland waterways shipping;

(4) preliminary data estimated by GEIPOP/MT.

Source: Anuário Estatístico dos Transportes

99% of the total), 26.6 Km of bridges and flyovers (or 97% of the total) and 142.7 million of m³ of earthworking (or 98% of the total)⁽¹⁾. Work on the superstructure was scheduled to begin in 1983. In July of that year construction was interrupted, and by then, it had consumed about US\$2.2 billion⁽²⁾.

The main adverse implication of failing to increase the share of the railway sector in total transportation in Brazil refers to the consumption of diesel which, in recent years, has been the determinant of the consumption of crude oil in Brazil. Indeed, table (4.2.3) brings out quite clearly the sharp rise in the share of diesel in the total consumption of energy by the transport sector until 1980, while the share of electricity remained roughly constant between 1973 and 1979, rising slightly thereafter. Note, however, that the shares of diesel in the consumption of energy in both the railway sector and in shipping have tended to fall in recent years, as shown in table (4.2.4). In the former, steam coal and electricity have been important substitutes, whereas in the latter fuel oil has partly replaced diesel.

Therefore, the sharp rise in the share of diesel has been partly due to the maintenance of a high share of road transportation in total transport. Nevertheless, a fall in the share of gasoline plus alcohol in the consumption of energy in road transportation, see table(4.2.4), has also played a part. Two main reasons may account for this rise in the consumption of diesel in road transportation. Firstly, it is likely to have been a reflection of a reduction in the use of automobiles as compared to the use of buses for the transport of passengers. This is undoubtedly a welcome change from an energy saving viewpoint. Secondly, it reflects an increase in the use of diesel fuelled lorries as compared to gasoline or alcohol fuelled lorries. The evidence shown in table (4.2.5) suggests that, although the production of new gasoline and alcohol fuelled lorries has been higher than the production of diesel fuelled lorries, the relative number of the latter on the road has

Table (4.2.3): Energy Consumption in the Transport Sector
(in percentages based on quantities in tonnes
of petroleum equivalent)

Year	Electricity	Diesel	Gasoline	Alcohol	Fuel-Oil
1970	1.4	34	56	1.1	2.9
1973	0.9	33.1	56.3	1.3	3.3
1974	0.9	33.6	53.7	0.7	5.6
1975	0.8	35.5	51.8	0.6	5.8
1976	0.9	36.4	48.4	0.6	5.9
1977	0.9	41.5	45.2	2.1	4.2
1978	0.8	41.3	42.6	4.6	4.9
1979	0.8	41.7	39.2	6.5	5.3
1980	1	45.7	34.9	7.8	4
1981	1	45.3	33.7	7	5.5
1982	1.2	45.2	31	10	5.4
1983	1.2	45.2	26.4	14	5.9

Source: Balanço Energético Nacional

Table (4.2.4): Energy Consumption in Rail Transportation, Shipping and Road Transportation
(in percentages based on quantities in tonnes of petroleum equivalent)

Year	Railways (1)		Shipping		Road Transportation				
	Diesel	Electricity	Fuel-Oil	Steam Coal	Diesel	Fuel-Oil	Diesel	Gasoline	Alcohol
1970	53.4	29.5	11.9	2.5	45.8	53.2	34.2	64.6	1.2
1973	65.0	27.9	4.7	0.3	39.9	59.7	33.5	65.0	1.5
1974	68.1	25.3	4.2	1.1	33.9	66.0	34.5	64.6	0.9
1975	68.8	25.5	3.8	1.4	29.4	70.6	37.2	62.1	0.7
1976	68.0	26.3	4.0	1.7	29.8	70.2	41.0	58.3	0.7
1977	68.6	27.0	2.2	2.2	35.7	64.3	44.0	53.5	2.5
1978	68.5	26.7	2.2	2.6	33.2	66.8	44.0	50.5	5.5
1979	69.4	26.6	1.6	2.4	33.4	66.6	44.9	47.3	7.8
1980	67.7	28.4	1.2	2.6	34.1	65.9	49.3	41.3	9.4
1981	66.2	30.5	0.8	2.4	26.6	73.4	50.3	41.0	8.7
1982	63.5	33.5	0.8	2.1	26.4	73.6	50.2	37.5	12.3
1983	62.0	34.4	0.8	2.7	21.2	78.8	50.8	32.0	17.2

Note: (1) Including undergrounds

Source: Balanço Energético Nacional

actually increased, probably due to the retirement of gasoline fuelled lorries.

The increase in diesel fuelled lorries is likely to be correlated with the increase in the use of heavier lorries which took place in this period as shown in table (4.2.6). To the extent that heavier lorries are more efficient, this change again represents a positive move within the road transport system. In point of fact, table (4.2.7) suggests that there has been some improvement in the efficiency of diesel consumption in road transportation, particularly in the transport of passengers.

Improved efficiency could also be regarded as a mitigating factor in the otherwise poor results from the investments in the railway sector. After having been neglected for so many years before 1974, the railway system in Brazil was obsolete and very inefficient⁽³⁾. Therefore, a substantial part of the investments made in the 1974/82 period was designed to modernise and improve the efficiency of the system. As a result, the energy productivity in the railway system as measured by thousands of units of traffic per tonne of fuel (in diesel equivalent) increased steadily from 114 in 1973 to 140 in 1979 and to 154 in 1982⁽⁴⁾.

Going back to road transportation a brief comment should be made about the consumption of alcohol (ethanol produced basically from sugar cane) as a fuel in Brazil. As mentioned before the II NDP referred to a policy of stimulating the use of alcohol (anhydrous ethanol) for gasoline mixture. In 1975 this policy became a programme, the National Alcohol Programme - Proálcool - designed to increase the production of anhydrous ethanol to be used mixed with gasoline as a fuel for vehicles. Table (4.2.4) shows that in fact the share of alcohol in the consumption of energy in road transportation rose very sharply between 1976 and 1979 contributing to the fall in the share of gasoline consumption.

However, it was only in the post-II NDP period or after the second oil

Table (4.2.5): Production and Fleet of Lorries by Type of Fuel
(in unities)

Year	Production of Lorries			Fleet of Lorries	
	Gasoline	Alcohol	Diesel	Gasoline & Alcohol	Diesel
1976	...	0	...	224245	462095
1977	...	0	...	268943	462862
1978	1333	0	84936	296009	515655
1979	2634	10	90407	248270	602823
1980	3934	14	98069	226589	695305
1981	5653	2157	68540	201264	750906
1982	628	904	45311	...	...

Source: Anuário Estatístico dos Transportes

Table (4.2.6): Fleet of Lorries by Weight (in percentages)

Year	Light & medium	semi-heavy	heavy	very heavy
1976	82.5	8.9	7.5	1.1
1977	81.3	10.1	8.5	0.1
1978	80.1	11.2	8.4	0.2
1979	78.6	12.6	8.5	0.4
1980	76.9	13.9	8.4	0.8
1981	75.8	14.9	8.6	0.7

Source: Anuário Estatístico dos Transportes

Table (4.2.7): Consumption of Diesel in Road Transportation
per unit of load (tonnes-km) and passengers-km transported
(1976=100.0)

Year	load	passengers
1976	100.0	100.0
1977	98.2	94.9
1978	98.2	89.7
1979	98.1	83.7
1980	99.1	79.7
1981	98.6	74.9
1982	99.0	75.1

Sources: Balanço Energético Nacional and Anuário Estatístico dos Transportes

Table (4.2.8): Participation of the Brazilian Flag in long range Shipping
(in percentages based on tonnes of cargo)

Year	Exported Cargo	Imported Cargo	Total
1976	18.1	89.2	46.7
1977	17.0	92.2	50.9
1978	18.5	94.1	51.6
1979	18.7	92.4	48.6
1980	18.2	93.0	49.6
1981	20.7	93.3	46.4

Source: Anuário Estatístico dos Transportes

shock in 1979 that the alcohol programme in Brazil actually received a big boost. In that year, the 'Proálcool' can be said to have entered a second phase as the government set a target of 10.7 billion litres of alcohol for the crop year of 1985/86 compared to 2.4 billion litres actually produced in 1978/79. Furthermore, hydrous ethanol, which allows total replacement of gasoline, began being produced to fuel new pure alcohol powered cars. Table (4.2.4) shows that the share of alcohol in total consumption of energy in road transportation jumped to 17.2% in 1983. In the crop year of 1984/85 ethanol production reached 85% of the target set for 1985/86 and almost 90% of new cars sold in Brazil had pure alcohol fuelled engines.

However, despite the impressive production and consumption performance of ethanol in Brazil, the social and economic viability of the alcohol programme has been a matter of great controversy. This controversy is partly due to the enormous difficulties that exist in assessing the programme viability in view of the complexity of its effects on the economy⁽⁵⁾. Indeed the main cost-benefit studies that have attempted to assess the programme viability have come to divergent conclusions⁽⁶⁾.

The most recent attempt⁽⁷⁾ has estimated the social cost of ethanol in São Paulo to be equal to US\$0.283 per litre of gasoline equivalent (at December 1981 prices)⁽⁸⁾. The international spot market price of gasoline plus an allowance for freight costs⁽⁹⁾ was equal to US\$0.28 per litre in 1981. Taking this price as the opportunity cost of gasoline in Brazil and assuming that gains in productivity would tend to lower the social cost of ethanol in Brazil, then the social and economic viability of the alcohol programme would seem assured provided that the international price of gasoline did not fall. Nevertheless, the import price (CIF) of gasoline dropped to US\$0.23 in 1983 and Brazil's export price of gasoline fell to US\$0.201 per litre in the same year. Therefore, a significant fall in the estimated social cost of ethanol would seem necessary for the viability of

the alcohol programme in Brazil at current international gasoline prices.

Two major objections can be made about the above analysis. Firstly, the figures estimated for the social cost of ethanol in Brazil are debatable on the grounds of data and methodology applied⁽¹⁰⁾. Secondly, the assumption that the international price or Brazil's export price of gasoline may be regarded as the opportunity cost of gasoline in Brazil can also be questioned⁽¹¹⁾. The quantity of gasoline traded internationally is marginal compared to total world production⁽¹²⁾. If exports of gasoline represent excess supply in domestic markets, gasoline surplus may be regarded as a residual from oil refining and thus be exported at 'marginal' cost. Therefore, it may well be that the international price of gasoline is closer to its 'marginal' rather than 'actual' cost⁽¹³⁾. Moreover, as gasoline is one among several oil derivatives that are inevitably produced by oil refining, the proportion of crude oil and refining costs that is allocated to gasoline cannot be determined without reference to domestic demand conditions and international prices of all relevant oil derivatives.

Nonetheless, if the social cost of ethanol in Brazil is higher than the export price of gasoline, then it does not make sense to produce ethanol in order to export gasoline, though severe scarcity of foreign exchange may drastically reduce the short-term social cost of ethanol. If alcohol production is reduced to the point where gasoline is solely produced for domestic consumption, then gasoline can no longer be regarded as a residual from oil refining but as a determinant of the amount of crude oil into the refineries and consequently of oil imports⁽¹⁴⁾. In this condition, it would be reasonable to consider a greater proportion of the total crude oil and refining costs as gasoline costs, as a penalty for preventing further cuts in the oil import bill.

Therefore, neither the international price nor Brazil's export price of gasoline can be the basis for assessing the viability of the alcohol

programme in Brazil. So long as uncertainties concerning the evolution of relative prices and some of the difficulties mentioned above remain, it is extremely unlikely that the controversy which surrounds the alcohol programme in Brazil can be settled within the framework of cost-benefit analysis. The use of sugar cane ethanol as a fuel in other countries may also dramatically change the parameters for assessing the "Proálcool" in Brazil.

As far as shipping is concerned, II NDP projections were not far from the actual results. The figures below show both the II NDP projections and results for the capacity of the Brazilian merchant fleet.

Year	1979	1979	1982
	II NDP Projections	Results	Results
capacity in DWT			
long-range navigation	8079	5807	7610
coastal shipping	967	1072	1248
inland waterways shipping	392	344	526
oil tankers	2280	2863	3048
total	9438	7223	9385

Sources: Anuário Estatístico dos Transportes and Anuário Estatístico do Brazil

Table (4.2.8) shows that the participation of the Brazilian flag in total long-range shipping (in tonnes of cargo) increased slightly in both the total cargo exported and in the total cargo imported in the 1976/1981 period. However, due to a sharp fall in the imported tonnage, in which the Brazilian flag has a very high share, the total participation of the Brazilian flag fell in 1981.

The results of the investments in communications can be considered quite satisfactory when compared to the II NDP targets. Telephone switchings were projected to increase to 123 thousand trunks by 1979. It actually rose to 124.5 thousand. International voice channels were projected

to reach 1404 in 1979 (444 via satellite and 960 via submarine cable). In 1979, international voice channels reached 1336, of which 876 were via satellite and 460 via submarine cable. The domestic telex network was planned to rise to 22 thousand installed terminals. In actuality, it rose to 38.3 thousand installed terminals. The number of telephones was estimated to increase to 8.1 million in 1979. In this year, it reached 6.4 million, but two years later it was 8.4 million. The intra-state toll circuits were projected to increase to 115 thousand in 1979. It rose to 138 thousand⁽¹⁵⁾.

(5) Current Account of Brazil's Balance of Payments and Brazil's Export Performance in World Markets

In previous sections, the import substitution process and export drive in a number of individual industries were examined. This section deals with the effects of these changes on Brazil's export and import structures and on Brazil's trade balance on goods and commercial services. The performance of Brazil's exports as compared to that of other countries and groups of countries is also discussed here.

The main aim of this section is to emphasise the following points:

(a) Brazil's imports have largely concentrated on imports of intermediate and capital goods, with very little foreign exchange being spent on consumer durables. A rapid import substitution process in the intermediate and capital goods industries is also clear from the changes in Brazil's import structure;

(b) The structure of Brazil's exports has changed dramatically as exports of manufactures, especially capital goods, rapidly increased their share in the value of exports from Brazil;

(c) The transfer of real resources to Brazil, as measured by the trade deficits on goods and commercial services, has declined steadily since 1974 and has turned into large and negative transfers since 1980. Indeed, the transfer of real resources from Brazil to the rest of the world in the three years from 1980 to 1982 was equivalent to more than 60 percent of the real transfer of resources to Brazil in the six years period from 1974 to 1979. In other words, in the last three years of the series Brazil has transferred real resources abroad at an average per year 23 percent greater than the annual average inflow of real resources in the 1974/79 period. This is a measure of the strenuous adjustment which Brazil underwent after 1980, but only made possible by the significant structural adjustment initiated in 1974;

(d) There is clear evidence that the level of consumption was allowed to expand at excessively high rates of growth in the 1973/79 period and, in particular, in 1974 and 1976. A more moderate rise in consumption could have reduced the trade deficits and thus relieve somewhat the subsequent burden of the foreign debt. However, the very good performance of Brazil's exports as compared to that of other countries suggests that world demand was at least as an important constraint on the rate of growth of Brazil's exports as was the expansion of consumption in Brazil in the 1974/79 period;

(e) disaggregation of Brazil's exports reveals that the penetration of Brazilian manufactures, especially machines and equipment, in world markets have indeed been very impressive. Exports of non-manufactures from Brazil have also performed well when relative prices and wheater effects are taken into account.

Table (5.1) brings out the changes in the composition of imports and exports in Brazil in the 1973/82 period. Note that the share of fuels (basically petroleum) underwent a phenomenal rise, accounting for more than half of total imports in 1982. The shares of all other import categories have sharply fallen since 1974/75 (except for food items in 1978/82). Bearing in mind that imports have been compressed relatively to GDP since 1974/75⁽¹⁾, this change in the composition of imports reflects the very significant import substitution that has taken place in the intermediate and capital goods industries.

As to the composition of exports, a steep rise in the share of manufactures, especially of machinery and equipment, is one of the most noticeable change. This rise was largely at the expense of a fall in the share of food items and agricultural raw materials (most of these goods are classified as consumer non-durable goods) while the share of consumer durable goods did not experience any significant change.

Table (5.1): Brazil's Import and Export Structures by main Categories (in percentages)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
-Imports										
all food items	10.9	7.6	6.2	7.9	6.8	10.1	11.9	9.6	8.8	8.5
agricult. raw matls.	2.0	2.0	1.5	1.4	1.5	1.5	1.4	1.3	1.1	0.9
fuels	15.1	23.8	26.2	31.6	34.0	32.9	37.1	43.1	50.5	53.5
ores & metals	12.4	17.7	14.0	9.0	10.1	7.9	7.7	7.5	6.0	4.7
manufactures	58.5	48.2	52.2	50.0	47.6	47.5	42.0	38.5	33.5	32.3
chemicals	14.8	15.6	12.8	14.4	14.7	14.6	14.3	13.9	9.4	9.2
machinery & equip.	33.6	24.2	31.7	29.0	26.0	26.0	21.4	19.5	18.4	17.2
other manufactures.	10.2	8.4	7.7	6.6	7.0	6.7	6.4	5.1	5.7	6.0
-Imports										
capital goods	35.5	25.4	32.7	30.2	27.1	27.4	22.0	20.1	19.3	18.1
intermediate goods	50.7	65.9	58.2	61.6	63.6	64.0	68.1	73.8	75.6	76.6
consumer durables	5.8	4.0	3.7	3.3	3.2	3.1	2.8	2.1	2.0	2.1
consumer non-durables	6.6	5.0	4.3	4.9	6.1	5.4	7.0	3.9	3.0	3.2
-Exports										
all food items	61.7	57.9	54.1	59.6	61.6	52.0	46.5	46.3	41.4	39.6
agricult. raw matls.	8.5	6.0	3.9	2.3	2.4	2.9	3.4	4.0	3.6	3.2
fuels	1.4	1.4	2.3	2.5	1.8	1.6	1.5	1.8	5.1	7.2
ores & metals	8.6	10.6	14.3	13.2	10.5	12.9	15.0	13.8	13.7	15.5
manufactures	17.9	22.3	23.3	20.8	23.0	29.7	32.6	32.8	34.8	33.3
chemicals	1.8	2.8	2.1	1.5	1.5	1.2	2.8	3.6	4.2	4.5
machinery & equip.	4.9	11.3	10.8	9.8	10.0	12.3	13.8	12.4	12.5	11.7
other manufactures.	11.2	8.1	10.3	9.5	11.5	15.3	15.0	16.9	18.1	17.2
-Exports										
capital goods	3.6	6.8	9.0	8.2	10.1	13.4	14.7	16.0	17.2	15.9
intermediate goods	46.3	46.1	50.1	47.4	47.4	46.3	48.7	44.6	49.1	49.4
consumer durables	2.3	2.8	3.0	2.5	2.9	3.9	3.7	3.4	3.2	2.7
consumer non-durables	45.1	41.6	35.5	38.1	38.7	35.4	32.0	34.7	29.0	30.8

Table (5.2) gives the trade balances on goods and commercial services at 1970 prices in the 1970-1982 period. It can be seen that the trade deficit, after reaching a peak in 1974, declined steadily and turned into sizeable surpluses in the last three years of the series. The ratio of imports to GDP in the same table shows an identical pattern, rising until 1974 and falling thereafter.

The ratio of exports to GDP in the 1974-1979 period tended to stay slightly below the average observed in the 1970-73 period (except for 1975). This fact would seem to suggest that domestic absorption was too high in this period. Indeed, this would seem to be particularly true for 1974 and 1976 when domestic absorption grew 9.4% and 12.0%, respectively - see table (5.3). It should also be stressed that the real rate of growth of consumption was consistently higher than that of GDP in the 1976/79 period, again suggesting that a somewhat more cautious policy could have been exercised.

However, the last column in table (5.2) reveals that the share of Brazil's export in total exports by developing countries at constant 1970 prices in the 1974/79 period was consistently higher than in the 1970/73 period. Therefore, this would suggest that world demand was at least as an important constraint on the level of Brazil's exports as was domestic absorption in Brazil. In other words, a fall in domestic absorption in the mid-1970's would not have been necessarily matched by an equivalent rise in exports as Brazilian goods would have had to face increasing competition abroad.

Both the ratios of exports to GDP (at constant prices) and to the volume of exports by developing countries increased quite dramatically in the 1980's. Although it is undeniable that the depression in the domestic markets in Brazil have contributed to this export success in the 1980's, the investments made in the 1970's must also be regarded as absolutely crucial

Table (5.2): Trade Balance on goods & commercial services and Selected ratios of Exports and Imports

Year	Exports of Goods & Com. Services (at 1970 prices)	Imports of Goods & Com. Services prices	Trade Balance Goods & Com. Services Cr.\$ millions)	Exports over GDP (at 1970)	Imports over GDP prices-in %)	Ratio of Brazil's export volume to export vol. from developing countries (in %) base year 1970
1970	13660.0	14476.1	-816.1	7.0	7.4	5.00
1971	14412.7	18022.3	-3609.6	6.6	8.2	5.34
1972	17895.2	21631.6	-3736.4	7.3	8.9	6.13
1973	20446.2	26044.8	-5598.6	7.4	9.4	6.06
1974	20923.2	33464.6	-12541.4	6.9	11.0	7.24
1975	23344.6	31950.3	-8605.7	7.3	10.0	8.85
1976	23276.2	31553.3	-8277.1	6.6	9.0	7.76
1977	23187.3	29163.8	-5976.5	6.2	7.8	8.72
1978	26260.0	30500.1	-4240.1	6.7	7.9	8.69
1979	28702.2	33003.5	-4301.3	6.9	7.5	11.89
1980	35204.6	33217.9	1986.7	7.9	6.6	15.66
1981	42707.7	29116.2	13591.5	9.7	6.2	14.86
1982	38782.0	27359.0	11423.0	8.8		

SOURCES: Contas Nacionais do Brasil, IBRE-FGV, 1984; and Handbook of Intern. Trade & Devel. Statistics, U.N.

Table (5.3): Real Annual Growth Rates of Selected Macro-variables (in percentages)

Year	GDP	Domestic Absorption	Consumption	Investment
1974/73	9.7	12.0	9.2	19.3
1975/74	5.4	4.0	0.8	11.8
1976/75	9.7	9.4	12.5	2.5
1977/76	5.7	5.0	7.3	-0.6
1978/77	5.0	4.5	5.3	2.2
1979/78	6.4	6.3	8.1	1.7
1980/79	7.2	5.6	3.4	12.1
1981/80	-1.6	-4.2	-1.4 (1)	-12.0 (2)
1982/81	0.9	1.5	3.2 (1)	-4.0 (2)

Notes: (1) including stock changes; (2) excluding stock changes.
Sources: Contas Nacionais do Brasil, IBRE/FGV, 1984.

Table (5.4): Ratios of Brazil's exports to exports from Developing Countries (in %) (excluding mineral fuels from both exports)

Year	Total	Manufactures	Non-manufactures
1973	9.25	1.86	7.40
1974	8.82	2.20	6.63
1975	9.92	2.60	7.32
1976	9.42	2.24	7.18
1977	9.53	2.46	7.07
1978	8.75	3.00	5.76
1979	8.39	3.25	5.13
1980	9.32	3.58	5.74
1981	10.26	4.28	5.98

Notes: (1) Brazil's exports of manufactures are those classified from SITC (5) to SITC (8); (2) The denominator in all three ratios is total exports from developing countries, thus col.(1)=col.(2)+col.(3).
Sources: Handbook of International Trade & Development Statistics, U.N.

to this success, since they were responsible for the large expansion in the capacity of production of manufactures, especially of capital and intermediate goods, which in fact turned out to be the fastest growing Brazilian exports⁽²⁾. They must also account for the diversification and competitiveness of Brazilian goods.

Table (5.4) shows that the ratios of Brazil's exports (excluding mineral fuels) to the same exports by developing countries at current prices from 1975 to 1977 and from 1980 to 1981 were higher than in 1973, but were below that level in 1974, 1978 and 1979. However, when Brazil's exports are broken down into exports of manufactures and non-manufactures (excluding mineral fuels), but keeping the denominator equal to total exports from developing countries (excluding mineral fuels), it can be seen that Brazil's exports of manufactures have largely accounted for the upward trend in the share of Brazil's total exports, whereas exports of non-manufactures have been mostly responsible for the short-run fluctuations.

Table (5.5) compares Brazil's exports of manufactures with world exports of manufactures and with the same exports from developing countries, from Latin American countries and developing countries of the South and South-East Asia. It comes out quite clearly from this table that Brazil has more than doubled its share of world manufacture exports in the 1973/81 period, has increased very significantly its share within developing countries and Latin American countries and has also performed well as compared to developing countries of the South and South-East Asia. The performance of Brazil's exports of machinery and equipment has been quite extraordinary. Note, however, that Brazil's exports of manufactures did not rise as fast as world exports of manufactures in 1976, suggesting that in that year economic policy in Brazil could have been more favourable to exports of manufactures.

In table (5.6) Brazil's exports of iron & steel and of non-ferrous

Table (5.5) : Brazil's Exports of Manufactures as Compared to Groups of Countries

Year	Ratio of Brazil's Exports of Total Manufactures to Exports of Total Manufactures by the		Ratio of Brazil's Exports of Basic Manufac. excl. iron, steel and non-ferrous metals to the same exports by the		ALADI South&South-East Asia	
	World	Ding Ctries	World	Ding Ctries	ALADI South&South-East Asia	East Asia
1970	0.35%	5.03%	0.21%	1.99%	25.70%	2.67%
1973	0.43%	5.96%	0.61%	4.48%	39.23%	5.91%
1974	0.44%	6.66%	0.63%	4.70%	40.83%	6.36%
1975	0.40%	5.20%	0.63%	4.79%	47.91%	6.33%
1976	0.46%	5.75%	0.57%	3.68%	40.09%	4.62%
1977	0.52%	6.18%	0.59%	3.81%	37.91%	4.86%
1978	0.57%	6.33%	0.62%	3.96%	40.24%	5.01%
1979	0.65%	6.91%	0.69%	4.19%	38.88%	5.44%
1980	0.80%	7.55%	0.70%	4.26%	45.27%	5.33%
1981			0.83%	4.38%	43.31%	5.50%

Year	Ratio of Brazil's Exports of Chemicals to the same exports by the		Ratio of Brazil's Exports of Machines & Equipment to the same exports by the		ALADI South&South-East Asia	
	World	Ding Ctries	World	Ding Ctries	ALADI South&South-East Asia	East Asia
1970	0.17%	3.77%	0.11%	6.79%	30.29%	10.83%
1973	0.27%	5.73%	0.18%	6.62%	28.80%	9.85%
1974	0.35%	5.55%	0.31%	9.87%	47.30%	14.48%
1975	0.30%	5.12%	0.37%	12.59%	54.12%	19.79%
1976	0.22%	3.90%	0.35%	10.10%	54.91%	14.13%
1977	0.24%	3.93%	0.44%	11.58%	61.16%	16.40%
1978	0.27%	4.64%	0.51%	12.29%	59.67%	17.18%
1979	0.34%	5.68%	0.55%	11.76%	63.25%	16.17%
1980	0.49%	7.33%	0.66%	12.46%	68.92%	17.04%
1981	0.69%	9.50%	0.81%	13.73%	71.75%	18.91%

Notes: (1) Manufactures include SITC (5)+(6)-(67)-(68)-(7)*(8); (2) Exports were in current US\$.

Table (5.6): Brazil's Exports of Iron & Steel and Non-ferrous Metals as Compared to Groups of Countries

Year	Ratios of Brazil's Exports of Iron & Steel to the same exports by the world			Ratios of Brazil's Exports of Non-ferrous Metals to the same exports by the world		
	Ding	ALADI	South&South-East Asia	Ding	ALADI	South&South-East Asia
1973	0.388%	11.470%	42.364%	0.068%	0.270%	0.696%
1974	0.327%	9.678%	41.322%	0.121%	0.439%	1.035%
1975	0.375%	13.621%	61.735%	0.158%	0.645%	1.623%
1976	0.513%	12.535%	53.849%	0.077%	0.301%	0.727%
1977	0.563%	13.911%	55.969%	0.115%	0.473%	1.191%
1978	0.791%	17.912%	55.316%	0.203%	0.915%	2.356%
1979	1.082%	16.706%	66.086%	0.247%	1.075%	2.378%
1980	1.161%	19.327%	70.748%	0.188%	0.920%	2.198%
1981	1.391%	20.219%	71.818%	0.320%	1.580%	4.520%

Notes: Iron & steel and non-ferrous metals are classified as SITC (67) and (68), respectively.

SOURCES: Handbook of International Trade and Development Statistics, U.N.; and Yearbook of International Trade Statistics, U.N.

metals are compared to these exports by the same groups of countries. Note that the relative performance of these exports from Brazil has been generally very good, though again 1976 does not seem to have been a particularly good year. Indeed, exports of iron & steel from Brazil in 1973/81 have more than trebled their share in world exports, have almost doubled their share in exports from developing countries (reaching 20.2% in 1981) and have grown at a much faster pace than the same exports from ALADI countries or from countries in the South and South-East Asia. Brazil's shares of exports of non-ferrous metals in world exports or in exports from developing countries have increased even more rapidly, though starting from a smaller base.

The ratios of Brazil's exports of non-manufactures (excluding mineral fuels) to the same exports from developing countries are shown in table (5.7). At current prices, the performance of Brazil's exports of non-manufactures has been generally good, though in 1974, 1978, 1979 and 1980, the shares of Brazil's exports of non-manufactures (excl. mineral fuels) were below the 1973 level. Note, however, that fluctuations in relative prices (Brazil's non-manufacture export price vis-à-vis the international price index of primary commodities excluding mineral fuels) accounted for the relatively poor performance in 1974 and in 1980, while the behaviour of price and volume of coffee beans exports largely explains the poor performance in 1978 and 1979 - see columns on the right hand side of table (5.7).

Table (5.7): Ratios of Brazil's exports of non-manufactures (excluding mineral fuels) to the same exports from developing countries

Year	Food Items	Agricultural Raw Materials & Metal Ores (based on values at current prices)	Crude Fertilizers	TOTAL	TOTAL (1) (based on values at 1970 prices)	Coffee Beans Export Volume Index price index	Share of coffee beans in Brazil's exports of non-manufactures (excluding mineral fuels) at current prices
1970	11.90	5.96	8.35	10.01	10.01	187.3	42.2
1971	11.75	5.72	9.55	10.08	10.77	202.3	35.1
1972	14.58	5.79	8.74	11.77	11.94	204.1	33.5
1973	16.12	5.37	9.59	12.55	14.59	209.7	28.2
1974	14.40	4.45	9.52	11.52	16.93	133.5	17.1
1975	14.09	4.24	15.43	12.55	15.25	151.5	15.4
1976	15.79	2.13	16.24	13.09	11.37	156.7	29.5
1977	15.36	2.46	14.34	12.91	10.18	100.0	26.3
1978	13.11	2.86	14.99	11.32	10.25	120.2	24.1
1979	12.44	2.85	14.87	10.64	11.28	109.3	21.2
1980	14.72	3.96	13.78	12.35	15.78	152.4	20.9
1981	15.72	5.03	15.97	13.80	14.14	160.5	12.1

Notes: (1) Brazil's exports of food items and agricultural raw materials were deflated by Brazil's export price indices for non-industrial goods while Brazil's exports of crude fertilizers and metalliferous ores were deflated by Brazil's export price indices for mineral goods (both indices from *Conjuntura Econômica*). Exports from developing countries were deflated by the annual indices of free market prices of selected primary commodities excluding mineral fuels (from Handbook, U.N.)

Sources: *Conjuntura Econômica* and Handbook of International Trade & Development Statistics, U.N.

(6) Pros and Cons of the II NDP Strategy

In retrospect, it can be said that the II NDP presented both a negative and a positive side.

On the negative side, it can be said that the II NDP strategy was too ambitious as far as economic growth was concerned (perhaps somewhat blinded by the euphoria of the economic miracle) because: (i) it underestimated the difficulties related to the fact that there were shortages of essential inputs, the economy had reached full utilization of capacity and was showing signs of overheating in many sectors, and (ii) it unrealistically counted on very favourable conditions regarding the world economy.

As reality proved to be much less favourable than anticipated by the II NDP⁽¹⁾, both economic growth and investment plans had to adjust to more modest levels. However, and this is the main adverse implication of the ambitious targets set by the II NDP, this adjustment process had almost inevitably to generate some misallocation of investment resources and hence much higher costs than anticipated. This was the consequence of the fact that some investment projects, after having been initiated, had to have construction delayed, interrupted or even abandoned due to the foreign exchange constraint on the overall level of investment, or due to the fact that they became economically unfeasible as, on the one hand, the price of inputs (especially of importables) and the financial costs rose and, on the other hand, expected future demand fell. Other investment projects, because of technical indivisibility had to be carried out with their originally projected capacities, though they had been planned on the assumption of a much faster growing demand.

The aim of sustaining the rate of growth at a level as high as 10% in 1974, coupled with an overdose of inflationary fears⁽²⁾ may have

significantly contributed to some speculative and unnecessary importation in that year.

On the positive side, it can be said that the II NDP correctly refused to adopt a strategy that would drastically reduce economic growth or plunge the country into a recession, as most advanced economies did following the first oil shock. Equally important was the determination to sustain and even increase the share of investment in total income rather than spend foreign resources in wasteful consumption.

The determination to advance the industrialization process in Brazil by implementing an import substitution programme in energy resources and by expanding the capacity of production of the capital and intermediate goods sector at a faster rate than that of the consumer goods sector (in order to correct what was rightly seen as an unbalanced economic growth), including the expansion and installation of new industrial branches in areas such as electronics, mechanical engineering, metallurgy, shipbuilding, railway equipment, aircraft manufacturing, petrochemicals and pharmaceuticals must also be counted as positive factors brought about by the II NDP.

Moreover, it would be reasonable to assume that the learning by doing process implicit in the tremendous investment effort made in this period must have had a very positive effect on the quality of Brazil's labour force and managing capacity. Indeed, the recent success of Brazil's exports of engineering services in areas such as civil engineering, hydroelectricity and oil exploration would seem to be one of the strongest evidence of this fact.

NOTES:

Introduction

- (1) "It is necessary a change in the relative priority given to different economic sectors and within industry in order to reduce imports and raise exports", II NDP, p.19;
- (2) Campos (1983);
- (3) Jornal do Brasil, 01.04.1984;
- (4) The state penetration in productive investment areas has been particularly attacked as one of the chief causes of Brazil's economic problems;
- (5) The Times, 26.06.1984;

Section (1)

- (1) The objective of this brief review is simply to set the stage for the analysis of the post-1973 period. A more detailed discussion of the period may be found in Bacha (1977) and Malan and Bonelli (1977);
- (2) Compound annual rates unless otherwise indicated. See Contes Nacionais (Conjuntura Econômica, December 1980 and June 1984) and Bonelli and Werneck (1978). See Suzigen et al. (1974) for the policies pursued in this period;
- (3) See Bacha (1977) and Malan and Bonelli (1977);
- (4) See Contes Nacionais (Conjuntura Econômica, December 1979 and June 1984);
- (5) Malan (1981) has emphasised this point (see page 145 to 157). "Indeed, today is relatively clear the peculiarity of the 1968/73 period when seen in a historical perspective and in light of the changes in the world economic conditions", Ibid, p.148;
- (6) See IFS-IMF. It is interesting to note that although the share of Brazil's

- exports in world imports (at 1970 prices) underwent a marked increase in this period, from 0.86% in 1967 to 1.06% in 1973, it still remained well below its level in the 1950's and early 1960's when it varied from 1.55% to 1.10% averaging 1.24% between 1953 and 1961. This point does not seem to have been sufficiently stressed in the literature;
- (7) For a more thorough analysis of the Brazilian export performance in this period see Doellinger et al. (1973) and (1974);
- (8) See Malan (1981), p.154;
- (9) See Contas Nacionais (Conjuntura Econômica, December 1979 and June 1984);
- (10) International reserves for all countries grew at an average annual growth-rate of 18.4% between 1969 and 1973 (based on SDR's), in sharp contrast with a modest rate of 2.7% per annum from 1951 to 1969. The growth-rates of 18.5% in 1970, 32.6% in 1971 and 19.1% in 1972 were not only unprecedented but by far the largest annual increases since 1951 (see IFS-IMF);
- (11) In point of fact, Brazil was not an isolated case since international reserves of the developing countries as a whole increased significantly in this period (20.4% on average per annum between 1969 and 1973 or 32.5% per annum between 1971 and 1973, based on SDR's). See IFS-IMF;
- (12) See Wells (1973) and Pereira (1974) for an account of this rise in the foreign debt in this period;
- (13) That does not mean to say that domestic policies had no importance in this period.
- (14) The growth-rate of imports of intermediate goods (quantity index) accelerated from 11% in 1971/70 to 17.1% in 1972/71 and to 28.5% in 1973/72. If oil and wheat are excluded those rates become 17.0%, 17.1% and 22.6%, respectively;
- (15) See tables in sections (3) and (4);

- (16) Bonelli and Werneck (1978) and Conjuntura Econômica, several issues;
- (17) Doellinger et al. (1977).

Section (2)

Section (2.1):

- (1) II NDP, p.21 (original in Portuguese);
- (2) Ibid, p.25;
- (3) Abreu and Malan (October 1974). The date is important because it means that they were criticising the plan itself rather than the actual implementation of it, thus they, as the plan makers, did not have the advantage that we now have of knowing how the world economy actually developed;
- (4) Ibid, p.2, 4 and 9;
- (5) Ibid, p.12;
- (6) Ibid, p.8;
- (7) Ibid, p.4;
- (8) GDP of all countries at constant price rose 3.2% on average per annum (compound rate) in the 1974/79 period, while GDP of the industrial countries rose 2.7% per year in the same period - see IFS/IMF;
- (9) Weighted average at constant price of 1970. If the simple averages of the rates of domestic savings based on current prices are taken instead, the figures are: 22.8% in 1965/66, 23.0% in 1967/73 and 23.2% in 1974/79. Note that the domestic savings rate peaked at 25.5% in 1974/75, despite the deterioration of the terms of trade in this period, and was equal to 25.0% in 1974/77 - see Conjuntura Econômica, June 1984. This suggests that the relationship between domestic savings and foreign savings in Brazil in this period was one of complementarity. The fall in domestic savings after 1977 should be seen as the combined result of the dramatic fall in the terms of trade,

the sharp rise in the interest rate on the foreign debt and the increase in idle capacity.

- (10) According to Furtado's ex-post analysis of the period, the II NDP strategic objectives - to fill the gaps of the industrial sector by expanding the capital goods and the basic inputs sectors, and to promote export diversification into the sectors which could benefit from economies of scale - were in themselves correct. However, he pointed out that in order to achieve those objectives, it would have been necessary to take measures to reduce the share of consumption in GDP (or to raise the domestic savings rate) so as to help to finance the rise in the investment rate. This would have meant modifying the Brazilian model of development based on the expansion of the consumer durable goods sector. He then, based on national accounts statistics that have been revised, argued that the Brazilian model was not modified, that no structural change can be observed in the supply side of the economy in this period and that the rate of investment remained stable while the domestic savings rate actually decreased in the period. He then came to the conclusion that the indebtedness strategy did not have the purpose of raising the future capability of the economy but was mainly the counterpart of an anti-inflationary policy. See Furtado (1982-A) p.43 to 56 and (1982-B) p.34 to 38.

Section (2.2):

- (1) Note that despite the fact that the data on the actual investments undertaken by manufacturing industry are based on a sample of firms and, hence, are an underestimation of the total investment in this sector, this underestimation could not possibly account for such a large difference. Furthermore, the share of investment in the basic industries in the total industrial investment was projected to rise

from roughly 56% in 1970/74 to 85% in 1975/79. It, in fact, reached 60% on average in 1975/79;

- (2) The share of investment in ports and airports would remain roughly the same. Other infra-structure investments in transportation include (in our calculations) investment in pipelines (undertaken by Petrobrás) and in the underground systems (undertaken by Metro-SP and Metro-Rio);
- (3) Particularly of oil and electricity. The II NDP also mentions the aim of expanding the use of coal in industry, of raising the production of alcohol to be mixed with gasoline and the development of the shale programme;
- (4) See II NDP, p.27, and from p.74 to p.76;
- (5) Even allowing for the fact that our estimates for investment in industry are underestimated;
- (6) Further disaggregation would show that the shares of investment in the automobile industry tended to fall after 1974 while the shares of investments in railway equipment, shipbuilding and in the aerospace industry tended to rise. Within chemicals, the share of investments in oil refining declined whereas the shares of intermediate petrochemicals and non-petrochemicals (including alcohol) rose quite significantly. The share of investments in cellulose also showed a pronounced upward trend between 1974 and 1979. See Industrial Surveys of FIBGE from 1974 to 1979.

Section (2.3):

- (1) In fact, exports of goods reached US\$ 15.2 billion in 1979, which corresponds to a compound annual rate of 13.9% in the 1974/79 period;
- (2) II NDP, p.67;
- (3) In fact, the accumulated current account deficit in 1974/79 reached US\$ 40 billion;

- (4) Abreu and Melan (October 1974), p.11.
- (5) II NDP, p.19;
- (6) Ibid, p.18;
- (7) Ibid, p.19.
- (8) Ibid, p.121;
- (9) In fact, this ratio reached 22.3% in 1974, fell below 20% from 1975 to 1978, rising again above 20% in 1979 and 1980;
- (10) The ratio of the net foreign debt to exports rose from 0.99 in 1973 to 2.64 in 1979;
- (11) International reserves fell sharply from 104% of imports in 1973 to 33% of imports in 1975, rose to 84% in 1978, falling thereafter.

Section (2.4):

- (1) II NDP, p.26;
- (2) Ibid, p.42;
- (3) Ibid, p.40;
- (4) The II NDP estimated that 36.0% of the total investment in mining and in manufacturing would be coordinated by the government (see p.112);
- (5) II NDP, p.43. The National Bank of Economic Development - BNDE - and its subsidiaries were planned to be the main financial and coordinating institutions;
- (6) Ibid, p.45
- (7) Ibid, p.45;
- (8) Reichstul and Coutinho (1981);
- (9) Lessa (1978);
- (10) The capital goods and the basic input industries would take over from the consumer durable goods industry as the centre of industrial expansion in Brazil. See from p.129 to 173.
- (11) Since by assumption the economic expansion had to fall, the state

room for manouvre would have to narrow down. The change in the pattern of industrialization would require a new political alliance among the economic groups which the state, despite its authoritarian character, could not impose. Ibid, p.142;

(12) Ibid, from p.129 to p.159 but, particularly, p.143.

Section (3):

- (1) The main basic input industries considered in the plan were: steel, non-ferrous metals, petrochemicals, fertilizers, pesticides, paper and cellulose, products for the pharmaceutical industry, cement, sulphur and other non-metallic minerals;
- (2) II NDP, p.8;

Section (3.1):

- (1) Machines and equipments 'made on order' are those which are specially designed to fit the specifications of the buyer. Examples are turbines for hydroelectric power plants, furnaces for steel mills, ships, special tanks or containers, etc.. Machines and equipments 'made in series' have standard specifications and are manufactured independently from any particular buyer. Examples are boilers, tractors, compressors, pumps, computers, etc.;

Section (3.2):

- (1) The relatively slow growth in steel production in Brazil in the early 1970's, which led to a drastic increase in the import coefficient of this product - see table (4.4.2) - was due to studies done in the late 1960's (starting with the Booz Allen International Study in 1966/67) which underestimated the growth of the demand for steel in Brazil. The II NDP projections for the capacity of production of steel in 1979, on the

other hand, were clearly overambitious. See Suzigan et al. (1974), p.50 to 63, for the plans for the expansion of the steel industry between 1964/65 and 1973;

(2) Capacity of production of aluminium was 261 thousand tonnes by the end of 1979 and reached 424 thousand tonnes by the end of 1983. See Anuário Estatístico ABAL (Associação Brasileira de Alumínio) 1983;

(3) Brazil has also achieved self-sufficiency in aluminium ore (bauxite) and has increased the share of exports in total production from 3% in 1974 to 18% in 1979 and almost 80% in 1983. See FIBGE and Anuário Estatístico ABAL (Associação Brasileira de Alumínio) 1983.

Section (4):

Section (4.1):

(1) II NDP, p.74;

(2) Ibid, p.75;

(3) Ibid, p.76;

(4) Ibid, p.9, p.27, p.73 and p.76;

(5) Balanço Energético Nacional 1983 and 1984.

Section (4.1.1):

(1) See table (2.2.1) for the rise in investments in this sector;

(2) In fact the II NDP was overoptimistic about the possibilities of increasing the domestic production of oil on the basis of the newly discovered offshore wells. See II NDP, p.74;

(3) In June of 1984 production reached 500 thousand barrels a day and by the end of 1984 it was equal to 530 thousand, against an average of 166 thousand barrels a day in 1979. See Relatório da Gazeta Mercantil, 28.02.1985;

(4) The refining of oil produces a number of oil derivatives such as gas, LPG, gasoline, kerosene, naphtha, diesel, fuel-oil, and others. The quantity of each derivative per unit of crude oil refined depends basically on the type of oil (lighter or heavier) and on technology. There is some flexibility as well as limits with respect to the shares of each derivative that can be extracted from a unit of crude oil. Consequently, if the maximum shares of each derivative that can be extracted from a unit of crude oil do not match the relative demand for each derivative, then those derivatives for which relative demand is greater than what can be extracted from a unit of crude oil will be the main determinants of the total amount of crude oil that should be refined (assuming that there is spare oil refining capacity in the country);

(5) Series from FIBGE (Anuário Estatístico do Brasil) for the consumption of crude oil in the Brazilian refineries. See Balanço Energético Nacional 1984 for data of 1983 and Relatório da Gazeta Mercantil 28.02.1985 for data of 1984;

(6) See Modiano (1982);

(7) A decline in the consumption of crude oil per unit of output can take place through the use of substitutes and/or through a more efficient use of crude and oil derivatives. Both types of 'substitution possibilities' seem likely to have been underestimated;

(8) Crude oil in cubic meters and GDP at 1970 prices;

Section (4.1.2):

(1) II NDP, page 96. Capacity included 626 MW from the first nuclear power station being built in Brazil (Angra I) and then schedule to start operation in 1977;

(2) The difference in capacity is mainly due to a revision in the capacity of self-producers (see Eletrobrás Annual Report of 1982);

(3) See Eletrobrás Annual Reports. In fact, it is worth mentioning that the share of consumption of fuel oil in the total consumption of energy at the centres of transformation of energy (refineries, electric centres, etc) was drastically reduced from 57.7% in 1973 to 35% in 1979 and to 14.8% in 1983, as the share of indigenous sources such as natural gas, bagasse and refinery gas increased. See *Balanco Energético Nacional 1984*;

(4) It should be pointed out that, although small, the shares of other oil derivatives (diesel, LPG, naphtha, kerosene and gas) tended to rise from 4.4% in 1973 to 5.1% in 1979, falling then to 3.9% in 1983. See *Balanco Energético Nacional 1984*;

(5) The average price of electricity for industrial consumers in Great Britain and in Brazil are shown below:

Year	Great Britain(**)	Brazil(***)
	in US\$/MWh(*)	
1978	36.45	24.75
1979	43.92	25.84
1980	55.25	26.26
1981	55.02	37.97
1982	51.48	33.50

(*) Quarter average exchange rates (US\$/£) and year average exchange rates, sale price (Cr\$/US\$);

(**) Prices delivered to large industrial consumers (average price paid by respondents to a department of energy survey covering some 800 establishments before the third quarter of 1979 and 900 establishments afterwards) average of the prices published on a quarterly basis;

(***) Average price for industrial consumption in the CESP area in São Paulo.

SOURCES: IFS-IMF, Banco Central do Brasil, Department of Energy - Energy

Trends - A Statistical Bulletin and CESP Annual Reports.

(6) The share of electricity in total consumption of energy rose from 4.0% in 1973 to 14.3% in 1983 in the agricultural sector, and from 16.3% in 1973 to 33.9% in 1983 in the residential sector. The share of firewood fell from 70.4% in 1973 to 49.6% in 1983 in the agricultural sector, and from 71.6% in 1973 to 50.9% in 1983 in the residential sector.

(7) A full evaluation of the investments made in the electricity sector is beyond the scope of this paper. The analysis here should be regarded as a preliminary assessment;

(8) Including only half of the capacity of Itaipu hydroelectric power plant (6300 MW) which corresponds to the Brazilian part. See Eletrobrás Annual Report 1979;

(9) Including 2.8×10^3 MW from Itaipu. Eletrobrás Annual Report 1979;

(10) 'Plano de Atendimento dos Requisitos de Energia Elétrica até 1990 - Regiões Sudeste e Sul do Brasil', Relatório Eletrobrás December 1974. This study is often referred to as 'Plano 90';

(11) See 'Plano 90', page III-16;

(12) See 'Plano 90', page III-17;

(13) In fact both the hydro potential in Brazil and the costs of nuclear power plants were underestimated in the study. In view of Brazil's inexperience and consequent uncertainty related to the cost of nuclear power stations, the study considered a number between 4 and 8 nuclear plants of 1200 MW each, as necessary by 1990 depending upon the inclusion or not of a 25% error margin on top of the cost estimates. The cost of two nuclear plants (2 x 1200 MW) to be installed in Angra in addition to Angra I was estimated in US\$ 413×10^3 /KW (price of June 1974) including interests during the construction and the initial load of fuel. Time of construction was assumed to be six years. The cost of Angra I at that time was estimated in US\$ 458×10^3 /KW (price of June of 1974) without

interests during the construction and the initial load of fuel;

(14) 'Plano 90', pages II-6, II-7 and V-16;

(15) Angra I has been officially inaugurated after 12 years of construction (or 7 years behind schedule). It cost US\$ 1.8 x 10⁹ or US\$ 2875/KW (about three times more than an equivalent hydroelectric plant of 657 MW). Angra II is approximately 70% complete and Angra III is still at the stage of foundation works, and they are not scheduled to start operation in the 1980's. Nuclebrás, the state-owned nuclear corporation, has invested a total of US\$ 3.8 x 10⁹ in the nuclear programme up to now, of which US\$ 890 x 10⁹ refer to financial costs. In fact, Nuclebrás is paying interests on all the heavy equipment for Angra II and III already in Brazil. See Relatório da Gazeta Mercantil, 28.02.1985 and Jornal do Brasil 10.02.1985;

(16) See Eletrobrás Annual Report 1979 and 'Plano de Atendimento aos requisitos de Energia Elétrica até 1975' or simply 'Plano 95', Eletrobrás, September of 1979. Note that the estimates of 'Plano 95' were in fact somewhere in between the estimates of hypothesis I and II of 'Plano 90' adjusted to take into account the Brazilian market (see 'Plano 95' page 17);

(17) The ratio of consumption of electricity in MW-year to the total installed capacity was equal to 38.3% in 1981, 38.6% in 1982 and 40.3% in 1983, against 43.9% in 1977 and 44.0% in 1978;

(18) Eletrobrás Annual Reports 1979 and 1983;

(19) See table below:

Year	Foreign loans and financing to the electricity sector over the total to Brazil (in %)	Average tariff rate for electricity in Brazil (in Cr\$ / KW h) ^(*)
1973	7.9	11.18
1974	6.8	10.34

1975	11.8	10.63
1976	9.0	9.38
1977	17.7	8.78
1978	15.0	8.15
1979	20.5	7.80
1980	28.7	7.77
1981	24.2	8.22
1982	28.9	7.73

(*) 1982 prices, implicit GDP deflator

SOURCES: Eletrobrás Setor de Energia Elétrica-Fontes e Usos de Recursos Retrospectivo 1973/1982

The total foreign debt of the electricity sector has been estimated to be 20% of the Brazilian foreign debt. See Relatório da Gazeta Mercantil, 28.02.1985;

(20) Excess capacity both in the sense of low load factor (available power over actual consumption) and capacity that could be available but whose installation is deliberately behind schedule because of lack of demand;

(21) In view of the extraordinary elasticity of consumption of electricity with respect to GDP witnessed in the early 1980's, it is quite possible that consumption of electricity could have expanded as projected if GDP had grown as little as 3% per year between 1980 and 1983;

(22) Operating and maintenance costs include expenses with personnel, materials and services, fuels and others for generating, transmitting and distributing electric energy in Brazil as a whole (the energy traded among electric companies in Brazil is not included). See 'Setor de Energia Elétrica Fontes e Usos de Recursos Retrospectivo 1973-82', Eletrobrás. Estimates of depreciation and capital costs were based on data from the State of São Paulo (CESP and Eletropaulo). Capital costs were estimated on the basis of the value of fixed assets in service (after depreciation)

at the end of 1982 and an estimation for working capital assumed to be equivalent to two months of the total revenue from energy sales. Fixed assets amounted to US\$605.07 per KW installed. Load factor was 52.2% (actual figure in 1982) and the average life expectancy for all fixed assets was assumed to be 20 years. Working capital costs were equal to US\$0.93 per MWh at 10% rate of interest and US\$1.12 per MWh at 12% rate of interest. See CESP and Eletropaulo Annual Reports 1982;

(23) The final cost of Itaipu hydroelectric power plant (12600 MW) has been estimated in US\$ 1200 per KW. See 'Relatório da Gazeta Mercantil', 28.02.1985.

Section (4.2):

(1) See RFFSA Annual Reports. The sophistication and excessive number of tunnels, bridges and flyovers of the project have been often pointed by the press as the main causes of its unfeasibility;

(2) The Times June, 26th 1984;

(3) See Conjuntura Econômica July 1976 and Anuário Estatístico dos Transportes 1973 and 1974;

(4) Railway energy productivity (in 1000 unities of traffic per ton of fuel in diesel equivalent):

year	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
produc.	114	124	128	132	131	137	140	146	151	154	154

Source: Anuário Estatístico do Brasil, several issues;

(5) The extensive use of arable land for sugar cane cultivation that is necessary for the programme has effects on both price and output of domestic as well as exportable crops. The programme has also important effects on the industrial sector, especially on the automobile and its input industries and on the capital goods industry;

(6) See for instance World Bank (1981), CENAL (1983), Homem de Melo and Pelin (1984) and Seroo da Motta (1985);

(7) Seroo da Motta (1985);

(8) The social cost of ethanol in the State of Goiás and Pernambuco were estimated to be US\$0.408 and US\$0.415 per litre of gasoline equivalent respectively. São Paulo, however, accounted for 50% of total ethanol production in 1983, whereas Goiás and Pernambuco were responsible for only 6.70% and 4.90% of the total in the same year;

(9) Freight costs were estimated to be US\$2.5 per barrel;

(10) The lack of accurate information and methodological shortcomings are generally acknowledged in most studies;

(11) The share of Brazil's exports of gasoline in the domestic production of gasoline reached 19% in 1983. See Balanço Energético Nacional 1984;

(12) World imports of gasoline were about 5.5% of total world production in the 1979/1981 period. See Yearbook of World Energy Statistics, U.N., 1981;

(13) The rise in the world oil refining idle capacity is likely to have raised the average cost of oil refining. Nevertheless, the international price of gasoline fell 15.9% between 1979 and 1983 while the international spot price of crude oil fell only 6.7% in the same period (average year prices). See Conjuntura Econômica, Rotterdam market prices. This suggests that the international price of gasoline may indeed be below 'actual' cost (or the average cost of refined oil);

(14) In other words, an increase in gasoline consumption has to be met by imports of either oil or gasoline.

(15) Telebrás and Embratel Annual Reports.

Section (5):

(1) Imports over GDP at current prices has fallen from 14.0% in 1974 to

8.8% in 1979 and 8.2% in 1982;

(2) It should be recalled that the investments in hydroelectricity also played an important part in the expansion and competitiveness of the exportable sector;

Section (6):

(1) Particularly in 1974 and 1975 when the terms of trade deteriorated 20.7%, world trade at constant price fell 1.3% and conditions in the international capital markets worsened considerably - see Batista Jr. (1980). Imports soared and the net foreign debt jumped from US\$ 6 billion to US\$ 17 billion between the end of 1973 and the end of 1975. International conditions experienced some improvement in the 1976/78 period, but only to deteriorate quite dramatically from 1979 onwards;

(2) An overvalued cruzeiro and delays in bringing in import restrictions sign the inflationary fear. See Doellinger (1977), Malan (1981) and Conjuntura Econômica, January 1976.

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